SaciWATERs
SOUTH ASIA CONSORTIUM FOR INTERDISCIPLINARY WATER RESOURCES STUDIES

Report
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BORDEAUX MÉTROPOLE

Arghyam
Safe, sustainable water for all

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Field Investigators:

Sai Kiran, Venu Gopal

Design:

Raju Kakkerla

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For further information contact

SaciWATERs
B-87, 3rd avenue
Sainikpuri, Secunderabad 500094, India
Telephone: +91 40 27116721
Telefax: +91 40 27116721
Website: www.saciwaters.org

List of Contents

List of Tables

List of Figures

Chapter One
Introduction

1.1 Peri-urbanization and significance of these spaces

India's nature of urbanization processes has undergone a change since the neo-liberal reforms in 1991. Several Indian cities have seen steady growth, sustained by a real estate boom and the rapid growth of outsourcing and other services (Narain, 2016). In this scenario the peripheries of these urban agglomeration face challenges of water security, particularly as their resources are re-appropriated to, and polluted by, growing urban cores (Prakash, 2014). The peri-urban areas are proximal but lack the same benefits of urban areas, and are being systematically exploited to cater the need of the neighboring city. Typically, the peri-urban areas experience a spillover effect from the city thereby resulting in its expansion.

'Peri-urban' refers to a social, physical and institutional space that is constituted through processes of rural and urban interactions (Allen, 2003; Narain and Nischal, 2007; Randhawa and Marshall, 2014). Socially and economically, peri-urban areas represent a transitional space characterized by a diversity of occupational interests that compete over limited resources. Farmers, real estate agents, tour and transport operators, traders, industrial workers may all compete for space and resources. Institutionally, peri-urbanization is characterized by a void created by poor institutional cover as rural and urban governance jurisdictions change hands, and institutional mechanisms to address the various environmental and social challenges confronting peri-urban areas remain absent (Vij & Narain, 2016; Mehta &Karpouzoglou, 2015). Peri-urban areas thus become grounds for contested water resource use and conflict (Douglas, 2006; Simon, 2008; Janakarajan, 2007).

The peri-urban areas can also be understood as an interface, which exemplifies quantity and direction of water flow, while simultaneously describing the social, economic, cultural and political process that influences the water flow (Heynen et al., 2006; Swyngedouw, 1999; Mehta et al., 2015). The emphasis is on material and natural resource flows, while also showcasing the constraining aspects, usually linked with the often politicized position of the peri-urban (Mehta et al., 2015).

Consequently, periurban spaces have been interpreted in multiple ways, as physical spaces of environmental degeneration and inequalities, as a process of 'reterritorialisation' due to globalization contingencies, as an outcome of re-scaling of state power and domain, as areas of flux and transitions, and as sheer concepts (Brenner 1999, Shaw 2005, Aguilar et al 2003, Kundu 2007, Narain 2010; Sen 2016). This part of the work draws relevance, in a lesser or greater extent, from all of these conceptualizations, though the current context begs for a political economy analytical framework to understand this unique space as an outcome of urban processes shaped by neo-liberal policy mechanics. Notably, it not only has immense impacts on the environments, but also on the freedom of basic livelihood choices. These impacts cannot be understood in the rural-urban binaries, and has to do with the process of sustainable urbanization (Simon 2008).

The importance of the peri-urban space emerges on ground of at least six important points. First, the peri-urban spaces of the large metropolitan cities have come under a process at the current moment that is qualitatively different compared to what it was experiencing three decades before this. In other words, the process of urbanization now is land intensive, capital intensive, has a low employment elasticity driven by private capital, one that encloses environmental commons,

alienating those dependent on them. Second, the interaction between the rural and the urban which is applicable for the rest of the country plays out sharply in the peri-urban context. Understanding the peri-urban today within the current context enables us to look into the future in terms of way the urban will 'treat' the rural. Third, even in situ, the situation in the peri-urban spaces over time impact increasingly larger number of people, due to increases in migration and relocation of slum population from the cities (Bhan 2009, Mosse et al 2005); as per the Census of India, 2001 and 2011, the growth of population in districts around the large cities have registered around two and half times higher rate of population growth. Fourth, unsustainable peripheries of today are bound to make for unsustainable cities of tomorrow. The unsustainable patterns is visible in three major aspects, environmental, socio-economic and political (Sen 2017, Zhao 2013, Aguilar 2008, Dupont 2007, Allen 2003). Fifth, the peri-urban spaces of particularly the large metropolises of developing countries, accommodates new forms of inequalities that is probably not visible anywhere else. On the one hand, at least three kinds of poor, i.e. the locals that have that have suffered the consequences of land acquisition, relocated slum dwellers of the city and migrants from rural interiors whose mobility does not only represent aspirations, but lack of options in rural areas are inhabitants of these areas. On the other, landscapes with high end infrastructure along with real estate development that house the nouveau riche is superimposed on the existing semi-urban or rural landscapes, with little incremental provisions for the marginalized who often 'make' the city, with little 'rights' to it (Harvey 2008, Purcell 2003,Lefebvre 1996). Sixth, this point being specific to water though applicable to other areas of governance too, the web of institutions that emerge to govern resources, particularly natural resources that have strong public good characteristics, are specific to peri-urban contexts, that explain the process through which the state operates to make way for the private; in other words, the 'public' is so intrinsically intertwined with the private, that it is relevant to ask whether the private would have taken the current trajectory without this intervention.

1.2 The context

The complex water markets that has evolved fairly rapidly in the last two decades, where the formal and informal is intertwined closely with and superimposed over the public sources. This has changed to a large extent the choices available to the citizens of the peri-urban communities, having implications for access to safe water for villages and their various constituent hamlets, both in the lean and the peak seasons. Furthermore, the way social differences shape their choices of drinking and domestic water options is the other issue that has been explored by this section.

Globally, the growth of private sector in water supply management has resulted in wide-spread anti-privatization campaigns to argue in favour of human rights to water access (Bakker 2007). One of the ways in which the larger control over the commons has been understood is through the concept of 'accumulation by dispossession', where the neo-liberal state is an equal partner with the corporate sector, and opens up new territories to capitalist forms of market mechanisms (Alhers 2010). Such partnerships play out both in form of public-private enterprises as well as allowing solely private operations to expand in areas of ostensible scarcities and poor infrastructure. Consistent with spatially wide-spread and insistent dissents from citizens that have often taken the form of social uprisings, several alternative strategies to privatization have been proposed by scholars and activists alike, ranging from environmental groups and those working on indigenous tribal population on the one hand, and women's groups and organized labour, on the other. Some of these alternatives are centred on the understanding of water as commons, in which the role of the community gets primacy. The public provisioning of water is the other option, which currently, the Government of Telangana has

opted for recently, through the Mission Bhagiratha that promises safe drinking water to every household.

1.3 Impacts of urbanization on water in peri-urban Hyderabad

Hyderabad is capital of the newly formed state Telangana and de jure capital of Andhra Pradesh. Currently, Hyderabad is fourth most populous city in India and it is expected to be one of the 30 most populous cities in the world by 2030 (UN Habitat 2009). Hyderabad city has undergone development post liberalization, with the rapid growth of new residential colonies, IT industry, educational, and research centres. However, this development has proved to be unsustainable and has turned out to be a serious threat to the city and its peripheries. Bio-physically, the city is located in the semi-arid agro climatic zone and it is also experiencing climate variability in the form of temperature, rainfall, and soil moisture. These changes are having a direct bearing on the water resources in the form of falling water tables, and drying of surface water bodies. The water stress is further aggravated by shorter rainy seasons with reducing rainfall since 1980s — increasing the reliance on groundwater in the catchment areas surrounding Hyderabad (Ramachandraiah & Prasad, 2008). This inter-linkage between climate variability and water is more precariously felt in the transitional peri-urban spaces.

Peri-urban Hyderabad faces water insecurity, but more relating to the production functions of water such as drinking water & sanitation, agriculture, and energy. SaciWATERs (2012) study in collaboration with the Department of Science & Technology (2012) reported that between 2004 and 2012, 13 lakes disappeared within Mir Alam Basin. Further, the sporadic nature of the official supply, forces peri-urban communities to rely on private bore wells and hand pumps for drinking and agricultural purposes. A study by Hyderabad's City Development Plan states that the peri-urban areas which make up the greater Hyderabad metropolis, the network of water supply covers approximately 65 per cent of the area and about 40 percent of the population (Water-Excreta Survey, 2006:331). Moreover, the water tankers which play a critical role in filling the vital gap, transport raw water from agricultural wells in peri-urban villages into the city peri-pheries for household consumption, commercial establishments, and construction sites (Janakarajan et al., 2007).

The private water as seen in Hyderabad today can be viewed in light of the changes in political regimes and the consequent changes in policies. Emergence of private water market, in the peri-pheries of Hyderabad, to a large extent, owes its existence to these policies, promoted under the political patronage of TDP government in 1990s. The policies made between 1994 and 2005 reflected the conditionality's put forward by international organizations like World Bank and was completely urban centric. The urban and water policies, particularly drinking and irrigation, followed the vision 2020 document prepared by world bank, which puts emphasise on the promotion of private sector (Bandyopadhyay, 2001). Water, Land and Trees Act, 2002, and Neru Meru are significant efforts made by TDP government to conserve water. The policies were centralized and top down, and even within the ruling party there was little in the way of policy debate (Manor 2004).

This urban centric growth trend continued in the years between 2005 and 2010, with the launching of the JNNURM in 2005, a centrally sponsored scheme. JNNURM emphasized on development of peri-urban areas, urban outgrowth and corridors justifying such appropriation (Bandopadhaya). These peri-urban sites soon experienced a mixed land use and infrastructural problems particularly with regard to water security. The ever-increasing demand-supply gaps of the excluded and marginalized peri-urban communities are met through mushrooming private bore wells, putting tremendous pressure on the already strenuous groundwater aquifer. Daily water needs of a peri-urban community are thus heavily

dependent on tanker trucks; small water vendors, community and private bore wells. Frequently, access to water is a tale of long drawn struggle, upfront payments, negotiation of residents, and elected leaders.

Peri-urban area denotes the co-existence of rural and urban activities, processes and institutions (Vij, 2014). With its unprecedented growth, Hyderabad's rapid urbanization has become a threat to the city and its environs. Basic amenities, like the supply of water to such extended boundaries, face a lot more pressure. The formal water supply particularly in these areas is sporadic and inadequate. Informal water markets attempt to bridge this gap in water supply. These informal mediums operate predominantly from the peri-urban areas. Common property resources such as water are diverted to infrastructure development towards the city. Thus, the ecological footprint of city spills over into the peri-urban areas. Further, the rising demand for land with an increasing pressure of population has led to the encroachment of traditional rainwater harvesting structures. With this effect, the peri-urban residents face water insecurity due to land acquisition and high water demand in the urban areas (Narain and Khan et al., 2013).

The project 'Ensuring Water Security in Metropolitan Hyderabad', is a study on the informal water markets operating in peri-urban Hyderabad. For this purpose, four study villages were selected: Mallampet, Kokapet, Adibatla and Malkaram. These villages lie outside the administrative boundaries of the Greater Hyderabad Municipal Corporation (GHMC), and within the Hyderabad Metropolitan Development Authority (HMDA) and also characterize the features of peri-urbanization (discussed below).

1.4 Objectives and Research Questions

With this backdrop on the challenges in the context of peri-urban water security and rise of informal water markets in peri-urban Hyderabad, the following research objectives and questions were developed for the study:

1. Explore the interlinkages between the formal and informal institutions in the functioning of the domestic water markets.

   i. To what extent have urban policies and processes been responsible in the evolution and operation of informal water markets?

   ii. In what forms have the informal water markets manifested itself in the peri-urban context within the formal structure?

2. Understand the actors and their power relations influencing informal water market

   i. What are the mechanisms through which the spatial outflow of water from peri-urban spaces occurs?

   ii. How are formal and informal actors arranged in the supply chain of domestic and drinking water provisioning?

   iii. How do changes in their arrangements influence the spatial flow of water and access to drinking and domestic water?

   iv. To what extent do power dynamics and crisis play a role in ensuring the spatial flow of water?

3. To understand the role that informal water market plays in meeting the water security of the peri-urban community

   i. To what extent are households dependent on informal water market?

   ii. How unequal is the access to domestic water and what are the axes to understand this inequality?

   iii. How much are the peri-urban residents paying for domestic water use and how much are they willing to pay?

4. To have an improved understanding of the impact of socio-economic process (caste, religion, gender, space etc) in the operation and growth of the domestic water markets

   i. Does caste have a significant bearing on access to domestic water? If yes, what are the ways in which this is visible?

ii. To what extent class in terms of monetary power influences the emergence of water lords?

iii. How does gender division of work and gendered access play out in a privatizing environment with respect to water?

5. To analyse the externality effect of the informal water market.

i. Is the transition of agriculture to non-primary sector related at all to the spatial outflow of water that we see in the peri-urban context?

Chapter Two
Methodology

2.1 Case study selection process

The selection of the case study villages followed a stepwise approach with the identification of a larger peri-urban area. The project identifies and demarcates this peri-urban area as the zone that lies between GHMC[1] and HMDA[2]. This geographical spread of 6450 Sq. km, consisting of 40 blocks/mandals, 3 municipalities, 813 gram panchayats largely coincides with governments' perception of peri-urban. Initially 163 villages that have given petition to HMWSSB[3] to avail water from board's pipelines were shortlisted from this area. These villages were considered vulnerable in terms of lack of infrastructural support, close proximity to the city, rapidly growing population pressure and heavy dependence on groundwater. Key interviews with the officials of State Groundwater board, HMWSSB and RWSS[4], helped in identifying 14 most vulnerable villages in terms of groundwater extraction and presence of informal water market. These second round of shortlisted villages were spread all around the core city boundary representing the geographical diversity of the area. Villages were clubbed into five clusters each depicting the unique story of urban spread and the growth of informal water market. Table 1 gives the list of the 14 villages.

After the shortlisting of the villages, five cases/villages were finally selected with following criteria:

- Peri-urban characteristics
- High incidence of groundwater extraction
- Presence of informal water market
- Willingness of the community to response in the SaciWATERs researchers

Peri-urban characteristics at this stage are measured by indicators taken from peri-urban/urban literature. These indicators are:

- Higher percentage of migrant population (Narain 2009).
- High incidence of daily commuting to the nearby industries and towns for employment, education etc. (Narain 2009).
- Larger presence of informal water market
- High valuation of building and land (Peri-urbanisation in Europe, Plural, 2010).
- Groundwater pollution.
- Change in the behavioral pattern of population, breaking of the traditional networks, creation of new associations (formal and informal).
- Larger expenditure in education, particularly girls education (Narain, Banerjee, & Anand 2014).
- Higher dependence on private sources for basic service delivery due to absence of state provided services.
- Connected with the nearby cities by means of transport corridor (Narain, Banerjee, & Anand 2014).

Several Group Discussions (GDs) (7), Key Person Interviews (KPI) (39) and transit walks were carried out during RRA. Scientific publications, newspaper clippings have provided necessary inputs to the case study selection process. Attention has been given to purposively select at least one village where SaciWATERs have previously worked.

Based on the above criteria, Mallampet, Kokapet, Adibatla and Malkaram were selected as study sites.

This study also follows aqualitative research

[1] *Greater Hyderabad Municipal Cooperation*
[2] *Hyderabad Metropolitan Development Authority*
[3] *Hyderabad Metropolitan Water Supply and Sewerage Board*
[4] *Rural Water Supply and Sanitation*

Table 1: List of Villages Selected for the Rapid Rural Appraisal

	Village	Block
Cluster 1	Kanchana singaram	Musi riverbed, good level of groundwater, presence of agriculture
	Prathapasingaram	
	Gowrelly	
Cluster 2	Adibatla	Agriculture, Industrialization, Multiple uses of water
	Chinnagolkonda	
	Posettyguda (hamidullanagar)	
	Bahaduguda (pedda golkonda)	
Cluster 3	Manikonda	Residential Area near Hitec City. Huge pressure of urbanization on the villages.
	Kokapet	
Cluster 4	Bahadurpalle	Industrial Corridor
	Mallampet	
	Bachupalli	
	Gundlapochampalli	
Cluster 5	Jawaharnagar (village consists of 72 colonies, Govt. divided the village in 7 administrative blocks) : • Ambedkarnagar • Balajinagar • Arundhatinagar • Malkaram • Mallelguda • Farah Nagar • Chennapuram	Largest village in whole Rangareddy district, drinking water crisis, groundwater pollution due to city's biggest public dump, slams, water contains fluoride. Lot of development along with the construction of ORR. Land price is soaring.

methodology. Case study method is used to elaborate informal water flows in the four study villages – Mallampet, Kokapet, Adibatla and Malkaram. Research has been conducted through 77 semi-structured interviews, conducted from April 2016 to December 2016 and the total time spent is around 300 hours in the four study villages. All the relevant stakeholders were interviewed in order to be able to capture most of the narratives concerning informal water flows in the regions. Relevant interviewees were selected with prior consultations from a few experts, and then the selection was validated during the interviews. Table 1 represents the classification of number and type of respondents for semi-structured interviews and group discussions. This list only includes the unique responses (77) and not those interviews which were conducted more than once with the same person.

The initial focus was to understand the 'how' and 'why' questions related to the flows of water to and from the villages. The interviews reflected on the day-to-day related to informal water procurement and supply. Group discussions (GDs) were also conducted with a minimum of 3 and maximum of 13 participants in the villages. The GDs were conducted to triangulate the information collected during the semi-structured interviews, with both men and women groups in the four villages. All interviews and discussions were recorded and fully transcribed.

In addition to these, several newspaper articles discussing various issues of groundwater pollution, land acquisition and other conflicts in the study villages, were referred to in order to develop a better understanding of the social, political and ecological background of these villages.

Table 2: Type of Respondents

Background of People	Key Person Interviews	Group Discussions
Local people	16	4
Immigrants	3	4
Women groups	-	4
Tanker owners/drivers/watchmen	25	3
Panchayat members/line -men	4	1
Farmers/ Agricultural labourers	4	2
Leasers of borewell to panchayat	3	1
RO plant owners/caretakers	17	-
Teachers/ Anganwadi workers	3	-
Ramky employees	2	1
Total	**77**	**20**

Source: **Prepared by authors**

A challenge faced during field work was the unwillingness of the people and panchayats of certain village to share information or participate in any group discussion. The high temperatures of Telangana during the summer, also made it difficult to travel to peri-urban sites and conduct field work.

Apart from this, research methods essentially include two quantitative exercises as well to substantiate the findings came out from qualitative surveys. A house-listing census survey was conducted to get a response to the source of supply for drinking and domestic water use. The survey was complemented with village level maps at household level, which, other than being a sampling frame to the detailed survey, aided us with the analysis of spatial influence of water provisioning. The house-listing exercise also provided an idea of the status of infrastructural coverage in normal and lean seasons. The house listing exercise contained some basic information which throws up insightful observations for the study. The information that were collected during the survey includes information about access to drinking and domestic water through various sources, by the respective household's social and economic status i.e. caste, religion, migratory status, access to agricultural land etc. The rate of non-response for access to agricultural land was high. Households which were found empty or absent (dwellings where nobody resides) or those which were not willing to participate during the house-listing, are kept out from the analysis. In addition, the collected information was mapped at household level to identify the spatial pattern of water supply services across various community groups. Table 3 and table 4 list out the number of households by caste and religious groups across the four study villages respectively.

For the mapping exercise, initially, boundaries of the study villages were identified with the help of google maps and verified from the official maps available from village Panchayat office or the Mandal (Block) revenue office in the concerned districts. Thereafter, clustering of settlements in each of the village was done on the basis of the geographical distance to identify the set of dwellings distinctly apart from each other, and also based on segmentation of community groups which are living in segregated manner on the basis of their social identity. The second type of clustering largely reflects the grouping of

Table 3: Percentage Distribution of Households by Caste Group, 2017

Village	OC	BC	SC	ST	All	All (Numbers)
Malkaram	33.6	47.3	18.3	0.8	100	372
Adibatla	7.8	67.1	23.0	2.1	100	526
Kokapet	11.2	72.9	13.0	2.9	100	1149
Mallampet	13.4	68.6	15.4	2.6	100	1389
All (Numbers)	14.0	67.5	16.1	2.4	100	3436
Source Houselisting survey.						

Table 4: Percentage Distribution of Households by Religion, 2017

Village	Hindu	Muslim	Christian	All	All (Numbers)
Malkaram	39.0	51.1	9.9	100	372
Adibatla	98.5	0.8	0.8	100	526
Kokapet	98.0	1.0	1.0	100	1149
Mallampet	96.8	2.7	0.5	100	1389
All(Numbers)	91.2	7.1	1.7	100	3436
Source Houselisting survey					

households from various caste, religious and migration statuses.

For the household selection, stratified systematic random sampling technique has been adopted for the survey. The two strata were based on social segregation and availability of nature of water supply services. Other than a household level questionnaire, and individual level questionnaire was canvassed among two representatives of the household, one man and one woman, who had some connection with collecting or managing water for drinking and domestic use within that surveyed household, to have a gendered understanding about implications of water markets. An attempt has been made to keep the sample size representative across the social groups to ensure robust results, though they were often not proportionate representation, which depended of the absolute size of the social group within the village (table 5). Special attention was given to village Malkaram for its uniqueness in terms of a segregation of households based on religion and migration status over and above other social identities as caste.

The information given in the house-listing questionnaire was further extended in a detailed way for the sample survey questionnaire. Apart from access to water supply services from various sources, the sample survey covers perception of household from different caste income groups about quality of water supply services in terms of sufficiency, regularity as well as physical quality of water from different sources during abundant and lean seasons. The survey also provides data on household's ability and willingness to pay for these services. The individual level questionnaire was carried out

Table 5: Percentage Distribution of Samples by Caste Group, 2017

Village	Caste group			
	Upper Caste	BC	SCST	Total#
Malkaram*	38.1	42.9	19.0	100 (63)
Adibatla	7.0	57.9	35.1	100 (57)
Mallampet	16.7	52.4	31.0	100 (84)
Kokapet	14.1	47.1	38.8	100 (85)
Total	18.7	49.8	31.5	100 (289)

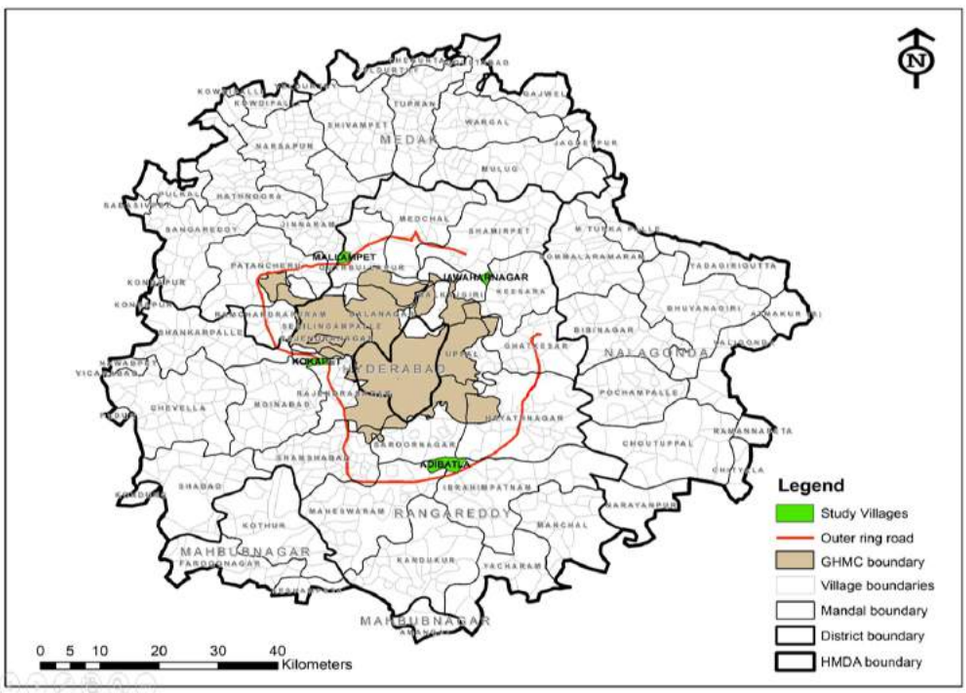
Source: sample survey. #Total number of households in parentheses. * Religion based sampling was done in Malkaram village. Out of the total samples, 23 house holds from Hindu, 33 households from Muslim and 7 households from Christian group were selected for the sample s

from every sample households to capature gender specific responses. Through individual questionnaires, attempts were made to understand the division of labour among men and women in fetching water from different sources separately for drinking and domestic purposes and to compare the gender differences in terms of time spent in travelling the distance and waiting for water collection. The survey also provides information on changes in agricultural land use and practices over the last few decades. Farmer's perception on changes in availability of water for irrigation has also been covered.

Chapter Three
The Study Villages

In this section, a background for each of the four villages will be given, along with some preliminary findings on water dynamics in the village-both formal and informal. Key interviews with the State Groundwater Board, HMWSSB and RWSS helped in identifying 14 most vulnerable villages in terms of groundwater extraction and presence of informal water markets. The selected villages fall under this list.

Figure 1: Map of the Study Villages



3.1 Mallampet – Background

Mallampet is a village of Quthbullahpur Mandal in Medchal district. The village is very close to Bolarum Industrial Area and Outer Ring Road (ORR) and is located around 5-6 km away from the municipal boundaries of Hyderabad towards the northwest of the city. Considering its rapid rate of urbanization and population growth, the municipality of Hyderabad (GHMC) has decided it to include the village within the GHMC before the year 2018.

Since the coming up of the Outer Ring Road (ORR) in 2010, there has been rapid industrialization in the village which has increased the prices of the land so much that they have nearly doubled. 15 years ago the price of one square yard of land was Rs. 250, whereas today the same land ranges between Rs.5000-Rs.6000.

Mallampet used to house various farming communities, most of who have sold their land to private ventures and moved out of the village. The decline of agriculture in the village is visible in fallow landholdings and rapid rate of constructions taking place in the village. There has been a significant influx of migrants in the village from Uttar Pradesh, Bihar, Orissa and Andhra Pradesh. Most of them are employed in Bolarum Industrial Area and the industries close to the village, such as Hartex Rubber Pvt Ltd., Dr. Reddy's Laboratories etc.

The Village Panchayat has two habitations under its jurisdictions, Mallampet and Maheshwaram. Mallampet is divided into eight colonies: Sakaliwada, Pochammabasthi, Ramchandra

Colony, Gagullawada, Weaker Section, Ganesh Nagar (60 sqft), Indiramma Colony (50 sqft) and Manvitha Apartments. The village has two Anganwadis, two public schools (one primary, one secondary and two private schools.

3.2 Kokapet- Background

Kokapet is a village in Ranjendranagar mandal in Ranga Reddy district. There are 14 panchayats in this block. The Outer Ring Road (ORR) passes through the village. It is 3 kms away from Gandipet and also close to Rajiv Gandhi International Airport. It is almost an extension of the Financial District and in the vicinity of the IT Hub. The Outer Ring Road encircles Hyderabad, and despite Kokapet lying just outside the ambit of the ORR, its inclusion in the Greater Municipal Hyderabad Corporation (GHMC) was being considered, along with 13 other gram panchayts, in 2013. However, stiff resistance from the villagers and opposition from the corporators of all political parties forced the state government to de-notify Kokapet along with 35 other villages.

In July 2006, the Hyderabad Urban Development Authority (HUDA) organized a bid for the plots in Kokapet, with a plan to develop an industrial zone called "Golden Miles". During the auction, the highest bid amount went up to Rs.14.45 crores per acre. Most of the owners of the land here sold their plots through the auction, or separately to private owners. Since then, the village has witnessed a meteoric rise in land prices. A number of corporate building have come up in the vicinity such as Wipro, Microsoft, Capgemini, ICICI, Polaris, TCS, DLF etc.

The village was originally occupied by cultivators. In 2004, with the coming of the Outer Ring Road (ORR), these landholdings were claimed back by the government from the villagers. There were plans to build commercial zones in and around the village. The government offered small plots of land elsewhere in the village to compensate them. The villagers accepted this offer, and in 2006, the government gave registered plots to everyone. Some of them sold their plots for money to private ventures; the others kept their plots and constructed houses. The prices of the land increased meteorically after the development, and made some of them wealthier but most of them have had to alter their occupation.

Kokapet also includes a colony called Shanti Nagar, which is slightly at a distance from the main village. There are two anganwadis, two private schools and one government school in the village.

3.3 Adibatla-Background

Adibatla is a village in Ibrahimpattanam mandal of Rangareddy district. The Outer Ring Road touches the southern part of this village. Around 5 kms away from the village lies Wonderla Amazement Park. Even the Rajiv Gandhi International Airport lies around 20 kms away from the village. The village hosts two Special Economic Zones (SEZ). The 200 acre SEZ hosts Tata Consultancy Services and other Tata group subsidiaries. The 300 acre SEZ hosts Tata Advanced Systems Limited and other aerospace related Tata subsidiaries. Apart from this, the state government also has plans to develop an IT cluster in the village. This will be the second IT cluster after the one in Gachibowli. Being close to the airport and the city, the village has been witnessing rapid changes from industrialization and commercialization. Residential colonies have come up and the price of land has been soaring, from Rs.4,000 per sqm to Rs.25,000 per sqm in 10 years.

Around ten years back when the coming of the SEZs was announced in the village, the villagers anticipated job opportunities and development. "Andaru annaru Adibatla lo ippudu maaku chala facilities ostayi. Chala develop autundi ani innamu. TATA company osthe maku akkada pani dorkutundi anni. Kani ippudu daka emi ra ledu" (Everybody said that adibatla will get all the facilities and people are going to benefit from the

development. When TATA company came, we thought that all the villagers would get jobs there. But very little has improved) (L1A). The villagers also expected a good price for their land, the government acquired the land by intimidation in survey no.656 at Rs. 5,40,000 per acre and sold the same to TATA Aerospace Technology Ltd at Rs. 40,000,00 per acre of land. Few farmers who were owners of the land are now daily wage laborers in TATA. Merely 20 villagers could secure jobs at the SEZ and that too as a part of their maintenance staff (cooks, cleaners, watchmen). The price of land has escalated since the coming of the SEZs. One acre of land cost Rs. 2,00,50,000 (two crores and fifty thousand). So people sell half acre of land and rotate money by giving it out as finance, constructing houses or doing some other business.

The village has two anganwadis, one government secondary school and one private kindergarten. There is also one private general clinic in the village.

3.4 Malkaram- Background

Jawaharnagar is a part of Shameerpet Mandal and is the largest village in Ranga Reddy district. It covers around 15000 acres of land. It also has BITS Pilani (Hyderabad campus), Bio-Tech Park and Medi-Tech Valley. For administrative purposes, the state government has divided Jawaharnagar into seven blocks: Ambedkarnagar, Balajinagar, Arundhatinagar, Malleguda, Chennapuram, Farah Nagar and Malkaram. The panchayat office is located at Balajinagar block and it is the most developed part of the village. There are 72 colonies in total in this village. Each block consists of several colonies.

Malkaram block, located at the north-western corner of the village is the most vulnerable part of the village in terms of water, owing to the high groundwater pollution in this block. The Greater Hyderabad Municipal Corporation (GHMC) has its dumpsite located in this village over an area of 350 acres and about 3500 metric tonnes of waste generated in the city of Hyderabad is disposed here on a daily basis. In 2009, Ramky Group was given the contract for Integrated Solid Waste management at the dumpyard. Ever since then, the company has hired people from the surrounding villages and provided them with a source of employment.

The dump-yard in Jawaharnagar is supposed to be the biggest in the GHMC area. It was set up between 2005 and 2006. According to our correspondent, all of this land came under the Jawaharnagar Land Colonisation Society, which was set up in 1952. This was the land (5977 acres) allocated for those who served the Indian Army during and after the Second World War. Even the land for the dump yard was allotted to ex-service men. The GHMC claimed that this land was government land. The GHMC has even been accused in the media for grabbing this land that was given to ex-servicemen. Even before the dumping yard came up, the people came out on the roads and protested, saying that their land and water will get polluted. But their efforts were overridden by the government. There are several complaints about the stench from the dump yard and the pollution of groundwater. A recent study conducted by the Centre for Water Resources in 2012 had reiterated the alarming concern. "The amount of Total Dissolved Salts (TDS) in the groundwater can cause kidney stones and heart diseases. The presence of high values of TDS in certain locations of the study area may be due to the influence of anthropogenic sources such as domestic sewage, solid waste dumping, agricultural activities and influence of rock-water interaction," the study had stated. Malkaram has just one anganwadi. It has no other schools or healthcare centre of any kind.

3.5 Existing water sources in the villages

Out of the four study villages, Mallampet, Kokapet and Adibatla have similar kind of water sources.

The water sources are either managed by the respective village panchayats, or are privately managed by informal institutions. For villages that have lakes (Mallampet and Kokapet) the dependence on its water was high for both drinking and domestic purposes, until the early 2000s, when the lakes either got encroached upon or completely dried up. Groundwater is now the main source of drinking and domestic water in all villages.

The village panchayats are responsible for supplying drinking and domestic water to the villages. The main source of domestic water is the direct piped water connection provided to the household. Not all the households have a direct piped connection. This is groundwater extracted by the Panchayats (from panchayat owned or leased borewells) and is stored in overhead tanks before supplying to the households. The frequency of this water supply vastly varies according to the location of the households in different colonies. In the normal season, the frequency varies between 2-4 days for around 1.5 hours. But in the lean season, the frequency reduces to 3-10 days for the same duration. These villages also have public stand posts, which are also managed and owned by the panchayat. There are households that are completely dependent on these sources for domestic water, for lack of direct piped connections. The frequency of this is usually similar or slightly lower than that of the direct piped water. Usually, the time or date of the water supply is not fixed.

Apart from this, the villagers enter various informal arrangements for domestic water. There is a considerable dependence on private water tankers during the lean season. A tanker of 5000 litres is purchased for Rs.400-Rs.600. In Kokapet and Adibatla, the panchayat also buys water from the private tankers so as to provide water to the villagers through the household connections and stand posts. During the lean seasons, the panchayats also send water tankers to the areas where there are issues with the access and availability of water.

Some households also have their own bore wells, which becomes their main source of domestic water. These households sometimes share their water with their neighbors, free of cost or for a monthly sum. The number of private borewells in these villages is on a steady rise. While the State Groundwater Board stipulates only bore wells of 4.5 inch diameter to be drilled, many 6 inch or wider diameter bore wells can be found, especially in the private apartment complexes that have sprung up in the villages. The permission to build an individual bore well is given by the Mandal Revenue Officer (MRO) under the collector. The MRO after issuing permission, needs to verify through the Village Revenue Officer (VRO) in the Mandal whether the stipulated conditions have been fulfilled. However, the local people have complained that they have never witnessed any kind of MRO or VRO checks for the depth, width or the number of bore wells in these residential apartments. There has been a lack of accountability that has allowed this illegal practice to thrive. The practice is against the Water, Air, Land and Tre8es Act. However, this act does not specify any punishment for the defaulters which makes it difficult for the authorities to take any action against the violators.

For drinking water, the villages have public/panchayat owned ROs, Public Private modeled ROs or private ROs. The source of all these plants is groundwater, which is then treated through Reverse Osmosis and sold. Water is sold between Rs.5- Rs.15 for 20 liters, depending on the ownership of the plant. During the lean seasons, the dependence usually shifts towards the private sources, as the public plants run out of water. Sometimes, during the lean season, the price of water in the private ROs are spike up, further increasing the burden on the poor on the village. These people are sometimes forced to drink untreated groundwater that is meant for domestic purposes.

The water sources in Malkaram are very different. Malkaram being part of a larger village, the provision of a formal water network in this part of the village is very weak. There are only two public stand posts present in this village, which are concentrated in one colony of the

village. A few households have an individual water connection, for which they were required to spend around Rs.6000 on an average. The panchayat rarely sends tankers of water for the people. The rest of the population depends on various informal arrangements made by the community for its daily supply of water. These informal arrangements are heavily used by the people as their primary source of domestic water.

Malkaram has three major colonies- Farah Nagar, Bada Malkaram and Church Malkaram. Most of Farah Nagar receives its water from a bore well that is owned by the locality mosque. The bore well is connected to carious stand posts, from where people either carry water, or further attach detachable pipes that reach their households. The people do not directly pay for the water, but every house pays a small amount towards the funds of the mosque. But if a household refuses to pay this amount, they are not allowed to use this water. This essentially makes it a paid and informal source of water. For drinking, people buy water from a private and unregistered RO, situated a little outside the village. This water is sold at Rs.10 for a 20 litre can and forms a major informal source of drinking water for the villagers.

Bada Malkaram is the only part of the village that has a few panchayat owned water stand posts. But apart from this, a fair portion of the village is depended on another informal source. This is an illegal water connection take from the HMWSSB Krishna water pipeline that travels to BITS college, just behind Malkaram.

Church Malkaram has no panchayat owned sources of water. Water is tapped through a community bore well and community stand posts that the villagers contributed towards. Drinking water is provided by Ramky through water tankers (surface water from a formal network), which is the company that runs waste management processes in the dump yard. This negotiation was brought about after long and violent protests from the villagers, as their groundwater was completely polluted (correspondents said it was "smelly, brownish-blackish") and absolutely unfit for any use. But the people say that they have to pay Rs.30-Rs.50 to the driver every month.

Amongst all the study villages selected for the project, Malkaram stands as the most divergent sample. Unlike the other peri-urban areas, Malkaram still has dominantly rural characteristics. Urbanization has occurred around the village, but none of its benefits have reached this space yet. Malkaram is also the poorest village amongst the study villages. This is apparent in its weak infrastructure and in the lack of any basic amenity- water, electricity, school, hospital etc. The ratio of formal to informal sources of water is lowest in this region, with not even a single panchayat owned drinking water source. This could also probably be one of the reasons why Malkaram has no informal water-selling taking place. Selling domestic or drinking water is an activity that requires a considerable amount of finances.

The maps of Mallampet, Kokapet and Adibatla in Figure 2 show a spatial segmentation of households on the basis of their caste. It can be seen that the lower castes houses are almost always located at the peri-pheries of the main village. Kokapet compromises of a colony Shanti Nagar, which is at a distance from the main village, and has no households belonging to the upper caste. The map of Malkaram shows a spatial segmentation on the basis of religion. Every cluster of the village has a religious composition vastly different from the others. This segmentation in all the villages has specific implications on the access of water for various households. Since in all the villages, the main water points, such as the public stand posts and PPP ROs are located in the central village, the lower caste households need to travel longer distances to fetch water. In all the villages, the panchayat office is centrally located. Since the households that are closer to the panchayat and its overhead tank get direct piped connections to their households first, the lower caste households are at a disadvantage again. Even in Malkaram, the Muslim dominated colony (Farah Nagar), has no access to any kind of water provision from the panchayat. Even the other

major informal source of water (Krishna water stand post) is located in the central village (Bada Malkaram) and is often a contested source of water on which the inhabitants of Bada Malkaram claim exclusive access.

Figure 2: Caste-wise Spatial Maps of the Study Villages

Chapter Four

Demographic, Social and Economic Contexts of the Study Villages (2001 to 2011)

To contextualize the villages within the peri-urban context, both in terms of their characteristics and changes from 2001 to 2011, an analysis of relevant indicators has been carried out, that will enable an understanding of the demographic, social and economic aspects of the study area vis-à-vis the rest of the state. Out of the four villages selected, three of them have been categorized as urban areas as per census norms; one of the field sites, Malkaram is located in a larger census administrative unit, Jawaharnagar, which is categorized as a census town, which fulfills the three criteria set by Census - 1. Population above 5000, 2. A population density of above 400 persons/sq. km and 3. 75% of the male main working population engaged in non-agricultural sectors. Two other habitations, i.e. Mallampet and Kokapet, have been classified as what Census of India terms as an outgrowth which is a village contiguous to a statutory town possessing urban features as infrastructure and amenities that resemle an urban area as pucca roads, electricity, post office, medical facilities, banks etc. Only Adibatla, i.e. the village farthest from Hyderabad out of the selected areas was classified as rural in Census of India 2011. Notably, all four villages are administered by gram panchayats or village councils, though the changes they have experienced in the past one or two decades are driven entirely by urban processes. The coming up of the Outer Ring Road (ORR) has been instrumental in setting the pace of urban processes impacting these villages.

Table 6: Population Growth between 2001 and 2011 in Study Vllages

Village/City/State	Census Classification	Growth of Population between 2001 and 2011		
		Total	Male	Female
Mallampet	Urban (OG)	182.6	170.8	196.7
Jawaharnagar	Urban (CT)	114.1	113.7	114.6
Kokapet	Urban (OG)	8.5	-0.6	17.9
Adibatla	Rural	0.1	1.3	-1.2
Hyderabad	Urban	3.0	1.9	4.1
Telangana	Total	13.6	12.6	14.6
Telangana	Rural	2.1	1.4	2.9
Telangana	Urban	38.1	36.3	40.0
***Source*: PCA, Census 2001 and 2011.**				

Table 6 reveals extremely irregular trends in the population growth rate within the four villages. Two of the villages (Malkaram being located in Jawaharnagar) closest to Hyderabad have experienced very high rates, above 4-6 times the rates of urban Telangana, while the population in two of the villages have been relatively stagnant, Adibatla actually registering a negative growth, indicating a high incidence of outmigration from the village.

Table 7: Trends in Sex Ratio*

Village/ City/ State	Status in Census 2011	Sex Ratio (Total Population)		Sex Ratio (Below 7 Population)	
		2001	2011	2001	2011
Mallampet	Urban (OG)	838	918	952	954
Jawaharnagar	Urban (CT)	956	961	945	917
Kokapet	Urban (OG)	956	1133	868	1219
Adibatla	Rural	970	946	1069	819
Hyderabad	Urban	933	954	943	914
Telangana	Total	971	988	957	933
	Rural	984	999	961	934
	Urban	945	970	948	930

***Source*: PCA, Census 2001 and 2011. * Number of Females per thousand males.**

Table 7 provides the crude sex ratio and below 7 sex ratio. While the below 7 sex ratio is a robust indicator of the gender status, a comparison between these two indicators provides an assessment of the degree of male selective outmigration. If the former indicator is higher than the latter, it is typically indicative of male selective outmigration. Since economic growth over the last three decades focused around the major metropolitan centres, it is expected that the peri-urban areas would have experienced in-migration. Table 7 reveals that over the decade, the gender situation has worsened in the state and also in the peri-urban village, except in Kokapet[5]. But more importantly, a comparison between the two types of sex ratios reveal that like the state, the peri-urban villages in 2011 have experienced a male-selective outmigration, which represents a change from the situation in 2001. This is somewhat unexpected, since the growth around the peri-urban areas of large metropolitan cities in the country in terms of expansion of built-up area, investments in these regions as well as the population growth has been phenomenal (Chakraborty 2000; Sen 2016). The information in Table 7 appears to point towards the trend that male-selective outmigration has exceeded in-migration in the recent years, and in some sense this pattern is indicative of economic distress of some kind.

Table 8 further strengthens this argument, because in two of the three villages considered in the table[6], the work participation rates have declined both for the males and the females, the decline for the latter group being sharper than the former. At the all India level, though there has been a fall in women's work participation rate, this is not the case with men. Secondly, in the state, both for the rural and urban areas, both male and female work participation have increased, indicating a form of economic growth not only delinked from employment development, but probably of a kind that is not only capital intensive, but also labour displacing.

The decline of the work participation rates does not complete the picture with respect to the nature of apparent economic distress in the study villages. The degree of marginalization of work, in other words, ratio of shorter term (less than six months) to longer-term employment (extending for more than 6 months) has gone up over the decade under consideration, irrespective of gender groups in our peri-urban study villages. This is also a characteristic feature of urban Telangana, though in most cases, the rate at which the degree of marginalization has increased is far higher in the study villages.

[5] The below 7 population sometimes suffer from low sample size in a village, and hence the indicator may not be providing accurate results.

[6] Jawaharnagar is a much larger administrative unit compared to the study village Malkaram, which is an exceedingly underdeveloped part of the former. The data for the former thus cannot be used to represent the latter.

Table 8: Work-Participation Rates (crude) among Males and Females in 2001 and 2011

Village/ Region	Male		Female	
	2001	2011	2001	2011
Mallampet	59.5	63.7	19.6	35.4
Kokapet	57.8	53.7	38.5	28.2
Adibatla	62.5	56.8	47.5	31.8
Telangana (Rural)	56.4	56.4	47.8	49.6
Telangana (Urban)	48.4	52.8	12.5	20.4
***Source*: PCA, Census 2001 and 2011**				

Table 9: Degree of Marginalization (marginal/main worker ratio)

Village/Region	Male		Female	
	2001	2011	2001	2011
Mallampet	0.07	0.18	0.53	0.74
Kokapet	0.07	1.37	0.27	1.87
Adibatla	0.03	0.16	0.05	0.20
Telangana (Rural)	***0.13***	***0.13***	***0.35***	***0.26***
Telangana (Urban)	***0.08***	***0.15***	***0.22***	***0.38***
***Source*: PCA, Census 2001 and 2011.**				

Notably, in rural Telangana, the degree of marginalization has reduced, particularly for the women. The dependence on agriculture, based on access to land appear to have provided more stable employment opportunities compared to the industrial and the services sectors, contrary to expectations.

The sectoral shifts in employment can be understood from Table 10, where two notable trends emerge. In Telangana as a whole, and two of the three study villages, the share of workers in services and industry (other than those in the household sector that engages a relatively small share of total workers) has undergone a decline. This decline is however, a male specific one in most cases, other than in Adibatla. This decline is much sharper in our study area compared to the state. Secondly, though the share of cultivators in total workers has declined over the decade, the share of agricultural labourers has increased for males in all cases, and also for females in two of the three selected villages figuring in the table. This indicates that the non-primary sector, from where economic growth is driven, has not been able to provide employment. On the other hand, the sector that has been on the decline in terms of contribution to GDP, is forced to accommodate workers, and this cannot be seen as anything other than driven by acute economic distress. From the point of view of our study, the sectoral shift in the peri-urban context is observable away from agriculture. Thus in the context of peri-urban Hyderabad, the agriculture that would continue would expectedly be less productive, facing pressure from two of the factors of production it depends on critically, namely land and water.

The fall in the share of cultivators is a reflection of the land shortage; the increase of share in agricultural labourers in spite of the fall in

Table 10: Changes in Employment across Sectors: 2011 over 2001

	Male		Female		Male		Female		Male		Female	
	2001	2011	2001	2011	2001	2011	2001	2011	2001	2011	2001	2011
	Mallampet				Kokapet				Adibatla			
Cultivators	7.1	1.9	6.0	0.8	11.2	1.4	10.1	1.5	22.8	26.7	12.7	27.3
Agricultural Labourers	2.5	14.9	27.6	15.9	6.3	14.4	19.6	19.8	17.8	27.2	34.9	50.1
Household Industry	0.5	5.5	0.9	13.5	4.4	2.2	5.8	2.3	0.2	0.9	0.2	0.5
Others	89.8	77.7	65.4	69.8	78.0	82.0	64.5	76.3	59.2	45.3	52.3	22.2
	Telangana (rural)				Telangana (urban)				Telangana (total)			
Cultivators	36.4	32.1	25.0	20.8	1.1	2.0	2.4	2.8	26.2	23.9	22.6	17.1
Agricultural Labourers	31.2	39.6	54.7	61.2	2.2	4.2	8.2	10.8	22.8	30.1	49.7	51.0
Household Industry	3.7	2.5	9.4	6.9	3.0	3.3	15.8	9.9	3.5	2.8	10.1	7.5
Others	28.7	25.8	10.9	11.1	93.8	90.5	73.6	76.5	47.6	43.2	17.6	24.4

cultivators, expect in Adibatla, where both categories of agricultural work have registered an increase, is indicative of low real wages relative to the situation prevailing before. This analysis provides a context for the spatial water outflow from peri-urban regions to feed the non-primary and urban household water demand. The implication from this analysis is that though the state as a whole is facing a challenge with respect to work participation, marginalization of work and increased incidence in agricultural activities, in the peri-urban areas these challenges in far more acute in terms of magnitude. The need to seek out more sustainable means of governing water is thus of acute importance to the peri-urban spaces of Hyderabad.

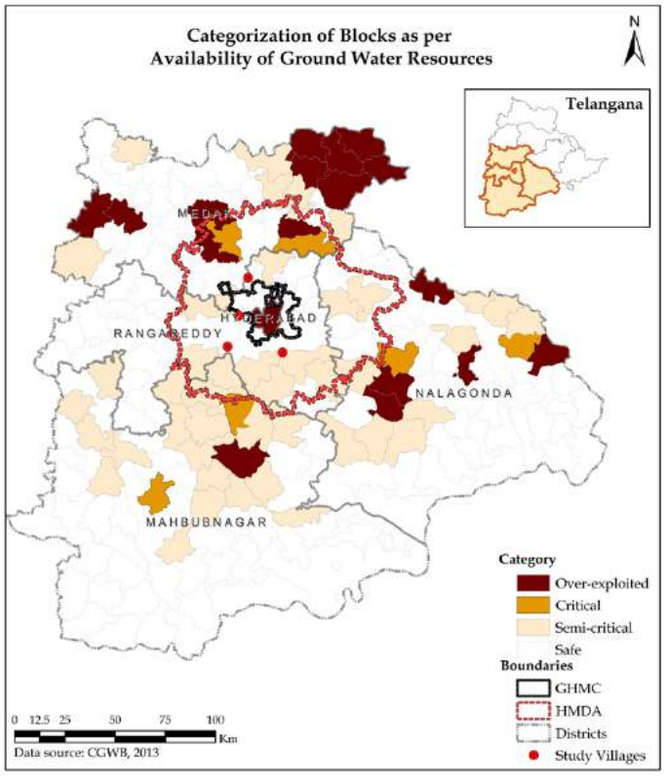
Status of Ground Water in Peri-Urban Hyderabad

The changes in formal and informal water institutions notwithstanding, droughts could cause significant scarcity in the availability of water. Telangana is a drought prone state; 43% of the area of state is drought prone and the probability of occurrence of drought in Telangana is once in 2.5 years, on an average.

This section analyses the ground water status of peri-urban areas and compares it with Hyderabad city on the one hand and rural peripheries outside Hyderabad Metropolitan Development Area (HMDA) on the other, but restricts it to the districts falling in the HMDA area. The purpose of this section is to get a sense of the degree to which the rainfall patterns explain ground water levels.

As per 2013 water resources availability data from Central Ground Water Board, more than 40% blocks of HMDA area are not falling under safe category which means the stage of ground water development has gone above 70 % in these blocks and either pre monsoon or post monsoon ground water level shows a significant long term decline(Figure 3).

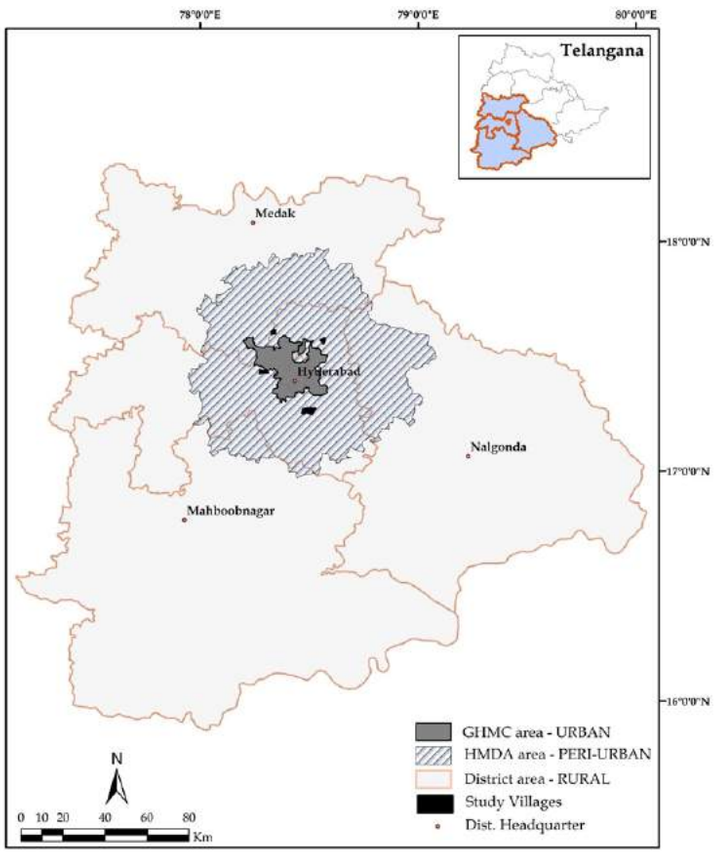
Figure 3: Block-wise Water Resources Categorization Map: Situation of Water Availability in the Study Area and its Surrounding



Ground water level fluctuation is a combined consequence of precipitation and its use and extraction. Climatic variability resulting in the increased occurrence of droughts or floods with decreasing number of rainy days poses a challenge to ground water recharge. Even with heavy rains with low number of rainy days, the infiltration feeding the stock of ground water can reduce significantly. A second factor that prevents infiltration is an increase of the built-up area, which are typical of urban areas, particularly large cities. The nature of ground-water extraction, that impacts the water table, depends on its uses, their intensities and trends.

It is not necessary, for example, that the largest user of groundwater, i.e. agriculture, would necessarily be the primary cause of ground water decline. Thus the status of ground water decline is explained by a complex set of factors, related to the increasing population pressure and climatic distress the changes in ground water level have been analyzed using geo-spatial techniques for three different zones around Hyderabad (Figure 4).

Figure 4: The map showing GHMC, HMDA and District area as Urban, Peri-urban and Rural

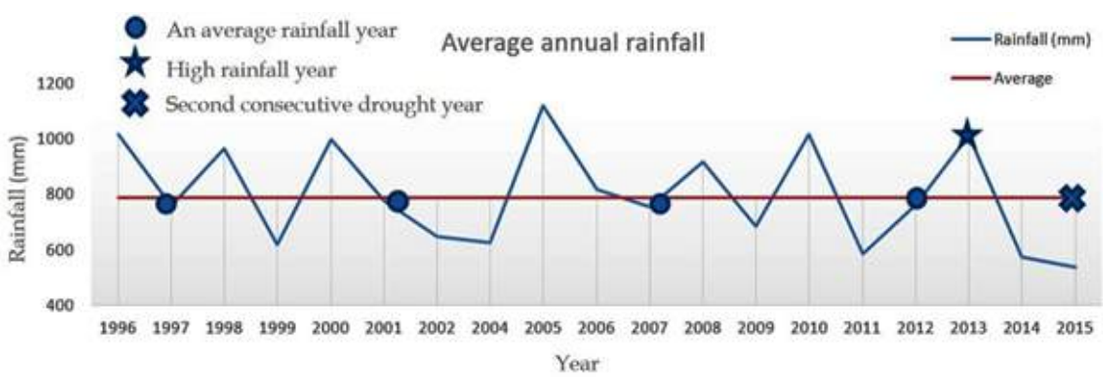


1. The urban core - around 626 square kilometers area whichcomes under Greater Hyderabad Municipal Corporation (GHMC),

2. The peri-urban area - the periphery of GHMC area which spreads over an area of 7,257 square kilometers (2,802 square miles) falls under Hyderabad Metropolitan Development Authority (HMDA). The HMDA area partially covers, Mahboobnagar, Medak, Nalgonda and Rangareddydistricts.

3. The rural area- the remaining district areaofRangareddy, Mahboobnagar, Nalgonda and Medak beyond the HMDA limit.

Figure 5: Average Annual Rainfall from 1996- 2015



The groundwater level data from year 1997 to 2015 has been obtained from India- Water Resources Information System. The water level maps were generated for certain years selected on the basis of rainfall criteria (Figure 5).

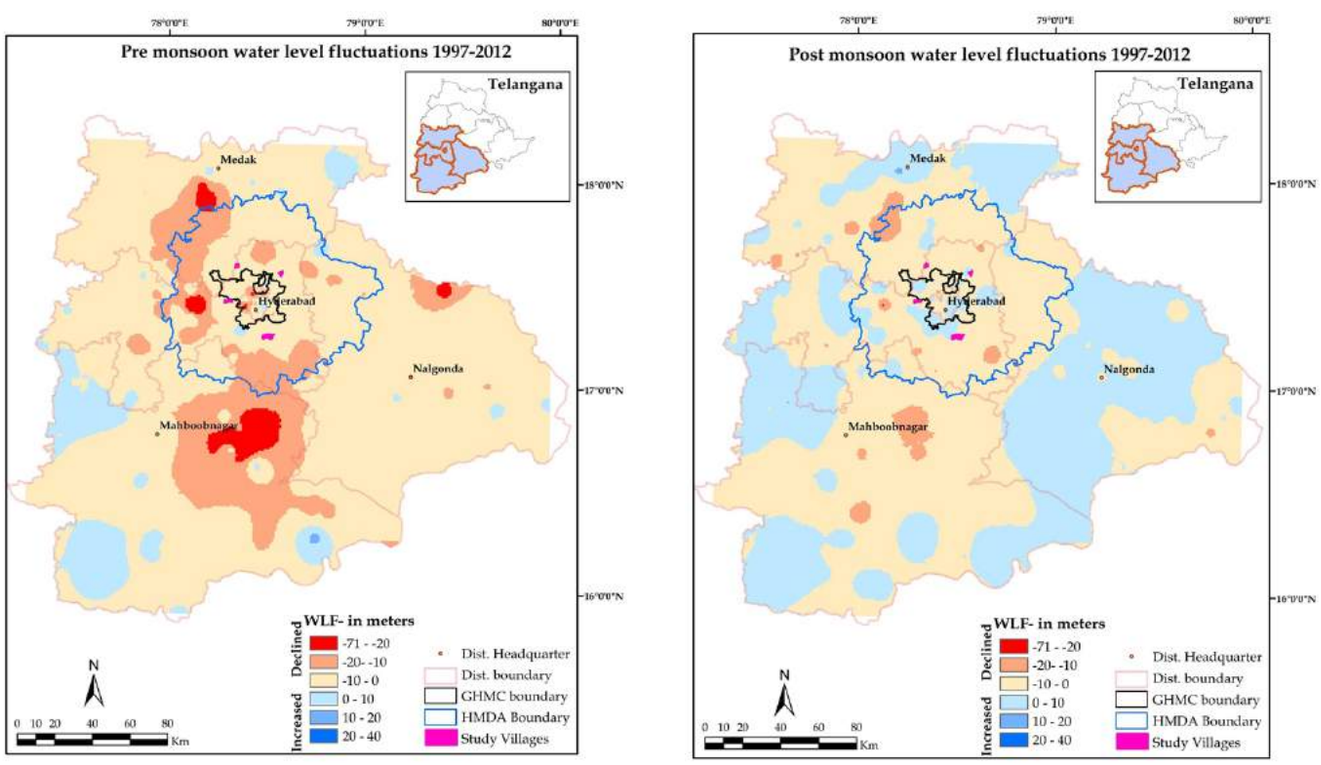
The long term average annual rainfall for five districts viz, Hyderabad, Mahboobnagar, Medak, Nalgonda and Rangareddy has been calculated to be 785 millimeters. To observe the long term water level decline, the years 1997 and 2012 have been selected as average rainfall years; 2013 and 2015 were selected to understand the impact of climate variability, while the years as they represent high and low rainfall years respectively.

The ground water table in the study area has depleted visibly. In the pre-monsoon season of 1997, water level for most of area was between 5 - 10 meters below ground level (mbgl) and expectedly increased in post-monsoon season of the same year. In 15 years period between 1997 and 2012 there has been a notable depletion in water level particularly in the pre-monsoon seasons. The changes observed in the post-monsoon seasons are less, but still evidences of depletion are clear. The latter show high correspondence with rainfall patterns (Figures 6, 7 and 8). Isolated though not extensive areas dropped to below 40 mbgl in 2012, which were absent in 1997. From the depletion between the two selected years, it would be fair to conclude that it is connected more with extraction patterns and less with the rainfall characteristics.

The two other selected years for this analysis were 2013 (Figure 7) and 2015 (Figure 8), which experienced 30% excess and deficit rainfall respectively. With 30 % excessive rainfall in 2013, the water level came up after post monsoon season, though the trend of depletion continued in the pre-monsoon season in spite of normal rainfall in the year before. The drought year of 2015 expectedly demonstrates widespread depletion in both the pre and the post monsoon periods in comparison with all preceding years.

A comparative picture of the three zones can be understood from Table 11 and Figures9 and 10. For the period under study, the two of three zones viz. urban and rural shows roughly similar

Figure 6: The pre to pre and post to post monsoon water level change map from 1997-2012



decline in average ground water level for both pre and post monsoon season. In both zones, the level has gone down by approximately 5 meters and 1 meter in the pre and post-monsoon season respectively. In comparison, the depletion was far steeper in the peri-urban zone with a water level of 8 meters and 3.5 meters for the pre and post monsoon seasons respectively. Two observations are clear from this analysis: firstly, the depth at all periods of time, starting 1997, have been the highest in the peri-urban areas. Secondly the decline, for the most part of the period under study was the sharpest in the peri-urban areas for both seasons. The above mentioned differences cannot be accounted for by rainfall; the spatial outflow and extraction of water supporting the tanker economy elaborated on in the last section probably holds an answer to this.

The depletion patterns, however, makes it clear that the peri-urban areas are at a particular disadvantage in the pre-monsoon or the lean seasons. The pre-monsoon seasons are also periods where there is an increase in water demand due to the increasing temperature. The implications of the increasingly scarce ground water are examined in the next chapters.

Figure 7: The pre and post monsoon water level map for the year 2013

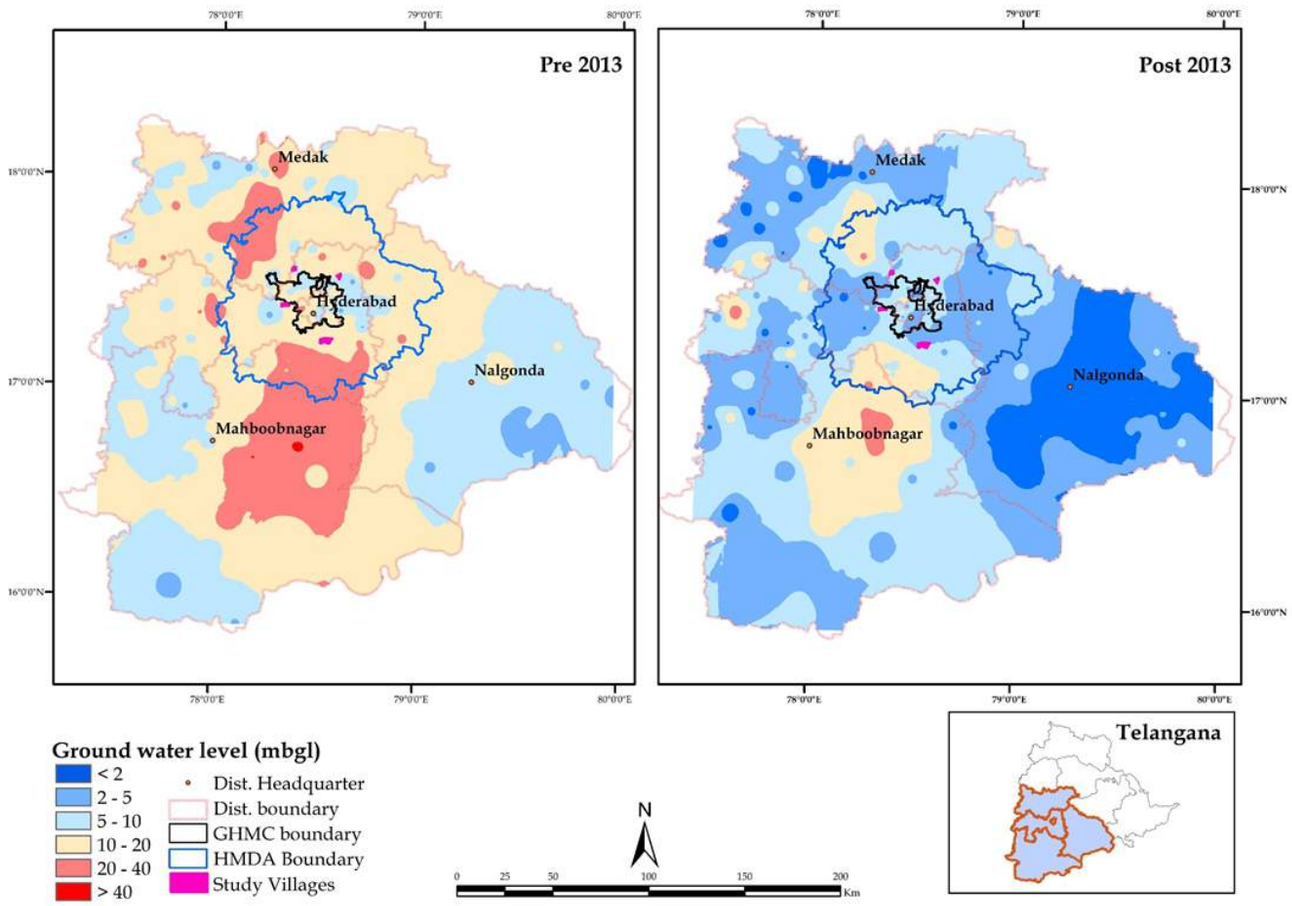


Figure 8: The pre and post monsoon water level map for the year 2015

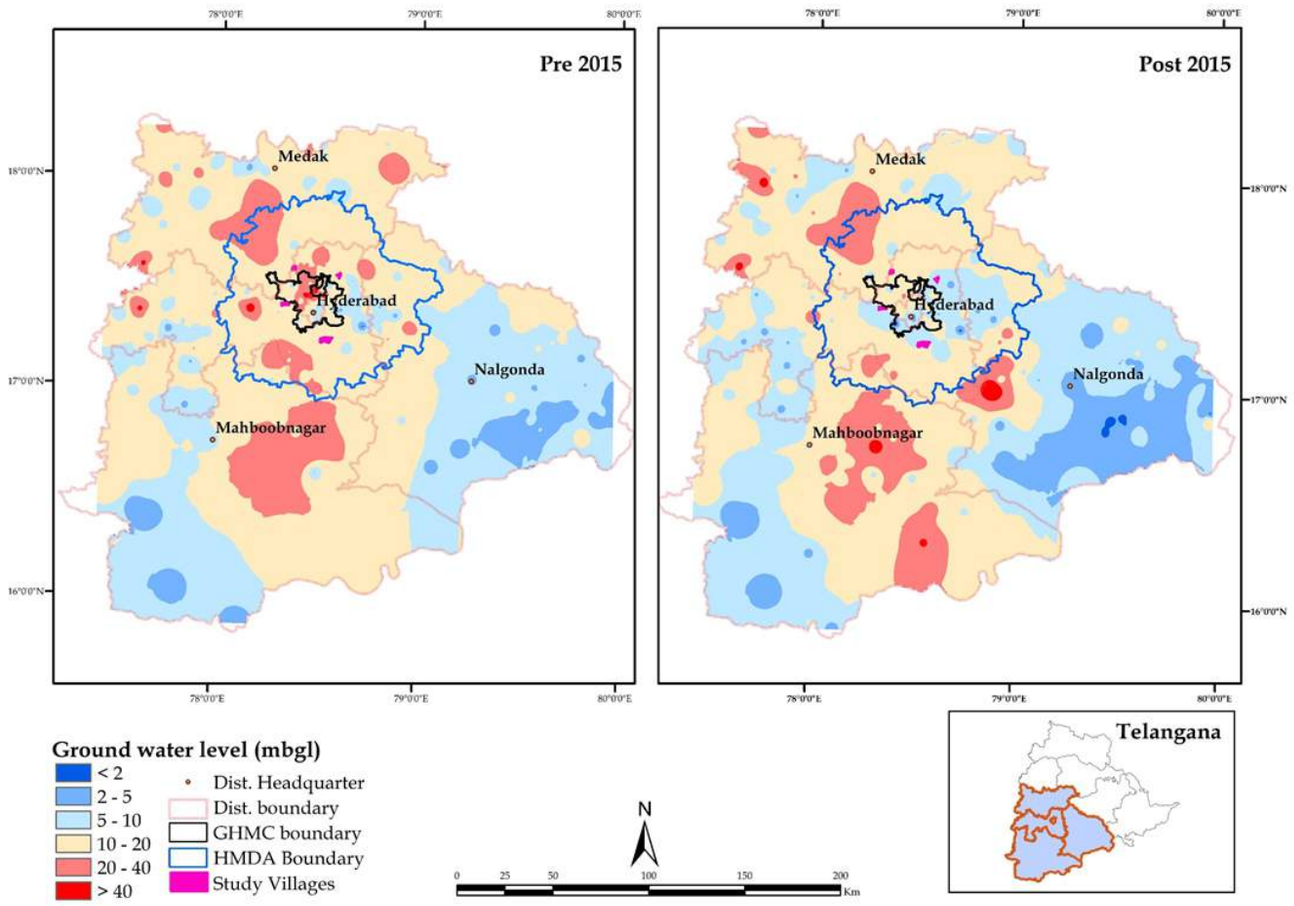


Table 11: Temporal and Seasonal Water Level Fluctuations within the Rural, Peri-Urban and Urban Area

Year	Rain fall	Rainfall (previous year)	Rural (Districts excluding HMDA)				Peri-urban (HMDA excluding GHMC)				Urban (GHMC)			
			AWL		WLF	AF	AWL		WLF	AF	AWL		WLF	AF
			Pre	Post			Pre	Post			Pre	Post		
1997	757	1016	8.64	7.19	1.45	0.18	9.31	7.7	1.61	0.19	7.21	6.43	0.78	0.11
2001	775	997	10.92	6.98	3.94	0.44	11.82	8.76	3.06	0.30	7.56	5.81	1.75	0.26
2013	1010	761	12.92	5.6	7.32	0.79	15.85	6.68	9.17	0.81	11.75	5.8	5.95	0.68
2015	537	573	12.1	11.95	0.15	0.01	15.92	13.57	2.35	0.16	16.7	10.95	5.75	0.42

AWL - Average water level
WLF - Water level fluctuation
AF - Average fluctuation (the ratio of fluctuation versus average of pre and post mo nsoon water level)

Figure 9: Temporal Average Water Level - Pre monsoon

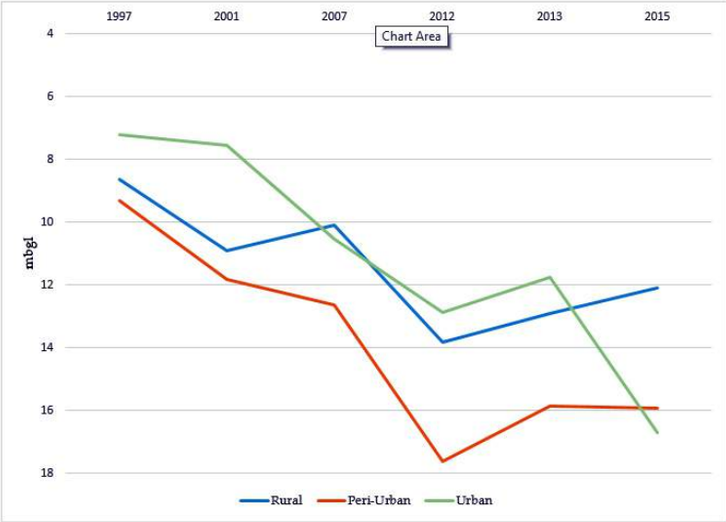
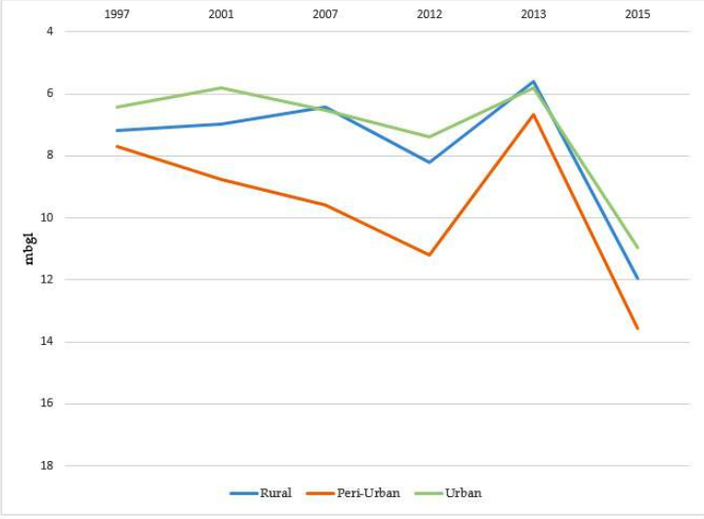


Figure 10: Temporal Average Water Level -Post monsoon



Chapter Six

Policies Shaping Emergence of Water Markets

The point that has been made by many scholars is that models of governance or cases of neo-liberalizing water are in no way homogenous and a failure to identify criteria by which these cases can be brought under the larger umbrella of one generic idea, in order to compare them with other models has caused confusion (Sparke 2006, Castree 2005). The concept of water as 'commons' is consistent with a deep ecology framework that views water as a flow resource essential for life that can be managed by the community, where it is a public good, free of cost and the goals are social equity and livelihoods (Keller 2008; Bakker 2007). Such an understanding of water recognizes its value beyond the immediate use by human beings. Bakker argues that the human rights approach cannot see beyond the private-public binary, both of which equally effectively marginalizes the role of the community (2007). The examples of community management of water as well as other elements of nature like forest and land are numerous, where traditional practices have been revitalized (Cochran and Ray 2009, Agarwal and Goyal 2001, Agarwal and Narain 2000, Benvenisti 1996, Ostrom 1994). Some critiques, however, pertain to the limitations of upscaling of such endeavors due to their highly localized character and at times unequal nature of distribution of benefits (Kashwan 2006, Adgar et al 2005, Kellert et al 2000). The latter problem is more significant, as one of the primary critiques of privatization is to do with inequalities and loss of access of the resource to the marginalized of the community. Understanding of water as an anthropocentric resource need not be conflated with viewing it as an economic good, though the former may represent a departure from treating it as a strictly community resource. In other words, the concept of water as a resource does not preclude the possibility of delivering it free of cost.

The trajectory of the rapid institutional changes visible in peri-urban Hyderabad can be traced back to national level policies, the execution of which has brought about such nuances in water-provisioning. National Water Policy of India, 1987 states that the growth process and the expansion of economic activities inevitably lead to increasing demands for water for diverse purposes: domestic, industrial, agricultural, hydro-power, navigation, recreation, etc....It is without doubt that such increasing demands due to rapid urbanization puts undue pressure on water as a natural resource. In order to address the issue of such limited natural resources, the World Bank, by adopting the discourse of market environmentalism in 1990s legitimized the pathway of privatization (Goldman 2005). This ultimately led to an international consensus on modernization of public services (Zerah & Jaglin 2011). Hence, since then, the onus of delivering water services has been gradually shifting away from the domain of the state to the private sector.

In the recent years, the way water has been interpreted has clearly, and arguably rapidly transformed from being a resource to an economic good, particularly by the nation state. The shift is visible between the 1987, 2002 and 2012 national water policies though there has been a toning down in the degree to which implicit privatization of water is deemed suitable between 2002 and 2012, in letter, if not in spirit (Table 12). In fact, it would be fair to interpret that the 2012 water policy excludes drinking water from the purview of an economic good (to be bought and sold), though the mode of governance that it specifies does not exclude private provisioning, and is thus ambivalent in its intent. The matter is further conflated in the latest Draft National Water Framework Bill, 2016, that avers 'The state's responsibility for ensuring every person's right to safe water for life shall remain even when water service provision is delegated to a private agency (emphasis added) and in case of such delegation, the right of

citizens to safe water for life and the duty of the state to provide the same shall remain in force' (p 7). The contradictions that may emerge between 'delegating' water service provision to a private agency and fulfilling state's duty towards maintaining 'the right of the citizens to safe drinking water for life' have not been engaged with. The argument of providing safe drinking water to the citizens, albeit at a price, appears valid only under the proviso that state is incapable of delivering this service.

Table 12: Change in Conceptualization of Water and Role of the State in Water Provisioning in National Policy Documents

	1987	2002	2012
Conceptualization of Water	Water is a precious natural resource hence it needs to be managed and utilized well	Water needs to be treated as an economic good	After meeting the needs of humans for basic purpose, water needs to be treated as an economic good
Role of the state in water governance	Role of the state getting diminished with the involvement of community for water management	Service provider, encouragement for private sector participation	Regulator and facilitator - PPP and private models (subsidized)
***Source*: National Water Policy, various years**			

The water policies of India encourage privatization by treating water as an economic good. The NWP 2002 encourages private sector participation in planning, development and management of water resources projects. On access to safe drinking water, the earlier policies mention about adequate and safe drinking water facilities to be provided to the entire population both in urban and in rural areas. However, NWP 2012 mentions that minimum quantity of potable water needs to be made available for essential health and hygiene to all its citizens, within the easy reach of the household. Does this leave scope for entry of multiple service delivery agents for water?

On institutional arrangements for water provisioning, NWP 2012 mentions that for an improved service delivery on sustainable basis, the State Governments / urban local bodies may associate private sector in public private partnership mode with penalties for failure, under regulatory control on prices charged and service standards with full accountability to democratically elected local bodies. The resonating rationale for the association with private sector is largely stated by their capability to operate with less manpower and better utilization of expertise (Kaphthalia & Kapoor 2002). National Water Policy (NWP) 2012 goes on to say that the "Service Provider" role of the state (as mentioned in NWP 2012) has to be gradually shifted to that of a regulator of services and facilitator for strengthening the institutions responsible for planning, implementation and management of water resources. The exact forms in which the public-private partnerships will manifest themselves and the regulatory mechanisms that would guide them have been left unspecified for the most part in these documents.

In India, private sector participation in urban development was opened up through the 7th Five year Plan during 1985-1990 (Batra 2009) and by the 8th FY plan water began to be treated as a commodity. The 74th Amendment in 1992 laid down responsibilities for Urban Local Bodies (ULBs) for the provision of basic amenities. However the National Water Mission, clearly states that, while the ULBs have been delegated with responsibilities and functions, they are not supplemented with adequate financial resources, as a result of which they are unable to perform

their functions effectively (NWM, 2008).

The inability of the ULBs to meet the urban resource demands pushes urban actors to look to the urban fringes to fulfill their unmet demands. However, space in which the effects of urbanization are thus most visible, i.e. the urban hinterland or the peri-urban spaces, is actually outside the ambit of the ULBs. While the periurban spaces house many significant urban processes such as the expanding population migrating to the urban centre, and urban activities such as industries, high-cost urban residential complexes, large campuses of elite educational institutions, amusement parks, etc., this space continues to be largely governed by rural institutions such as village councils or gram panchayats. The village councils or gram panchayats mostly govern this space but are neither financially, nor in terms of their scope, enabled to deal with the exponential changes that are impacting resources and livelihoods in these spaces.

World Bank's Urban Water Report[7] on India hence mentions that ULBs need to tap capital market for additional investment rationalizing the need for private sector participation. New Urban Agenda[8] too allows entry of private sector to assist urban local bodies. In 2003 the Ministry of Urban Development formulated the Model Municipal Law to assist ULBs in the areas of resource mobilization and entry of private sector. The law aims at simplification municipal bylaws, provision for enhanced borrowing, entry of private sector, and penalties for non-payment of tariffs. Not surprisingly, the thrust of 10th FY plan was promotion of Public-Private Partnerships (PPPs) in urban infrastructure services. With the onset of JNNURM a large emphasis has been given to enhancing urban water supply systems and encouraging PPPs in water sector (Zerah & Jaglin 2011).

In the erstwhile undivided state of Andhra Pradesh, in 1994, the TDP government under Chandrababu Naidu brought in more focus on the economic reforms in the governance of the state. In 2003 the Andhra Pradesh Water Vision outlined the state vision for water which includes the vision of "clean, hygienic, accessible, affordable and secure drinking water supplies for the entire population". However it acknowledged that putting the vision to practice will require financing principles wherein public funds should be steered away from general subsidies and investments, which can be taken up by private or community action. It outrightly stated that – "A climate should be developed where useful private and commercial investments are promoted". The AP State Water Policy which was formulated in 2008 repeatedly stated its alignment with the National Water Policy 2002, particularly with regard to its prioritization of drinking water among all other sectors, however also simultaneously stating that these priorities could be modified if necessary. However, unlike the national policy, it stays notably ambiguous with regard to its policy on service delivery of the resource stating only that the state will take "appropriate measures" to ensure effective, timely, and cost-effective delivery of water-related services.

The Hyderabad Metropolitan Water Supply and Sewerage Board Act of 1989 (amended in 2007 to facilitate institutional requirements of JNNURM), provides for the formation of the Board to make provision for water supply and sewerage in Hyderabad Metropolitan area. However, according to the Act the board can't be held liable for cutting off water supply or for not supplying water in unusual drought. The Act does not provide for any alternative for such periods of reduced water supply. This gap in assured water supply during lean periods would leave a vacuum which, without any active regulation or active prohibition, can be filled in by the market. On ground the HMWSSB provides water tankers at a cost on booking.

In the drought relief policy, both national and state, government tankers as well as private tankers leased in by the government are offered

[7] https://www.cse.iitb.ac.in/~sohoni/wbepw.pdf
[8] http://mhupa.gov.in/writereaddata/1560.pdf

as a drought relief measure to affected rural and urban areas, but only after the declaration of drought. The APWALTA provides for the ability of an authority in any urban area to prohibit the extraction of groundwater for sale in an 'overexploited area' which is conditional to the declaration of an area as overexploited for a maximum period of six months and is valid only if the source of extraction is adversely affecting a public drinking water source, or is in urban residential areas. These conditions are thus visibly highly specific and limited temporally and spatially, and do not appear to prohibit the general environment of groundwater extraction for sale. But because of a lack of direct acknowledgement of private players as major actors in the water sector in these acts, even while leaving enough vacuum and ambiguity to allow for market presence, informality ensues and mechanisms for regulating such players are not outlined or incorporated in the policies. This general environment of a gap in water scarce periods, lack of active prohibition of private players, use of pricing mechanisms, and use of priced tankers even by the government provides an enabling environment for a market.

Given the above reflections and gaps existing within the policies, legitimizing logic of introducing private parties in water management is quite evident. However, the route that larger 'efficiency' rationale that appears to have been put forward to promote private sector in domestic water provisioning to particularly cover the uncovered, remains hazy; more importantly, how the market logic of making profits would be sustained if this public welfare goal is to be fulfilled has been kept unclear. Hence, in the policy narratives, what exists is not just about public or private provisioning of water services, but an attempt at management of rising and varying demand for water supply. The water quality issue that critically impacts the access to safe drinking water, relevant particularly for the urban and peri-urban spaces, has been by and large bypassed in the water policy documents, though they are present in some form in the environmental acts of both the Centre and the states. The convergence between these two sets of policy and para-legal norms are rarely seen to be working on ground. Even the issue of rising demand is met by complex path of water services provisioning (Bakker 2003). This has come as a response to the inability or unwillingness of both public and private institutional players to adequately deal with the governance and operational challenges of water provision (Ahlers et al 2014). Hence what is essentially seen is the co-production and co-existence of both conventional modes of water supply viz. piped water and non-conventional modes viz. bottled water, tanker water, and water vending etc. The non-conventional modes of water provisioning have been identified and characterized as urban water mafia who have the ability to break boundaries between the formal and informal (Ranganathan 2014).

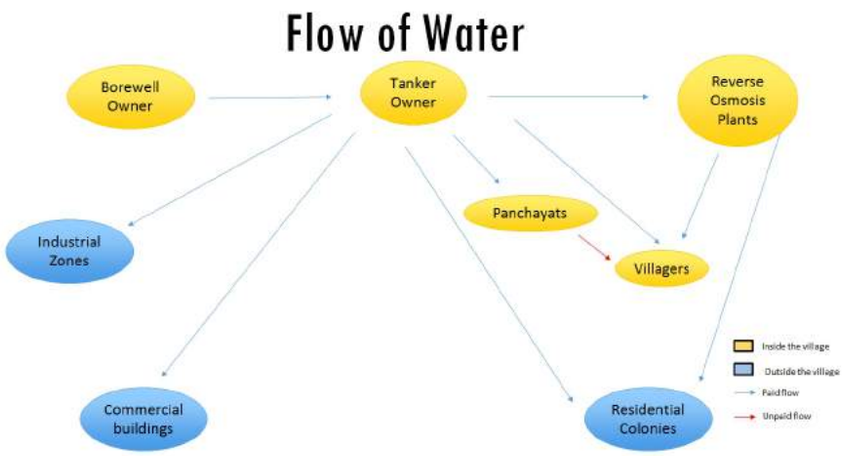
It is notable though that in spite of increasing gaps between demand and supply of drinking water provisions, and reports of widespread agrarian distress, the budgetary allocation of water, both for drinking water and irrigation has fallen. Over the past two and a half decades, water sector allocations have fallen as a percentage of total outlay both for the heads of irrigation, and water supply and sanitation (Sen and Chakraborty 2017). The budget for water supply and sanitation, declined from around 2.5% in the very early 1990s to close to or below 2% in the last five years for all states. However, in contrast, the erstwhile Andhra Pradesh, before the formation of Telangana in 2014-15, allocated only about 0.7% of its outlay on water supply and sanitation, significantly lower than even the corresponding share of 1.8% for all states in the same year. This average is much below that of the developing countries as a whole (Annamraju et al 2001). The point that needs to be made from this is that the so called 'inefficiency' of the public sector also stems from the extraordinarily low spending in the sector, and does not support an overarching argument for inefficiency. To the contrary, it has been argued that publicly owned enterprises can balance both commercial efficiency goals with that of distributive justice; examples from developed countries as Sweden, Netherlands etc. and from developing countries

as Honduras, Brazil, South Africa etc. are cases in point (Lobina and Hall 2000). Thus the situation prevailing currently in the study area has to be understood against the backdrop of a lack of intent of the government to engage in public provisioning of water.

7.1 Actors and Spatial Flows

The informal water market can be studied by understanding the flow of water between various actors. This chapter will elaborate on the various actors and spaces the water flows through in an informal water market. The flow is not just between actors but also between various uses or services. The water may be used for domestic, drinking or even industrial purposes. The water even flows to actors outside the village, to urban agglomerations or other villages either in its raw or filtered form. The interplay between these actors decides the quantum and the rate at which this water is bought and sold.

Figure 11: The flow of water between actors



Source: Field work, 2016 conducted by SaciWATERs

The flow of water from its source to end use happens via actors. All of these actors do not use this water as an end-use product, but may use it as a raw material for another business (like RO plants) or may further transfer the water to another actor (panchayats to villagers). Figure 11 broadly shows the flow of water within and outside the village. Each flow is influenced by the power relations between its actors. For villages that do not sell but buy water, the main actors are the villagers, members of the panchayats and RO plant owners. The following paragraphs will explain the flows between each pair of actors in detail.

The flow of water starts with a transfer of water from the borewell to the tanker. Water is extracted through electricity or generators and transferred to the tankers. After being extracted, water may also be stored in an artificial sump, from where it is pumped into tankers.

The smallest tanker capacity is about 5500 litres and costs between Rs.400-800 depending on the season. The other capacities are 10000 litres, 12000 litres and 24000 litres. These tankers are not all informal mediums. They may be owned by the panchayat to supply water to the remote parts of the village. In an exceptional case in Malkaram, drinking water tankers are sent by Ramky Group (waste management unit) for the villagers living in Church Malkaram, after the villagers protested against the contamination of groundwater by the dump yard.

The actors involved in the first flow are mainly the bore well owner and the tanker owner. Field work in Mallampet and Kokapet have also shown instances where the tanker owner also has his own bore well, which is an example of a single

person playing the role of both actors. This usually happens in more well-established tanker businesses. Those who play the role of both actors are usually those individuals who sold part of the land that they received as compensation from the government, during the acquisition of land for the Outer Ring Road. Those who are only bore well owners are usually farmers who use their subsidized electricity to sell water to tanker owners.

For a bore well owner, the cost for the business is the electricity bill (unsubsidised and commercial) for the pump or the cost of diesel for the generator. This comes to around Rs.30,000-Rs.50,000 per month. For a tanker owner, the cost of the vehicle is around Rs. 8,00,000 and diesel costs between Rs. 10,000- Rs.12,000 per month. In addition to this, most of them hire a driver for a salary of Rs. 8,000- Rs.10,000 per month. Table 13 includes the summary of costs involved for tanker operators.

Table 13: Costs of Informal Water Selling throughTtankers

Heads/Costs	Fixed Costs (Rs.)	Variable Costs (Rs/ month)
Borewell	3,00,000 -5,00,000	30,000 -50,000 (electricity cost)
Tanker cost	8,00,000	10,000 -12,000 (diesel cost)
Driver salary	-	8,000 -10,000
Total cost	**11,00,000 -13,00,000**	**48,000 -72,000**
***Source* : Field work, 2016 conducted by SaciWATERs**		

The second flow is from the tankers to the RO plant storage sumps. Although tankers supply raw water to these plants, they also have other sources like their own bore well or a leased bore well. The RO plants in these villages are usually either privately owned, or are formed through public-private partnerships. Usually, the ones formed through partnerships provide water at a cheaper rate than the private plants. The former charge between Rs. 5- Rs. 10 for 20 litres, and the latter charge between Rs. 10- Rs.20 for the same quantity. The difference in price comes as a result of the arrangements made between the panchayat and the private player, to provide water at a cheaper rate to the villagers, in return for permission to use panchayat owned land/bore wells. The actors involved in this flow are the tanker owner and the RO plant owner/manager.

The third flow is from the tankers to the household storage structures. The actors involved in this flow are the tanker owners and the villagers. Since the villagers cannot always afford or store water in such big quantities, they store around 500 litres in plastic drums, buckets and pots. They pay between Rs.120-Rs.150 for this. The villagers also have other sources of water such as their own bore well, or a neighbour's bore well, community stand posts, public taps or a household water connection.

The last flow is from the tankers to the panchayat overhead tanks. The panchayat overhead tanks also may also get their water from other sources like its panchayat bore wells, leased bore wells, or water from an HMWSSB pipeline (if) passing through the village.

The actors involved in this flow are the tanker owners and the member(s) of the panchayat. The change in power relations in two actors is seen clearly here. An instance of this would be when the panchayat of Adibatla has to buy water from the tanker owners to overcome the water crisis in the village during the months of summer. The panchayat buys around 20-25 tankers a day from the dominant tanker operator inside the village. This tanker operator is a member of the Mandal Parishad Terrotorial Constituency (MPTC), which is an institutional body higher than the

panchayats in the local governance hierarchy. The members of the panchayat may be elected to become members of the MPTC. The advancement of their political careers is influenced by their relationship with the current MPTC members, who are senior in authority and hence more powerful. The power dynamic is such that the panchayat buys water solely from the MPTC member, thereby maintaining good relationships that are conducive to their political advancement, and helping the MPTC member earn huge profits. There has been no objection from the villagers in any manner, as they are unaware of the But in Kokapet, in a similar crisis situation, the panchayat forces the tanker operators to sell water to them. If the tankers do not provide water to the panchayat, they are not allowed to leave the village and confiscates their generators or cuts-off their electricity connection to pump water. They are even physically stopped by the villagers at times. Although the panchayat promises to pay them, they are never paid. Clearly in this situation, the panchayat is more powerful than the tanker operators.

The following table elaborates on the various actors involved in each flow within the village.

Table 14: Flows of Water and the Actor Involved

	Flow	**Actors**
1	Bore well sump to tankers	Bore well owner, bore well watchman, tanker owner, tanker supervisor, tanker driver
2	Tankers to RO plant storage sump	Tanker owner, tanker driver, RO plant owner, RO plant manager
3	Tankers to household storage structures	Tanker owners, tanker drivers, villagers
4	Tankers to *panchayat* overhead tankers	Tanker owners, tanker drivers, panchayat member(s), water line man
Source: Field work, 2016 conducted by SaciWATERs		

The above is an overview of the flow of water and its uses inside the village. The flow of water from the village to spaces outside the village also happens mainly through private informal tankers. Water is sold for domestic, commercial and industrial uses outside the villages. Groundwater from Mallampet is a significant source of water for Bolarum Industrial Area and Dr. Reddy's Lab. The water operators of Kokapet find large customers in the offices of Hitech City. Both of these villages also sell water to residential colonies nearby. The coming of a new amusement park- Wonderla Amazement Park near Adibatla has caused most of the groundwater of the village to be sold there. The park demands water in large quantities for its water rides. There is also a difference in prices between the water that is sold within and outside the village. During the summer, the prices outside the village are almost 30%-50% more than the price in the village. Hence, most of the operators prefer selling their water outside their respective villages. Table[9] 10 provides details of water extracted each day and sold from each village during the summer months.

Informal water markets also showcase varied power dynamics between informal operators and local governments. The reason for the creation of such dynamics and the gains for the stakeholders will also be explained using examples from our study villages. The first part of this section explains the role local governments

[9] *The table has been made from calculations and estimations obtained from field work conducted in Mallampet, Kokapet and Adibatla between January -November 2016.*

Table 15: Details of Water Sold and Areas of Sale

Village	Amount Of Water Sold Per Day (Litres) (approximate estimates)	Areas Of Sale
Mallampet	2,40,000 (44.59% to commercial/industrial spaces)	Mallampet, Dr. Reddy's Laboratory, residences in Nizampet, Bachupally, Bolarum and companies in Kizaipalli
Kokapet	3,81,000 (32% to commercial spaces)	Kokapet, residences and companies in Manikonda, Hitech City, Rajendranagar
Adibatla	1,70,500 (88% to commercial spaces)	Adibatla, Wonderla Amusement Park, Narayana College Hostel for Boys, Mandawaram (poultry farm)
Source: **Field work, 2016 conducted by SaciWATERs**		

play by allowing such markets to operate in a more passive mode. The second part of this section will throw light on incidents where the local governments are not just allowing but are actively involved in the informal operations of this market, thereby perpetuating its growth.

The spatial flow of water across the village also implies that this brings in a considerable amount of income to the village in the hands of a few people, at the cost of creating an inequity with those who have unlimited access to the resource and those who do not positioned at the receiving end. Thus, the nature of this business is such that the interest of the stakeholders has been protected by a power that is not easily questionable by others. Such power is found in the political power invested in local governments. Thus, it is common to see various informal water operators deriving their power from a close nexus with the local governments. Instances of such arrangements are seen in Kokapet and Adibatla, where many individuals previously holding political positions are now into the water selling business.

The involvement of the local governments in these informal markets is significant. Their role as an actor in the supply chain is not just limited to allowing the market to exist, but also in making arrangements for its growth. An instance of the former would be the scenario of Kokapet. Kokapet is the village with the largest number of informal water sellers amongst our study villages. The panchayat needs to give its nod for any water tanker that leaves the boundary of the village. At any occasion, if the panchayat feels that the village is falling short of water for its inhabitants, it stops the tankers from leaving the village. The panchayat essentially puts a halt on the spatial flow of water outside the village, unless the water sellers provide water to the panchayat first, so that villagers have access to this water.

This is what happened twice in the month of April, 2016. The first time, the panchayat asked the water sellers to sell water to the panchayat for a few days and then sell water outside. When the sellers didn't oblige, the panchayat tampered their electricity connection without which they could not extract water from bore wells. So the water sellers were forced to provide water to the panchayats, after which they were allowed to sell outside. Although the panchayat promised to pay each seller 15000 rupees for 15 minutes of water supply each day, none of the sellers got paid, with one exception.

Nepotism of the local governments also influences informal water operations significantly. When questioned about reason for the payment to only a single seller the panchayat claimed that it was because this particular seller never sold water outside the village. Thus his payment came as a sort of incentive for his loyalty to his village. But when the other water sellers were asked, they said that everyone, including the panchayat knew that the seller in question sells water outside the village. An inquiry into the background of this seller led us to the information that his father used to be a former

MPTC (Mandal Parishad Territorial Constituency) member, and that the Sarpanch was in good terms with him. Apart from that, he was the most educated of the sellers, and also belonged to a well to-do family from the village. The payment made only to him could also be because of the higher social status he possesses over others, and the fact that the panchayat did not consider equal to the other sellers to withhold his payment.

The second time this happened, the water sellers had stop providing water to the panchayat, as they never got paid. This time around, they were more prepared for the situation, and used diesel generators to pump water. But the panchayat confiscated their generators, leaving them helpless again. The sellers protested, and asked the panchayat to give them an alternative source of livelihood, if it does not want to pay them or let them continue their business. After many rounds of negotiations, the generators were returned, after a warning to provide water to the panchayats whenever necessary. All of this happened informally, with no resolutions passed to this effect. Water being a common resource, this kind of negotiation by the panchayat for the most part, could be interpreted to be favouring the common person the village, with the caveat of non-payment to the tanker owner. On the flip side, such restrictions are likely to lead to underhand dealings between the panchayat member/s and the tanker, ultimately sacrificing public interest.

An instance of the latter (making arrangements for the growths of informal markets) would be the case of Krishna water in Adibatla. According to a GO passed in 2004, all villages through which the water pipeline for the city passes, are entitled to water from the pipeline. Adibatla, being an en-route village, received Krishna water in 2004. The reservoir is located at Gungal which is around 25 kms away from the village. Adibatla is supposed to receive 1,00,000 litres of Krishna water every day. Unfortunately for the village, the Krishna water pipeline broke during the construction of the Outer Ring Road (ORR), and never got repaired. This occurred hardly two weeks after the village started receiving Krishna water. A panchayat member told us that the ORR authorities did not give them the permission to make the necessary repairs. They made several attempts by complaining to the RWSS, but of no avail.

But according to a Krishna water operator the pipe was never broken, it had only been clogged with stones and debris. The pipe keeps getting clogged as it was not laid properly and the water flows against gravity. The RWSS was also ready to help but the ORR authorities had not given permission until very recently. The Mandal Parishad President offered to pay the authorities some bribe, or as the operator put it, “good will amount”. After all of these efforts, in 2016 the approval from the ORR authorities had been given to repair the pipeline.

However, the operator also said that the panchayat has been negligent in paying the bill for the water. The village panchayat has been dependent on tanker water. They have been buying water from the dominant water seller, who himself is a Mandal Parishad Territorial Constituency member. During the summers, the panchayat buys around 20-25 tankers of water every day from this seller, despite there being a few other sellers in the market.

However, very few local people know anything about the Krishna water supply. Some even said that the village never got that water. Some said that it was provided for just a week or so. It seems like the panchayat and the MPTC member may have entered into an agreement to create artificial scarcity of Krishna water in the village, or a stop-gap arrangement. The creation of such a scarcity, creates a gap in the formal water network, which then strengthens the informal mediums of water, making the people completely dependent on it. In this village, the political nexus created is to ensure the continuity of the tanker sales in the village. Since the MPTC member is higher than the panchayats in the hierarchy of local governance, the panchayat members could gain political favours by agreeing to this nexus.

There are several other nexus that are formed

within the realms of informal water flows. These sometimes involve private entities that in some way influence that source or flow of water. Such a scenario is seen in Malkaram. One of the colonies of the village, Bada Malkaram, receives water from an HMWSSB pipeline that is for the use of BITS College, behind the village. Since this pipeline travels along the village, the villagers have taken an illegal connection from this pipeline, so that some of the water is redirected towards the village. A large portion of the population is dependent on this informal source of water for their drinking as well as domestic needs. The other source is groundwater, treated/untreated for drinking/domestic needs. When BITS found out about this diversion of water, they tried to put a halt to it. But the villagers wanted a negotiation, owing to the fact that BITS college illegally discards their sewage pipe into the fields of Malkaram, which completely pollutes the surroundings and create unsanitary conditions for the people living around. The sewage also seeps into the groundwater, making it unusable. Thus, both parties have a tacit understanding. BITS has now allowed them to use this water. This stand post is located outside a temple, and is said to be used for 'temple purposes', so as to avoid any further conflict. Hence, this is an example of a nexus formed, where both the parties involved stand to gain from the informal flows of water into the village.

Thus, the above describe the various actors, spatial flows and power dynamics, particularly with respect to the domestic water market. For the purpose of this study, a distinction is made between domestic and drinking water, the latter being a more expensive and scarce resource in the study villages.

7.2 Informal and Formal Drinking Water Market: The Case of Reverse Osmosis Plants

The dominant non-conventional mode of drinking water in most areas surrounding Hyderabad is water treated through Reverse Osmosis(RO) plants. None of our study villages have any other designated source of drinking water by either the RWSS or the HMWSSB. Peri-urban areas like these tend to be the victims of an ambiguous institutional mechanism, where the authorities or their responsibilities are unclear, further delaying the process of government provisions. Thus, RO plants are set up in large numbers in the peri-urban areas, where there is demand not just from the village, but also from the urban pockets that lie close to these areas.

The RO plants that are set up are operated mostly as three models: Public (panchayat owned), Private and the Public-Private Partnership (PPP) RO plants.These plants in the study villages procure raw water from multiple sources like bore wells that they own or lease, those owned by the panchayats, or water tankers, that transfer water from bore wells in other places, or even a combination of these. The water tankers could be owned by panchayats, or companies or individual persons. The raw water source, thus, as well as the plants themselves represent an example of not only various types of institutions, but an intermixing of public and private institutions on the one hand and formal and informal, on the other. Our case studies of RO plants in and around the study villages revealed that the PPP model, for example, leased out the land and often tubewells to a range of private players, from informal small players, to sometimes large, sometimes multinational companies operating across cities, sometimes nations.

Processed drinking water is usually sold in a standard quantity of 20 liters. This costs anywhere between Rs.4 and Rs.15, depending on the ownership of the plant, the place that it is bought from (at the shop or door-to-door delivery). Drinking water is sold even outside the peri-urban spaces, in the city, for prices ranging between Rs.20-Rs.25, which is four times the original price. None of the plants sell water in sealed cans to the villagers. The cans are purchased by the consumers from a local store, and these cans are then used permanently, to fill water from the plant on a daily basis. Even for the

door-to-door delivery system, each household typically has more than one can, so that every time they buy one can of water, the other can be returned to be brought next day.

A look at the registration norms reveals that, if the cans sold by the RO plants are not sealed, then the plant is called a filtering unit and it is not labelled as packaged drinking water industry. '*There is no tax levy on filtration plants, which has further encouraged these filtration plants to operate at a large scale*' (Official, Telangana State Ground Water Department, 2017).

Our field evidences reveal that in the majority of cases, water is not packaged and often transacted in containers belonging to the buyer; those who cannot afford/do not need 20 litres of water a day, buy less and pay a proportionate price. Same is the case with cans sold outside the village. This trend is typically seen in the economically weaker households, and happens at every RO, whether formal or informal. Since the household sizes not being very different, this evidence may imply that poorer households are consuming less than optimum quantities of water, when they are forced to purchase it. This is also evident in the fact that some poor households are using untreated water for cooking. In the lean season, it has often been seen that the poorer households drink untreated groundwater for the lack of another option[iii].

A woman in Kokapet filling untreated groundwater to drink from a public stand post

Except for one or two plants, none of the plants sell packaged drinking water, irrespective of whether they are formal or informal, either to the villages or outside. They have no label, no mark as an indication of their standard and no guarantee in any form of the quality of water. Hence, theyare not obliged to sell water of a safe quality to the villagers. The water quality of these plants in terms of traces of heavy metals is not known. Although the villagers are of the opinion that since the water is being sold from a treatment plant it must be clean, this may not be the case. Most ROs do not adhere to the procedural norms of setting up a water quality testing lab while setting up ROs as mentioned in the Bureau of Indian Standards (BIS) guidelines, as the cost of setting up a testing lab within the industry is Rs 1 lakh (Kumaraswamy, Deputy Director, Telangana State Ground Water Department), thus, putting the health of many at risk.

The public and PPP ROs are registered and can (usually) be treated as formal units in that sense, with the rider that they still can have functional intersections with the informal enterprises, as mentioned above. The private RO plants, however, can be either registered or unregistered. On the face of it, no distinction can be made between a formal and an informal RO plant. Usually, the public and PPP RO plants sell

water at a cheaper price than the private ROs, as the prices for these plants are decided by the panchayats. The private ROs' price is decided by the demand and supply characteristics of the market and correspondingly the prices increase in the lean seasons; though they sell water at a competitive price to stay in the market, this is far higher than the prices in the PPP plants. Currently, the prices at which the water is sold in the villages are substantially lower than the packed and sealed water commonly sold in urban areas, but in the foreseeable future, as the market shifts to a more oligopolistic situation, the prices may move upward, as it is evident from the price difference between the scarce and relatively abundant seasons at present.

One may assume that a private registered RO can be classified as a formal entity. But this assumption can be challenged based on findings from the study villages. The source of raw water for all of these models varies from village to village. The RO plant may have its own private bore well, or a panchayat owned bore well or a panchayat leased bore well, or may procure water from a tanker which is either publicly or privately owned. Although the RO plant may itself be registered and formal, the source of the water or the bore well may not have been installed with prior legal permission. In Mallampet, even the PPP RO, Dr. Water procures water from private tankers, which are most definitely illegal. The panchayat borewell that they usually use, often runs out of water in the summer and hence to keep the plant running, they have to depend on other informal sources.

Another perception of the villagers is that, if the RO plant has a name, then they are registered and the quality is assured. But there have been cases in Mallampet and Kokapet, where the RO plant owners have a name-board outside their plant, even if they are not registered, to advertise an element of authenticity. Even outside Malkaram, there are four RO plants in a row, all with a name boards and a registration numbers on it. But each of the plant owners claims that the other is unregistered and that the number on their boards is fake. Thus, the very boundaries between formal and informal in this water market is hazy, and degree of involvement of the types of institutions are neither separable, nor quantifiable. The following table summarizes all the sources of drinking water in our peri-urban study sites:

A Private RO plant owner proving the quality of his plant's water through a home-testing kit

Table 16: Characteristics of different modes of drinking water supply

Sources	Suppliers	Origin and Treatment	Reliability of supply	Reasons for supply	Average cost per litre
Direct piped water	Government (panchayat)	Untreated groundwater	Bad quality, unreliable	Source of domestic water	Usually free or minimally charged
Public stand post	Government (panchayat)	Untreated groundwater	Bad quality, unreliable	Source of domestic water	Free of cost
Borewell	Individual household	Untreated groundwater	Bad quality, reliable	Source of domestic water	Less than Rs. 0.05 per litre.
Borewell	Private vendor	Untreated groundwater	Bad quality, reliable	Source of domestic water	Rs. 0.25 per litre
Community taps or stand posts	Community	Untreated groundwater	Bad quality, reliable	Source of domestic water	Free of cost
Bottled water from RO	Government (panchayat)	Treated groundwater	Doubtful quality, unreliable supply	Main source	Rs. 0.25 per litre
Krishna common water point	Government (HMWSSB)	Treated surface water	Decent quality, reliable	Illegal connection	Free of cost
Borewell (aquaguard)	Individual households	Treated groundwater	Non-verifiable quality, reliable	For personal consumption	Less than Rs. 0.30 per litre
Bottled water from RO	Private enterprise	Treated groudnwater	Non-verifiable quality, usually reliable	To meet deficiency of public utility	Rs, 0.50—0.75 per litre
Bottled water from RO	PPP enterprise	Treated groundwater	Non-verifiable quality, reliable	Main source	Rs. 0.75 per litre
Common treated water supplied through tankers (Church Malkaram)	Ramky Ltd.	Treated surface water	Non-verifiable quality, reliable	To meet deficiency of public utility	Rs. 0.005 per litre
Note: None of the above bottle water plants sell water in actual packaged bottles. **Note: Some of the sources mentioned aboveare specific to certain village.**					

Most of the private RO plants are run out of households in the villages. They operate out of or just at the margins of established legal frameworks. Commercial electricity tariff rates are supposed to apply for the operation of such a plant, but most of these plant owners are still making use of their domestic electricity connection, or worse, their agricultural bore well connections. During the Chief Ministership of Y.S.Rajasekar Reddy, farmers in united Andhra Pradesh were given motors of less than 5 horsepower free of cost to support agriculture. This power subsidy is still prevalent in Telangana (post bifurcation of AP) and is being misused. As there is no restriction on power consumed or user charges levied, many farmers (today, water sellers) in the study villages have been extracting and selling water at considerable prices to various buyers such as tanker suppliers, RO plants while keeping the cost of production down. This commodification of water is in violation of the AP WALTA[10] 2002 and is subject to penalty (R.D.Prasad, Deputy Director, Telangana State Ground Water Department(GWD).

Unless someone complains against the plant, there is no one to check and take action against the defaulter. But with prevailing power structure of the panchayat leaders on the one hand and the private sector, on the other, this does not appear to be a welcome choice for the villagers. Also, since they are mostly dependent on these sources, though more on the lean seasons than others. Also, their perception that it only would lead to an increase in the price of water they consume, appears to be realistic. Moreover, given the high incidence of pollution in most of the study villages, the villagers think of RO plants as a desirable option. But most of them fail to realize that though the water supplied by the RO plants is filtered, the source is still the polluted ground water. This is a major concern as the potability of the filtered water depends on the quality of the carbon filters and frequency at which the RO membranes and the candles are cleaned/replaced. Because, the higher the pollution of raw water, the higher is the corrosion of the membranes and thus, contamination of water. Citing various reports of packaged water samples, an official of Telangana State Ground Water Department states '*there are no health benefits in consuming this packaged water as the essential minerals required for the human body is lost in the filtration process*'.

These ROs have mushroomed without necessary approvals by the concerned departments. Interviews with RO plant operators reveal that these plants rely on Total Dissolved Solids (TDS) meters to test the filtered water. This, again, is done only once in 15 days as against the norms of testing the filtered water twice a day. Thus, the quality of RO water becomes highly questionable.

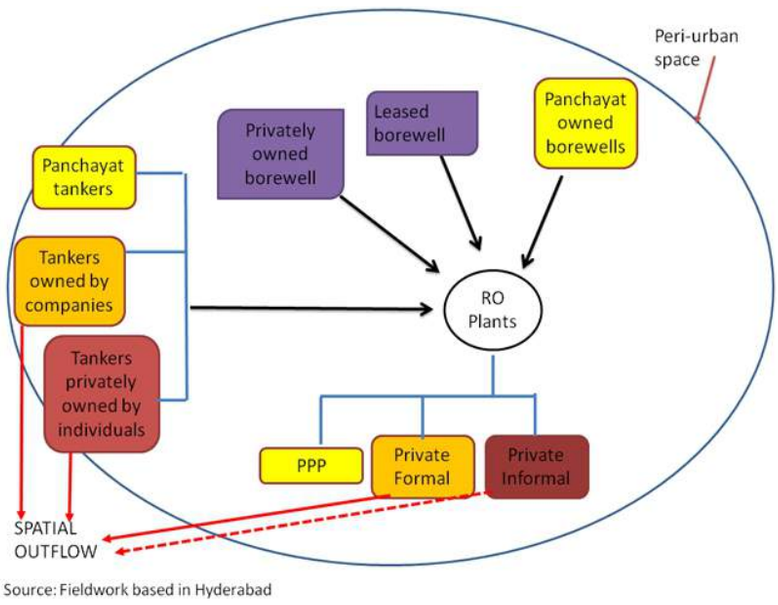
7.3 Complexities in governance

Out of the marketized water models (where water is bought and sold), which can be seen in a continuum of public to private modes, the existing options, when we consider all villages are Government Reverse Osmosis (RO) Plants, RO plants in public private partnerships (PPP) and private RO plants. Unlike the treated Krishna water, which is also provided by the Government, the government RO plant water is priced, though the price is lowest among all other plants with similar technology. Also, notably, the price for the government RO plant is fixed, irrespective of the season. Between the PPP and the private RO plants, the price difference is more than double in the latter case, in both the lean and abundant season. The difference in the lean season (summer pre-monsoon months), in proportionate terms is higher compared to that in the normal seasons. The PPP models as per out field survey function at variance with each other, and depend mostly on the informal arrangements with the panchayat or the village council. In all cases, the land and the bore wells are owned by the panchayat is handed over to the private firm to operate, and the latter ranges from an unknown informal sector to multinational

[10] *Andhra Pradesh Water, Land and Trees Act, 2002*

corporations. The RO plants (both public private partnerships and private ones) in the study villages procure raw water from multiple sources like bore wells that they own or lease, those owned by the panchayats, or water tankers, that transfer water from bore wells in other places, or even a combination of these as shown in figure 12. The raw water source, thus, as well as the plants themselves represent an example of not only various types of institutions, but an intermixing of public and private institutions on the one hand, and formal and informal, on the other. Our case studies of RO plants in and around the study villages revealed that the PPP model, for example, leased out the land and often tube wells to the private partner.

Figure 12: Institutional structure of Reverse Osmosis plants in a peri-urban space



Source: Fieldwork based in Hyderabad

The PPP plants are mostly operated under an agreement between the panchayat of the respective village and a private water treating company. Our study villages have PPP plants where the partnerships with multinational companies like Dr. Water and SMAAT. The agreement is such that the bore wells for raw water and the space for operating the plant are provided by the panchayat. The maintenance and the operation is handled by the private company who also gets 100% of the revenue. The plant has to be handed over to the panchayat after 10 years of operation by the private company. Until then, the company is obligated to sell water at an 'affordable' rate, which at times is fixed for the year. This price ranges between Rs.4-Rs.8 for 20 liters of water. Almost all of this water is unsealed, hence there is no legal commitment from the part of the seller of the water, though arguably, sealing and labelling would increase the cost.

The PPP plants function differently in different villages. Dr. Water in Mallampet purchases water from private tankers as raw water, when their bore wells stop functioning. The burden of the increased cost falls on the consumer. But in Kokapet, SMAAT Aqua simply shuts shop, leaving the villagers to depend on higher prices private RO plants. Thus, in both cases, the interest of the private company is always protected, and the public element is overridden.

The various actors involved in the supply chain make governing such a market a challenge. The RO plants functioning as PPP models often present complex institutional mechanisms. Rules are ignored by the operators to which even the panchayats turn a blind eye. The most common example of this is the sale of water outside the village boundaries.

A PPP modeled RO plant called Dr. Water sells water to the locals of Mallampet at a cost of Rs. 8-

Rs. 10 for 20 litres. This plant is operated by a local of the village. The operator has bought his own auto rickshaw and carries bottles of water to sell outside the village, in the up-scale residential colonies. He charges not less than Rs.25 for 20 liters from those buyers. Since the company takes back a fixed amount of money depending on the quantity of water sold, the extra money accrues to the operator, i.e, Rs.15 for every can he sells outside. However, it is not clear from our field observations whether firstly, they are mandated to sell the entire water they process only in the village, and secondly, if not, whether there is a minimum quantity they have to sell within the village. Some villagers did say the operator sells more water outside.

There have also been cases where PPP modeled ROs are not entirely formal or registered. The actors involved are not revealed and the operations are unclear. This is the case in Adibatla, where the PPP RO plant is the only source of water. The villagers all claim that the plant has been given by Tata Group, that operates in an SEZ inside the village. But when the operator was asked to provide a contact person from Tata, he claimed that it was not the same Tata, but some other company with the same name. He also refused to provide any contact details and claimed that he had none, although in his initial interview, he did mention that the company sends their maintenance person, whenever he calls them. In this regard the sarpanch claimed that it was an individual who donated the RO plant to the village, and he was known to the previous sarpanch who had requested him to help the villagers out. Hence he said that there is no written contract or agreement, and everything is verbal. This could mean that the plant is not actually registered, and once again its categorization into formal or informal becomes a challenge.

Although completely different from the PPPs that function in the other two villages, this is the only one where the panchayat has been able to protect the interest of the villagers by not allowing an increase in the price of the water sold, even during the lean seasons.

One may assume that a private registered RO can be classified as a formal entity, but formality gets diluted since the raw water purchased very often from an informal entity. Although the RO plant may itself be registered and formal, the source of the water or the bore well may not have been installed with prior legal permission. It is this connect through which the drinking and domestic water, the formal and the informal as well as the public and the private get connected.

7.4 Implications of the Emerging Water Market

The involvement of the private sector in water and sanitation utilities has increased substantially over the last few decades. This private-sector participation comes as a response, but also as a contribution to the decline or complete absence of public-provisions (Kjellen&Mcgranahan, 2006). Hyderabad is encountering a very specific kind of urbanization that is driven by private entities. The government is lagging behind in its responsibility to provide basic amenities to the extended population through ether public-provisioning or surface water. Peri-urban areas that lie just outside of urban agglomerations are rural in nature but are experiencing processes that are urban. The local governments or the panchayats are ill equipped to handle such a change in the dynamics of the village and its populations. The absence of Nagar Panchayat to administer transitional areas – peri-urban areas have led to uneven development. The lack of reliable formal provisions in such spaces has led to the inevitable emergence and growth of private and/or informal channels. Ineffective implementation of the APWALTA 2002 and BIS norms, poor regulation and monitoring of borewells, RO plants, and policies by concerned authorities at all levels has led to the emergence and growth of private and/or informal channels.
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The private forms of sale of drinking water thrive mostly to feed the urban and not the local

demands. These informal mediums provide for a very unsustainable water use. Owing to their proximity to both peri-urban and urban areas, the RO plants experience a high demand for drinking water leading to a large scale extraction and treatment of depleting groundwater. The process of treatment through reverse osmosis is such that almost 70% of the water that is treated is left as waste water, and only 30% is the actual consumable product. Also, disposal of the water in contaminated cases represents a critical issue, as the wastewater in such case is highly contaminated and commonly finds its way back to the groundwater. Such a large amount of wastage further adds to the degradation of groundwater and makes the entire process all the more unsustainable.

The political economy of such a drinking water market made a transition to a deeply power-ridden water sector, one that cannot be displaced by simple public-provisioning that is merely superimposed on the existing system. This has been noticed in one of our study village, Mallampet is the village with the most number of RO plants amongst all out study villages. In February 2017, under Mission Bhagiratha, a drinking water scheme, every household was given a treated-surface water connection. This water is consumable and free of cost. Despite this provision, none of these villagers are consuming this water. They only use it as a supplementary source for their domestic purposes. As per our field responses, nobody informed them as to why these new connections were being installed, or whether this water was safe for drinking water purposes. On the basis of observations from the field, this appears to be an attempt by the panchayat to maintain the sales of all the RO plants at an earlier level, of course including the ones in which it has a stake. Additionally, the residents in general do not trust the quality of water from the piped connection, and are of the opinion that since they pay for RO water, they are assured of the quality. The fact that in many of the cases, the piped water connections earlier were supplied from untreated ground water sources, which were often contaminated, may have acted as a deterrent for the villagers to use the treated surface water source, as the difference in water quality supplied through piped connection earlier and now under Mission Bhagiratha, is not obvious to the residents. Apart from that, they say they are used to the taste of water treated through reverse osmosis. Thus, this entire market has been very carefully ingrained into the system by the stakeholders. The movement towards privatization of water and the treatment of water as a commodity that can be bought and sold in the market appears to have worsened the already grave situation of a falling groundwater table. An analysis of ground water depths in peri-urban Hyderabad based on data from Water Resource Information System (WRIS) reveals that the status of ground water has worsened over a period of time, heightened by increased occurrences of drought. The pre and the post monsoon differences have narrowed over a period of time, with the later years' spatial patterns of the water abundant seasons tending towards the scarce seasons. The fuzziness in the water governance institutions, i.e. private and public on the one hand, and formal and informal on the other, will make it increasingly challenging for the Government to deliver sustainable solutions. The current rate of extraction has already created a distress in the peri-urban areas, which is evident in the shift in livelihood of the peri-urban residents out of agriculture. Contrary to the popular perceptions of land-use changes leading to water re-allocations, our study reveals water mobility leading to forced land use shifts, where agriculture is phasing out due to water shortages, without alternative livelihoods means. The changes in the institutional mechanisms in terms of a movement towards privatization of drinking water provisioning system, have had a direct bearing on the cost of access to drinking water to both local and migrant population, which increases in drought years and/or dry periods for some, while for the marginal sections of population, there has been instances of dependence on unsafe sources of water due to increased cost of water in times of scarcity.

Chapter Eight

Emerging Institutions in Domestic and Drinking Water Markets

This study just precedes the implementation of Mission Bhagiratha, a public sector drinking water programme promising universal access and thus portrays a scenario where priced domestic and drinking water supply is seen as a valid option to promote greater efficiency and spread in the water production and delivery system. The overall purpose of this section is to identify the nature of choices that are available to the residents in the peri-urban areas, and identifying the alternatives opted for when the 'usual' choices are not available.

In particular, an attempt has been made the ways drinking and domestic water choices are shaped by:

- Seasons, to gauge the impact of 'natural' scarcities
- Spatial difference and the effect of spatial isolation and integration
- Social identities

8.1 Significance of domestic and drinking water

Though privatization has made inroads into the domestic and drinking water sectors, there is little doubt that a sustainable view of water needs to adopt a holistic perspective, since one form of use impact the availability of the other. Consequently, city-centric domestic sector water has been the most researched, which focuses mostly on drinking water (Stoler et al 2012, Bakker 2010, Mckenzie and Ray 2009, Gandy 2004, Budds and McGranahan 2003). The studies that deal with impact of privatization on rural water supply including implications for irrigation are few (Alhers 2010, McKenzie and Ray 2004). The need to research both drinking and domestic water in the peri-urban context stems from a few concerns. These sectors, particularly drinking water, is central to human life, and under any norm, needs to be accessible to every citizen, with acceptable quality following standard norms, and one would venture to argue, at very low cost options or free of cost. As such, these two sectors have deep bearing on the economically and socially marginalized, though not always in the same ways. Within the social hierarchies, both gender and caste questions have notable bearing on the way water is accessed, and pricing this resource, and making them available in some places and not others makes a difference in the access to these two social identities and their intersectionalities. This is not to argue that alienation from irrigation water does not impact women and marginalized caste groups, but more often than not, this alienation is tied to the access to land and not centrally to water. In the preceding section, the relevance of the peri-urban space with respect to water has been mentioned, and it is within these two water sectors that far-reaching institutional changes are observed. It is of relevance to add on to the existing body of work that depict the way the micro empirical evidences play out, to enable a clearer view of the reality. Lastly, and most importantly, in the existing body of work, rarely has the distinction been made of the domestic and the drinking water sectors, since either they have been looked on as synonymous, or the focus is exclusively, though deservedly, on drinking water. We however argue here that these two sectors are in no way synonymous and have to be understood separately to be able to see the connections between them. We submit that it is through these connections that a more complete understanding of the institutions governing water can be attained.

8.2 Available Options of Water Sources in the Study Villages

The availability of the options for both drinking and domestic water shapes the choices available to the households. The difference in these two categories are important, since the quality of water used of these uses, and hence the available choices are different. From our field investigation, it is evident that the sources of water used for drinking and cooking are the same and these sources, to a very large extent, are what is perceived to be 'safe'. In contrast, water used for washing, bathing, and cleaning is primarily from untreated sources, though in an extremely polluted environment, washing vessels with untreated water, for example, may hold some degree of health related threat, which is commonly discounted by the residents in the study villages.

Table 17 and 18 provide village wise distribution of primary sources of treated and untreated water. Table 17 throws up some significant evidences. Firstly, treated Krishna water, which is the only government and surface unpriced water source, presumably free of industrial pollution, is not supplied to any of the peri-urban villages that have been selected by the government. The two villages that make use of it informally from Gandipet and BITS Hyderabad connections are Kokapet and Malkaramrespectively; in other words, informal connections have been extended to the two villages, in a socially agreed upon norm with the institutions for whom the water connection was sanctioned.

Out of the marketized water models (where water is bought and sold), which can be seen in a continuum of public to private modes, the existing options, when we consider all villages are Government Reverse Osmosis (RO) Plants, RO plants in public private partnerships (PPP) and private RO plants (also detailed in the last chapter). Unlike the treated Krishna water, which is also provided by the Government, the government RO plant water is priced, though the price is lowest among all other plants with similar technology. Also, notably, the price for the government RO plant is fixed, irrespective of the season. Between the PPP and the private RO plants, the price difference is more than double in the latter case, in both the lean and abundant season. The difference in the lean season (summer pre monsoon months), in proportionate terms is higher compared to that in the normal seasons. The PPP models as per out field survey function at variance with each other, and depend mostly on the informal arrangements with the panchayat or the village council. In all cases, the land and the borewells are owned by the panchayat is handed over to the private firm to operate, and the latter ranges from an unknown informal sector to multinational corporations.

The other aspect is the distribution of the RO plants in the different villages. The cheapest variant, i.e. the government model with a fixed price is available in only one of the four villages, i.e. Mallampet. For the other villages, this does not represent a choice. The PPP model is not available in the poorest village in our sample, i.e. Malkaram, though one plant each of this variety is available in the other villages. Private ROs are not located either in Malkaram and the village that is farthest from the city core, i.e. Adibatla, though water from private firms get delivered to these villages from nearby areas. Malkaram, which is, as per Census of India, a small part of an urban outgrowth called Jawaharnagar, and houses the biggest dump-yard of the city that leads to water pollution in the former, has no 'formal' option of treated drinking water source. The Krishna water source is located at the centre of the village and is at a distance from the poorest section of the village. The only other options are private RO plants located outside the village, i.e. the most expensive source of water.

Out of the untreated sources of water that are primarily used for domestic purposes other than drinking and cooking, the first three options are decentralized government sources (Table 21). In other words, unlike in case of Krishna water source, which is a state system, all the untreated sources of water are provided by the panchayats

Table 17: Sources of treated water in the study villages

Sources of water	Descriptions	Cost	Mallampet	Kokapet	Adibatla	Malkaram
Krishna Water supply	Treated surface (river water) provided for the city by the HMWSSB, sometimes to villages that lie en route the path of the pipeline. Free of cost and a shared source.	Free	No	Yes- Informally tapped	No	Yes- Informally tapped
Public RO	Treated groundwater plants owned by Panchayats.	Rs.5 per 20 litres	1	0	0	0
PPP RO	Treated groundwater plants run using a public private partnership model. Co-owned by panchayat and private entity.	Rs.4-Rs.10* per 20 litres	1	1	1	0
Private ROs	Treated groundwater plants owned by private individuals.	Rs.10-Rs.25* per 20 litres	12-15	3	0	0 (5 plants outside the village)
Water from industry through tanker	Treated surface water from HMWSSB pipeline in Tarnaka.	Rs. 30-50 per month	No	No	No	Yes (Church Malkaram)**

*** The higher prices are charged during the scarce period, i.e. summer.**

**** This colony is provided drinking water from Ramky industries, as it lies on the downstream from the industry and their water was most polluted. The residents protested violently on the roads or more than a week, after which this negotiation was made.**

Table 18: Sources of untreated water in the villages

	Sources of water	Descriptions	Cost	Mallampet	Kokapet	Adibatla	Malkaram
1	Direct piped water connections to households	Untreated groundwater provided by panchayat from their bore wells. panchayat may buy water from private tankers to provide through these connections. Paid for as a part of house taxes. Exclusive or shared with 2-3 households.	Rs.40-60 per year	Some	Some	Most	Very few
2	Public stand posts	Untreated groundwater provided by panchayat from their bore wells. Free of costs and shared source.	Free	Yes- sufficient	Yes- sufficient	Yes- sufficient	Yes- insufficient
3	Panchayat sending tankers to households	Untreated groundwater from privately owned bore wells of individuals who sell water. Free of cost for households and a shared source.	Free	Yes	Yes	Yes	No
4	Community stand posts	Untreated groundwater from community owned and managed bore wells. Shared source. Ex- Masjid bore well and stand posts in Farah Nagar, community owned stand posts in Church Malkaram. Shared operational costs and shared source.	Rs.20-50 for 3 months	No	No	No	Yes
5	Households buying private tankers	Untreated groundwater from privately owned bore wells of individuals who sell water. Paid for by households. Could be exclusive or shared.	Rs. 400-600* for 5500 litres	Yes	Yes	Yes	Yes
6	Households having private bore wells	Untreated groundwater. Paid for and managed by households. Sometimes shared with neighbours free of cost or for a price.	Rs. 100 per month	Yes (Some households)	Yes (Some households)	Yes (Some households)	Very few
	* The higher prices are charged duringthe scarce period, i.e. summer.						

through their own borewells or purchased water in our study area. The first source (option 1 in Table 21) has a state level intervention in terms of providing the infrastructure of pipes, which are connected to overhead tanks within the villages. These tanks, however, are fed by water from mostly the aquifers under the village for the most part. These sources are either free or involve negligible cost.

Notably, Malkaram, the poorest village, has, like in case of the drinking water options, the least options provided by the panchayat. This area is contiguous in terms of urban built-up area to the city of Hyderabad. For the most part, this settlement, which experiences urban growth processes very acutely, actually lies in a 'shadow zone' without negligible basic facilities; it however, faces a negative externality effect due to the direct consequences of the largest garbage dump of the city in a nearby area, which pollutes its surface and ground water aquifer in a significant way.

Options 6, i.e. own bore well is a source that can provide domestic water for people who has access to some financial capital. Though the electricity charges are not high and are paid at a flat rate, the cost of digging the borewell is not an option for all. Consequently, very few in Malkaram have access to this source. Option 5, i.e. purchase from private tankers is also costly affair, not available for all, as it is not only the cost of the water per se, but the requirement to invest in a sump or storage space, where the tankers empty the water. Some people from all the villages resort to this option at times of scarcity.

Option 4, i.e. the community stand posts that are operative in Malkaram are examples of collective action, in two spatially separated sections of the village. Due to the lack of viable low cost options in the village, effective community action resulted in the people coming together to work out viable solutions. In one case, the Masjid(mosque) borewell was used by the Muslim dominated cluster that jointly pay for the operation and maintenance cost. In case of Church Malkaram hamlet, a mixed community of Hindus and Christians came together to dig a borewell, got it connected to four stand posts by bringing together their funds for both the capital and operating expenditure. Box 1: Water Insecurity, Collective Action and Effective Bargaining

Church Malkaram is a part of Malkaram which is a closer to the Jawaharnagar dumping yard than the other parts of the village. It lies on the downstream of the dumping yard. None of the residents in this hamlet have a piped water connection. They do not even have a public water stand post from the Panchayat. Few of them have their own bore wells, which they share with their neighbours, usually for a monthly sum. In 2011, Ramky industries, responsible for recycling the waste material at Jawaharnagar employed a few labourers from Church Malkaram to de-silt a lake, as they required the sand in their recycling plant. The workers requested the company to drill a bore well in their colony, in exchange for their labour. The labourers came together and reached a mutual agreement to sacrifice their wages in return for the bore well. The industry dug a bore well, after which the residents contributed money to fit a pump and build a community stand posts in every lane. There are three stand posts in this colony. This is the only source of domestic water for the residents in this colony. Until a few years back, the people here used to drink groundwater. But with the dump yard and its activities, their groundwater got contaminated. Since this colony is located downstream and closer to the dump yard, it was more affected by the pollution than the other colonies. A 40 year old muslim woman said, “Paani ek dum kaala aur badbu wala tha. Teen din tak wohi paani dikh raha tha. Is dauran sare mard log jake Bade Malkaram se paani laye” (The water was black and was stinking. For three dayswe got only that water. During this time all the men had to go to Bada Malkaram to get water). The residents then came together went and took to the roads to protest against the industry. They did not let any garbage trucks enter the village for 8 days. After this episode, Ramky Group agreed to send this colony water tankers of drinking water every day. The residents say that the water comes once in three days. These tankers come from Tarnaka,

and is Krishna river water from an HMWSSB pipeline. Although the water is treated, the women complained that many a times the water contains mud, leaves and stones.The community action in Church Malkaram that demonstrates an example of effective bargaining with the industry, both in terms of drinking and domestic water (See Box 1)

Box 1: Water Insecurity, Collective Action and Effective Bargaining

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8.3 Choice or Compulsion?: Sources of Drinking water in the Study Villages in Seasons of Relative Abundance and Scarcity

The choices available to the peri-urban villages is intrinsically linked with the way the institutional complexities of water sources developed in this area within the neo-liberal environment governing it. As elaborated before, there is great extent of plurality in the way this institutional mechanism panned out in the four villages, which has numerous common elements, but significant differences too. While the commonality is primarily driven by the state's changing conceptualization of water and an understanding of its responsibilities with respect to this sector, the differences are drawn from the characters of the villages, nature of the respective panchayats in terms of their commitment to their constituencies, and the existing water related infrastructure in the village.

Figure 13 is a representation of all four villages, and shows the sources by payment and treatment of sources of drinking water consumption of all the households in the village. Over 90% of the households pay for the principal source of water they drink, both in the lean (summer months, pre monsoon) or normal season. It is relevant to note that our reference year for the lean season included a drought year, which was a second consecutive year of low rainfall. It would be fair to conclude from this observation, that scarcity of water does not have much to do with whether households pay or not[vii].

There are, however, some notable differences across seasons, which are shaped by scarcity of water. Firstly, the share of people who depend on only one source of water reduce drastically from normal to lean season, from around 86% to 56%. Secondly, though a small share of households

depend on untreated water for drinking as a principal water source, this share doubles in the lean season from 1.3% to 2.7%. It needs to be remembered that all these sources draws upon ground water aquifers, which are mostly polluted in these villages. Most of these households belong to Malkaram village, where households have very few options and limited capacity to pay, and the groundwater aquifer is noticeably contaminated due to the Jawaharnagar garbage dump.

Figure 13: Drinking Water Sources by Payment and Treatment

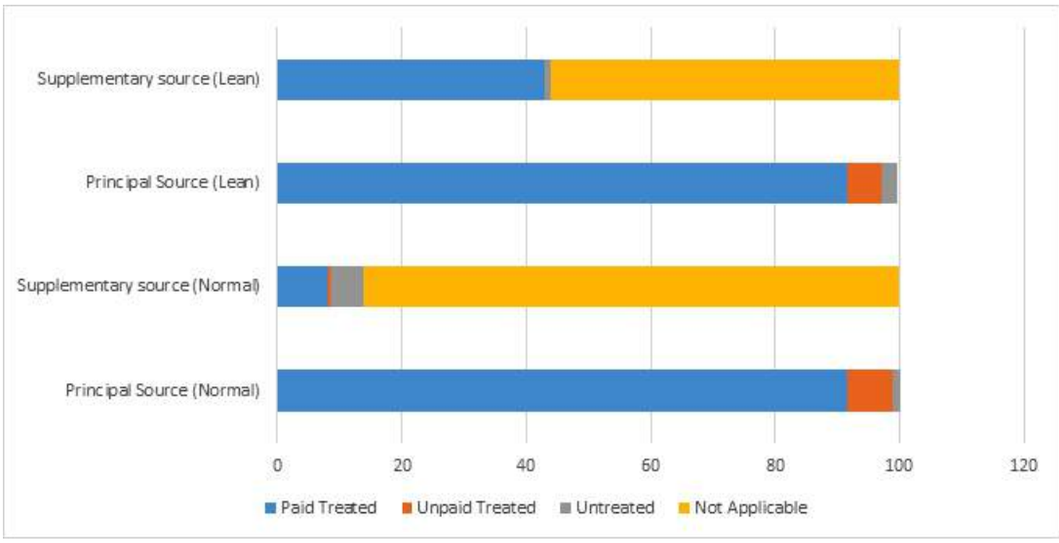
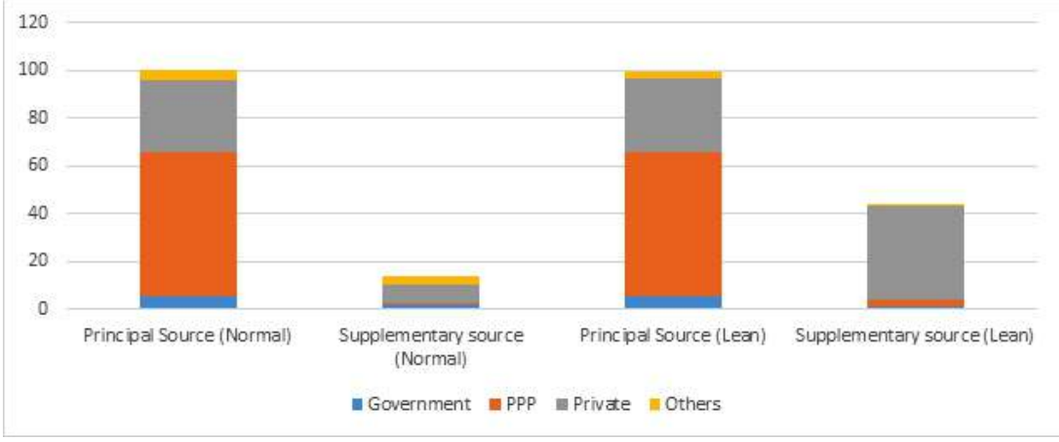


Figure 14: Drinking Water Sources by Ownership



The dependence on drinking water sources by ownership indicates a strong presence of public-private partnerships, a form of which is present in all the villages other than one (Figure 14). The private ownership dominance is also significant, and it is the second most important source. As was obvious from Figure 13, there is no change in the principal source of drinking water used by households across seasons. However, the dominance of private significantly goes up in the lean seasons, as the main source of water has to be supplemented by many in the season of scarcity, a gap that is dominated by the private sector. The category of 'others' are multiple sources like own source, community sources, water shared among neighbours. The extent to which households depend on this, which collectively can be understood as a coping strategy to deal with limited options, further go down in the lean season, both as the main and supplementary source[viii].

- Table 19 provides us the village level details of distribution of drinking water and the

Table 19: Village wise distribution of households by primary and supplementary sources of drinking water in abundant and lean season, 2017

Source	Primary source in abundant season				Primary source in lean season			
	Malkaram	Adibatla	Kokapet	Mallampet	Malkaram	Adibatla	Kokapet	Mallampet
Public stand post (treated water)	39.5	0	0	0	42.5	0	0	0
Industry tanker (treated water)	21.2	0	0	0	0.3	0	0	0
Private RO	29.6	1.7	0	66.6	32.5	1.7	0	66.6
PPP RO	0	97.5	100	28.7	0	97.5	100	28.7
Govt. RO	0	0	0	3	0	0	0	2.8
Direct piped water (temporary) managed by the community	3.2	0	0	0	7.5	0	0	0
Common taps/ stand-posts managed by the community	1.1	0	0	0	7.5	0	0	0
Others	5.4	0.8	0	1.8	9.7	0.8	0	2
	Supplementary source in abundant season				Supplementary source in lean season			
Public stand post (treated water)	2.4	0	0	0	NA	0	0	0
Industry tanker (treated water)	0	0	0	0	NA	0	0	0
Private RO	40.9	0.2	1.6	6	NA	1.4	87.4	14.2
PPP RO	0	0.2	0	1.4	NA	1.1	0	6.6
Govt RO	0	0	0	0.4	NA	0	0	0.8
Direct piped water (temporary) managed by the community	11.8	0	0	0	NA	0	0	0
Common taps/ stand-posts managed by the community	5.9	0	0	0	NA	0	0	0
Others	29.7	0.2	0	0		0.2	2.3	0
None	7	99.4	98.4	92.2		97.3	10.3	78.4
Total Observation (N)	372	526	1149	1389	372	526	1149	1389

following points emerge from it:

- The pattern of Malkaram is very different from the others, and expectedly so. The provisions of cheaper option like the Government or PPP models are not available in the village as in case of the three other villages. Notably, while in the normal season, more than 90% of the households do not have to depend on a second water source in the three other villages, 93% of the Malkaram households have to depend on a supplementary source even when the scarcity of water is not heightened. While 21.2 % and 39.5% of the households are dependent on treated water source from the industry and treated Krishna water respectively in the normal season, both of which are a successful cases of collective action, at the other end, 9.7% of the households in the lean season also have to fall back on untreated options as a primary water source. A staggering 25% of the households depend on untreated water as

supplementary sources even in the normal season in this village. It needs to be mentioned here that the health risks would be similar irrespective of the quantum of polluted water consumed by individuals.

- The dependence on private RO, which is the most expensive source, increases in the lean season both as a supplementary source and primary source. In Malkaram, where the supplementary sources cannot be compared in the two seasons, there is some increase of private option as the primary source in the lean season, though this increase is not significant. However, going by the fact that 41 % of the households in the village depend on it as a supplementary source even in the normal season when the villages are ill equipped to pay for it, this figure is likely to be indicative of either increased economic pressures or exposure to poor quality water in the lean season.

- The analysis for the other villages point towards the importance of the panchayat's bargaining power with the private sector on the nature of water used by the residents. For example, two of the villages, i.e. Mallampet and Kokapet have entered into contracts with multinational corporations named Dr. Water and SMAAT respectively. While the panchayat in Kokapet has not allowed the SMAAT to increase the price of the water in the lean seasons, that in Mallampet has been more flexible with Dr. Water. The consequence of this has been that in case of the former village around 90% of the households have to depend on supplementary sources (87% on private ROs). As per our qualitative field insights, it was reported that on a number of days in the summer months, SMAAT was non-operational, forcing the residents to depend on private firms. In case of Mallampet, Dr. Water supplements the borewell water as a raw material with private tankers and manages to provide water in its entirety to around 78% of the residents, albeit at an increased price. Significantly, Dr. Water charges the highest price among three of the PPP models that we have empirical evidence of. In Adibatla, which is the farthest village located in the periphery of Hyderabad Metropolitan Development Area (HMDA) with respect to the core city, the shift to supplementary source in the lean season is negligible. Notably though the private partner in the village is an informal one, the relatively small water table decline has enabled a more continuous supply of water in the lean season. In Adibatla too, the prices were not increased in the lean season, though this did not impact the supply.

- The government owned RO, though selling water at the lowest price among ROs, is completely ineffective in the only village it has an existence, i.e. Mallampet. It serves only 3 and 2.8% of the residents in the normal and lean seasons respectively as a primary source of water, and less than 1% of the households as a supplementary source.

What clearly comes up from the foregoing analysis is that firstly, the privatization of water has not in any way offered a viable and affordable alternative to a poor village like Malkaram. Secondly, the formal private sector, in this case, multinational corporations, bears no risk whatsoever, in the periods of scarcity. This risk in part is borne by the residents and the panchayats, more the former than the latter; in the latter case, the degree of risk borne is dependent on the degree to which the panchayat serves its constituency and falls in line with the commercial logic of the corporate sector. In Mallampet the consequence of strict norms being imposed on the corporate sector has resulted in it shutting down on a number of days, with residents paying for a far more expensive source. In Adibatla, the strict norm has worked in favour of the residents, probably partly because of the informality and insignificance of the private party vis-à-vis the panchayat and partly because of better ground water conditions.

Table 20 reveals caste patterns in access to water, both in the normal and the lean seasons. Caste historically has defined significantly the nature of access to water not only in terms of its use, but this alienation has had been an extension of the loss of dignity particularly to the dalits (oppressed) that the society has witnessed and institutionalized. Joshi argues that 'Contrary to popular assumptions, both official welfare-based supply and recent neo-liberal policies and interventions hinge on a tokenistic, segregated and apolitical mention of gender and/or caste concerns which, when translated into action, have often reinforced existing inequities' (2011:p 56). In other words, it is not with privatization that exclusion of marginalized caste groups have exacerbated, but the new institutional order has simply carried on with what was historically experienced, at times deepening it.

Table 20: Caste wise percentage distribution of households by primary source of drinking water in abundant and lean season, 2017

Source	Primary source in abundant season			Primary source in lean season		
	OC	BC	SCST	OC	BC	SCST
Public stand post (treated water)	11	2.9	4.1	12.1	3.1	4.3
Industry tanker (treated water)	2.3	2	3.5	0	0	0
Private RO	33.3	30.8	26.8	30.2	31.5	28.1
PPP RO	49.5	62.6	58.3	49.5	62.4	58.6
Govt. RO	0.2	0.1	6	0.2	0.1	5.7
Direct piped water (temporary) managed by the community	1.2	0.3	0	2.3	0.5	0.8
Common taps/ stand -posts managed by the community	0.2	0.1	0.2	2.7	0.3	1.1
Others	2.2	1.3	1.3	3	1.8	1.7
	Supplementary source in abundant season			Supplementary source in lean season		
Public stand post (treated water)	0.2	0.4	0.9	0	0	0
Industry tanker (treated water)	0	0	0	0	0	0
Private RO	13.9	6.7	4.9	39.9	41	33.1
PPP RO	0.4	0.4	1.4	2.2	2.4	6.9
Govt. RO	0.2	0	0.6	0.3	0	1.8
Direct piped water (temporary) managed by the community	4.4	0.7	1.1	0	0	0
Common taps/ stand -posts managed by the community	1.9	0.3	0.9	0	0	0
Others	7.1	2.5	3	1.1	0.6	2
None	71.7	88.8	87.2	56.5	56.1	56.2

Note: OC: Other castes (upper); BC: Backward castes; SC- Scheduled castes (Dalits/ oppressed); ST – Scheduled tribes (indigenous groups whose share is very low in the study areas).

Table 20 throws up mixed evidences, some of which conforms to the general understanding of water access among caste groups. Firstly, treated Krishna water, a safe government and unpaid source in Malkaram has mostly been appropriated by the upper caste groups. The reason for this is the spatial segmentation by caste groups in villages, and this source being located in the cluster inhabited mostly by the upper caste households. Thus the 'collective action' elaborated around the access of this water source was clearly exclusive in nature and did not necessarily serve the most marginalized. Secondly, though the dependence on private RO plants as a primary source of water in the normal season has a clear caste pattern in the sense that

upper caste depend on it more than SC/ST households, this pattern gets diluted in the lean season. This dilution happens due to higher increases in dependence of the BCs and SC/STs in the lean season as the main source of water. As a supplementary source of water this pattern is even more visible. In other words, during times of scarcity when the prices of water is the maximum, the lower caste groups are forced to depend far more on the most expensive sources of water, in all probability due to lack of alternatives.

However, some of the trends are contrary to popular perceptions. In Mallampet, the only village having a government RO, the SC/STs in relative terms enjoy greater access to this cheaper source of drinking water. However, this may well be one of the reasons why the plant has not expanded in the manner it was required to, since this could be linked to the poor and lack of effective bargaining power of the group with the government at all levels. On the whole access to the PPP plants is higher for the BCs followed by the SC/STs compared to the upper caste. A deeper investigation is required to unpack the reasons for the same, which could provide useful insights for future policy directions.

8.4 Access to Domestic Water Sources: Impact of Tanker Economy on the Peri-urban Residents

As mentioned earlier, one of the ways in which this study can be differentiated with the existing ones is that most of the existing studies do not make a difference between drinking water and other domestic uses of water (Bain et al 2014, Goff and Crow 2014, Kayser et al 2013, Crow & Sultana 2002). This study argues that not only are these two sectors (drinking and residual domestic water sector save cooking water) distinct in terms of their operation, content and implications for residents, they are at the same time connected to each other in a manner that an analysis of either or the other precludes the possibility of a holistic understanding of both the uses. The Hyderabad case reveals that the water typically used for the residual domestic sector (henceforth referred to as domestic water) often serves as a raw material for the processed drinking water. The expansion of privatization in ground water based domestic water sector thus exerts increasing and competing demand to the drinking water available to the residents.

One of the characteristics that differentiate these two kinds of water is that domestic water is required in vast quantities. Thus the quality of access of domestic water has strong implications for work burden in the household for its collection and management within the household, typically for the woman in the household. This analysis also reveals that the most of the domestic water used in peri-urban Hyderabad is almost always from untreated sources. It is clear from figure 15 that unlike in the drinking water sector, the government sources are used by a significant share of households as a primary source of domestic water both in the normal and the lean seasons and this share does not change significantly in the lean season. The next important source is own source, which are mostly personal borewells. The difference between the normal and the lean seasons is that a few households (less than 5%) in the study villages depend primarily on private tanker water in the lean season. There is however, a substantial difference in the normal and the lean seasons in case of supplementary sources. The share of households using supplementary sources of water increases from 15% to 49%, and the incremental sources that they depend on are private tankers, personal borewells and a mix of government sources, where the former is by far the most dominant.

Figure 16 reveals that the share of households depending on paid sources for domestic water, driven centrally by the use of water purchased from private tankers, increases in the lean season, both for primary and supplementary sources, but mainly in case of the latter.

The village-wise distribution of domestic water reveals a commonality with the pattern of drinking water use in the sense that the most economically deprived village, Malkaram, having

Figure 15: Share of Domestic Water Sources used by Households by Ownership

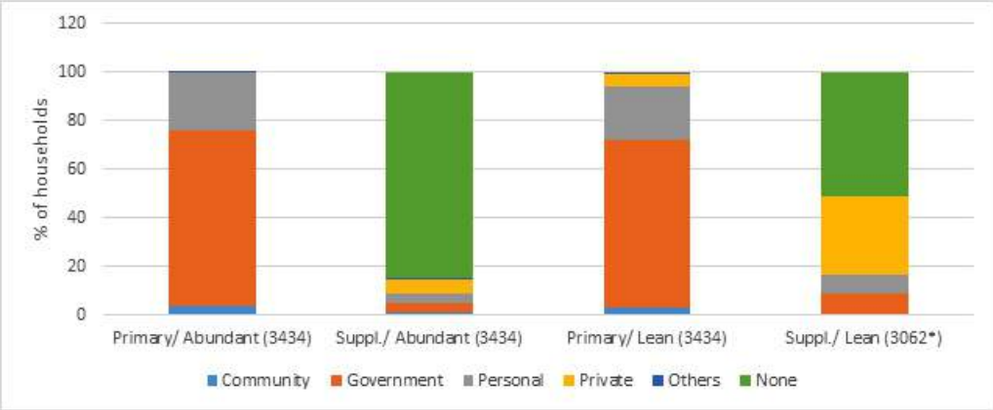
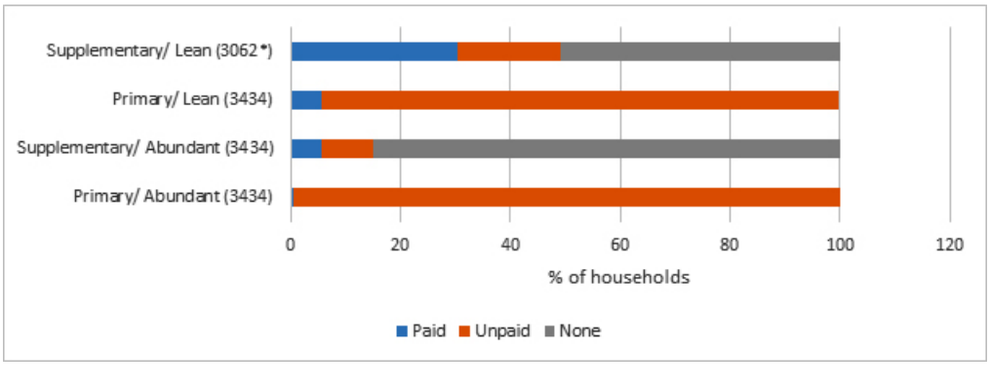


Figure 16: Share of Domestic Water Sources by Payment



poor water infrastructure has patterns that is starkly in deviance with the other villages (Table 21). In all the other villages, government sources (a combination of state infrastructure and panchayat water delivery) through piped water is the main source of domestic water in primary capacity in both seasons, though in the lean seasons, in two of the three villages there is a slight fall in its share. In these villages, personal sources, i.e. borewells are the only other significant source, the incidence of dependence of which in the primary capacity also does not change a lot. There are a number of differences in Malkaram when we compare it to the other three villages; they are as follows:

- The government sources are far less important both because of low coverage of piped water supply and inadequate water delivery by the panchayat.
- In spite of low access to own borewells, in the normal season, a relatively high share of households depend on this source due to sharing water among neighbours, a phenomenon absent in the other villages. The incidence of water sharing goes down drastically in the lean season.
- Community sources through informal arrangements are an important source of domestic water, from the sources mentioned in the earlier section, though the share of households dependent on such sources goes down in the lean season.
- Most importantly, in spite of adapting through collective informal arrangements to make up for the lack of infrastructure, the dependence on private tankers is a primary source of domestic water in the village is far higher in the lean season compared to other villages. This trend is similar for drinking water, though the sources in question are completely different for the two uses. In other words, the village and the residents least capable of paying for water end up paying the most for both domestic and drinking water, bearing the cost of poor public governance on the one hand and privatization of water, on the other.

Table 21:Village wise distribution of households by primary and supplementary sources of drinking water in abundant and lean season by ownership, 2017

Source	Primary source in abundant season				Primary source in lean season			
	Malkaram	Adibatla	Kokapet	Mallampet	Malkaram	Adibatla	Kokapet	Mallampet
Government	35.7	83.3	80.4	71.3	21.2	76.2	80.4	70.5
Personal/own	26.1	16.2	19.5	28.8	16.7	17.5	19.6	27.5
Private	0	0.6	0	0	33.6	5.7	0	2
Community	36.5	0	0	0	25	0	0	0
Others	1.6	0	0	0	3.5	0.6	0	0
	Supplementary source in abundant season				Supplementary source in lean season			
Government	8.5	3.4	0.5	4.5	NA	22.8	5.9	5.3
Personal/own	13.8	0.2	0	5.7	NA	6.3	0	15.8
Private	35.2	1.4	0	3.2	NA	33.6	1.6	53.2
Community	11.3	0	0	0	NA	0	0	0
Others	1.6	0	3.1	0	NA	0	5.1	0.1
None	29.6	95	96.4	86.6		37.3	87.4	25.6

Table 22:Village wise distribution of households by primary and supplementary sources of drinking water in abundant and lean season by access, 2017

Access	Primary source in abundant season				Primary source in lean season			
	Malkaram	Adibatla	Kokapet	Mallampet	Malkaram	Adibatla	Kokapet	Mallampet
Exclusive	45.9	98.9	86.8	61.7	53.3	96.8	86.8	63.6
Shared	15.6	1	0	2	10.2	3	0	1.9
Public access	38.4	0.2	13.1	36.4	36.5	0.2	13.2	34.5
	Supplementary source in abundant season				Supplementary source in lean season			
Exclusive	46.3	3.1	3.6	8.3	NA	39.5	7.8	61.4
Shared	6.7	1.9	0	3.8	NA	23.2	0.9	10.6
Public access	17.4	0	0	1.3	NA	0	3.9	2.4
None	29.6	95	96.4	86.6	NA	37.3	87.4	25.6

The quality of access to domestic water is a far more important issue due to the quantity of water use, which has been discussed in detailed subsequently in the chapter on gender. Other than the piped water supply delivered by the panchayat, most government and community sources have a public access and is essentially located outside the premises of the household. The purchased water from the tanker, on the other hand, provides an exclusive use even when the tanker water is purchased on a shared basis, since the water is delivered to a large storing space (sump) owned by the households using a pipe. Thus the exclusive use actually increases in the lean seasons for the households that can afford to purchase the tanker water (Table 22). The problems of scarcity and cost notwithstanding, the lean season thus is likely to reduce the burden of fetching domestic water, which is almost exclusively done by women.

The caste differences in the study villages by use of domestic water reveals the following (Table 23):

- There is not much difference in the sources of use between the BCs and SCs. Both

groups depend more on piped water supply than the upper castes. It is not clear whether this is because the latter have greater access to personal borewell supply; our field insights reveal no significant caste wise difference in distribution of pipe-line connections.

- The upper castes depend more heavily on own borewells compared to the other two caste groups. In case of this source, there is a hierarchy between the BCs and Scs.
- Somewhat greater shares of BCs and SCs depend on public stand posts compared to OCs. However, more benefits accrue to the upper caste groups compared to its counterparts from community stand posts, which is a source only in Malkaram, primarily due to the location of the facility.
- Although in the abundant season, less share of BCs and SCs use a supplementary source, in the lean season this order reverses.
- Interestingly, in the lean season and as a supplementary source, which is the category in which tanker is used the most, the share of households that use purchased water from the tanker increases as one goes down the caste ladder. This finding is significant, and shows lower access to dependable sources of water in the lean seasons among the lower caste groups.

Table 23: Caste wise percentage distribution of households by primary source of domestic water in abundant and lean season, 2017

Source	Primary source in abundant season			Primary source in lean season		
	OC	BC	SCST	OC	BC	SCST
Direct piped water (Govt.)	29.9	53	55.7	28.7	51.3	52.4
Direct piped water shared with other hhs (Govt.)	0.2	0	0	0.2	0	0
Direct piped water borrowed from neighbour (Govt.)	0.6	0.5	1.3	0.2	0.3	0.5
Direct piped water (temporary) managed by the community	6.2	1.2	1.3	2.7	0.3	0.6
Public stand post (Govt.)	16.8	21.5	18.6	13.5	20.2	18
Common taps/ stand-posts managed by the community	3.1	1.2	3.9	3.7	1.3	3.1
Public stand post (treated water)	2.1	0.7	0.6	3.7	1	0.8
Public hand-pump	0	0	0	0.4	0	0
Personal borewell	39.9	21.5	18.4	35.1	20.3	18.2
Private Tanker	0	0	0	1.9	2.3	2.3
Govt. tanker(shared with other hhs)	0	0	0	0	0.3	0
Borewell water purchased from private vendors (drum size <25)	0	0	0	8.1	1.9	3.5
Personal well	0.2	0	0	0.4	0.2	0
Cheruvu/ Kunta	0	0.1	0	0	0	0
Others	0.6	0	0.3	0.4	0.4	0.6
None	0	0	0	0	0	0
Total (%)	100	100	100	100	100	100
Households using no supplementary source	73	87.2	85.2	58.7	49.7	49.8
Tanker use as a supplementary source	2.7	1.7	2.5	25.5	30.9	32.1
Total households	481	2318	635	481	2318	635

Figure 17: Caste Groups Distribution in Village Malkaram

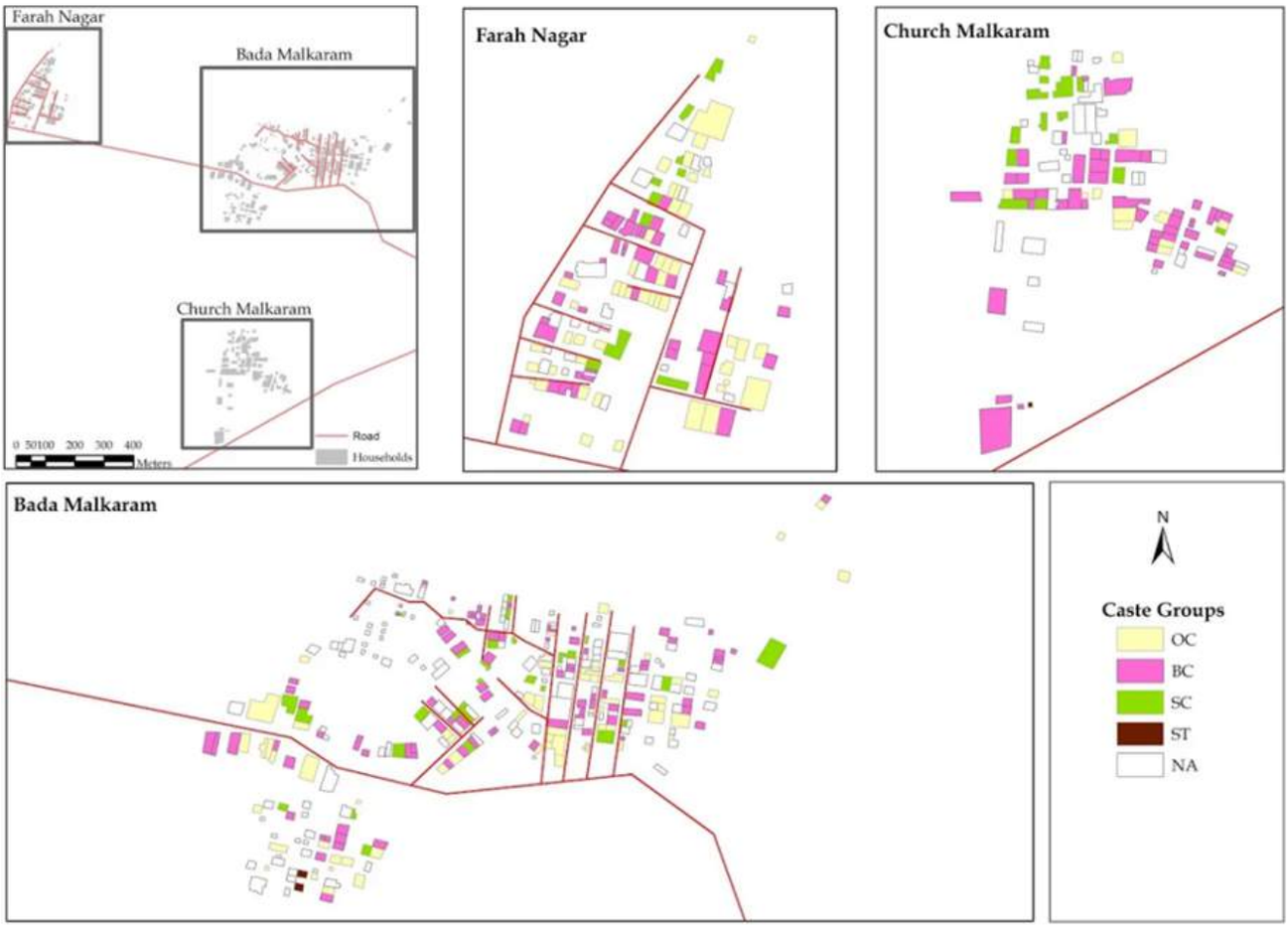


Figure 18 shows a complete spatial segmentation in terms of drinking water sources in the three clusters of the village in the normal season, and the pattern is in some sense counter-intuitive. While Bada Malkaram and Church Malkaram benefited from collective community actions which was restricted to these clusters, Farah Nagar, the poorest section of the village is almost completely dependent on private RO plants. This can be explained through two interrelated facts; the Jawahar Nagar Dump Yard pollutes most of the surface and ground water around the cluster and due to this, no options other than treated sources are viewed as safe.

The lean season reveal an unexpected spatial pattern. While the situation in Bada Malkaram remain unchanged in terms of the sources of water, Church Malkaram shifts primarily to private RO plants; *Farah Nagar actually shifts out of RO water to multiple sources of water that either involve labour for women or/and are unsafe sources. Women from a few households walk to Bada Malkaram to carry back Krishna water, due to which they have to drop out of work for the season, as reported by residents of the cluster. The shifting out of RO water from normal to lean season is related to the price of this water that doubles in the lean season.*

It can be observed from figures 20 and 21that the incidence of households consuming unsafe (untreated) sources of water has increased visibly in the lean season, and this increase is mostly concentrated in Farah Nagar. As mentioned before, in the village, around 27% of the households during water scarcity depend on unsafe water source.

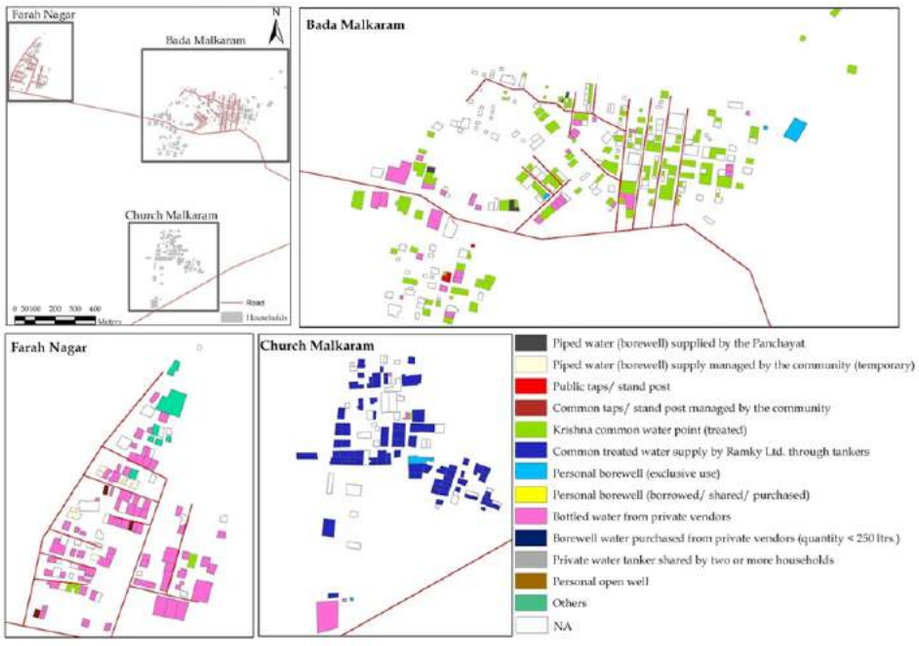
In case of domestic water, our analysis shows that in Farah Nagar, a lot of households have to switch from community managed taps to community managed stand posts in the lean season due to fall in water supply, due to which the water has to be collected from outside the premises. The better-off households in Church Malkaram falls back on own bore well during the summer months, while those in Bada Malkaram depend on purchased water from tankers.

8.5 Spatial Segmentation in Villages and Inequalities in Water Availability and Access

In the foregoing analysis, unequal conditions across caste and villages have been discussed. The inequality of water related infrastructure provisions was seen to be clearly lacking in the most deprived village, and this reveals that the lack of public coverage is not made up by the private operators either in drinking or the domestic water sector. This kind of inequality in literature has been called a potentially negative and fragmenting socio-spatial effect that exacerbates inequalities primarily shaped by economic reforms (Zérah 2008). There are a number of studies that elaborate on complex relationships in the society that manifests spatially, and it has been argued that the new forms of spatial inequalities imposes itself on the older ones to deepen the existing cleavages(Pflieger & Matthieussent 2008, Daniels, & Friedman 1999).

In this section, we take the case of one village, Malkaram, which has been discussed in details, because of high incidence of poverty and lack of infrastructure. As one level, this is a manifestation of a spatio-social inequality. However, it can be argued that this runs within the village and are expressed in intra-village differences; this case study thus reveals new forms of inequalities that were not clear from village-level comparisons.

Figure 18: Primary Source of Drinking Water during Normal Season in Village Malkaram



There is a mix of caste groups in the three clusters of the village, though there is a religious segregation (Figure 17). Farah Nagar is dominated by Muslim households, Bada Malkaram, which is the central part of the village is inhabited largely by Hindus, while a fair share of the households in Church Malkaram are Christians. In this cluster, there is a concentration of SC households in the North West portion. Thus, for the most part, other than that of Church Malkaram, the caste groups are intermixed, and thus any spatial differences that may be observed is not likely to be driven by caste identities. As mentioned while the introduction to the villages were being provided, Farah Nagar is the most deprived cluster, economically, socially and in terms of basic facilities. Church Malkaram is as well as Bada Malkaram are better off in the generally neglected village, and a large share of the households in the former cluster are in regular salaried jobs.

Figure 19: Source of Drinking Water during Lean Season in Village Malkaram

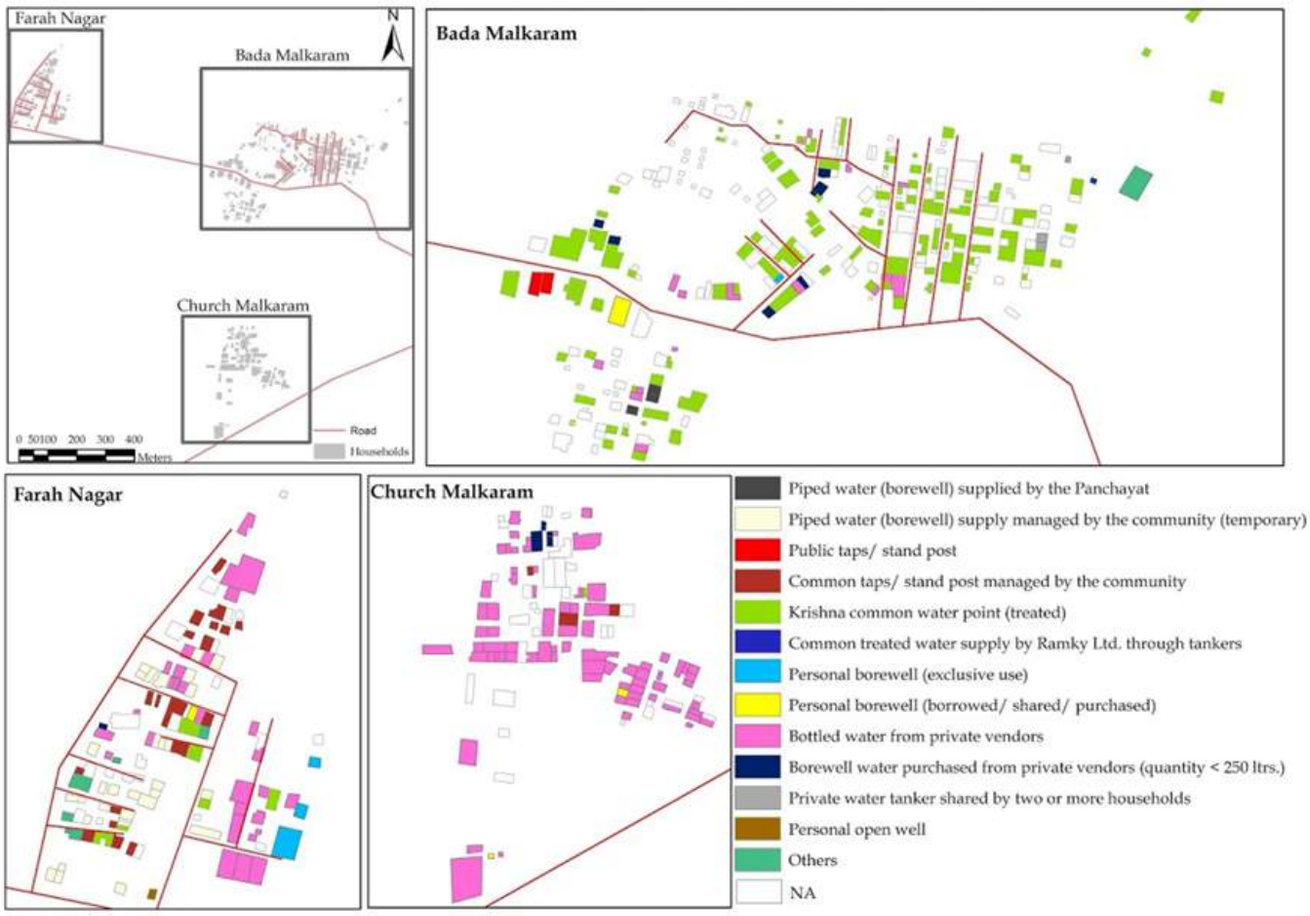


Figure 20: Quality of Primary Sources of Drinking Water during Normal Season in Village Malkaram

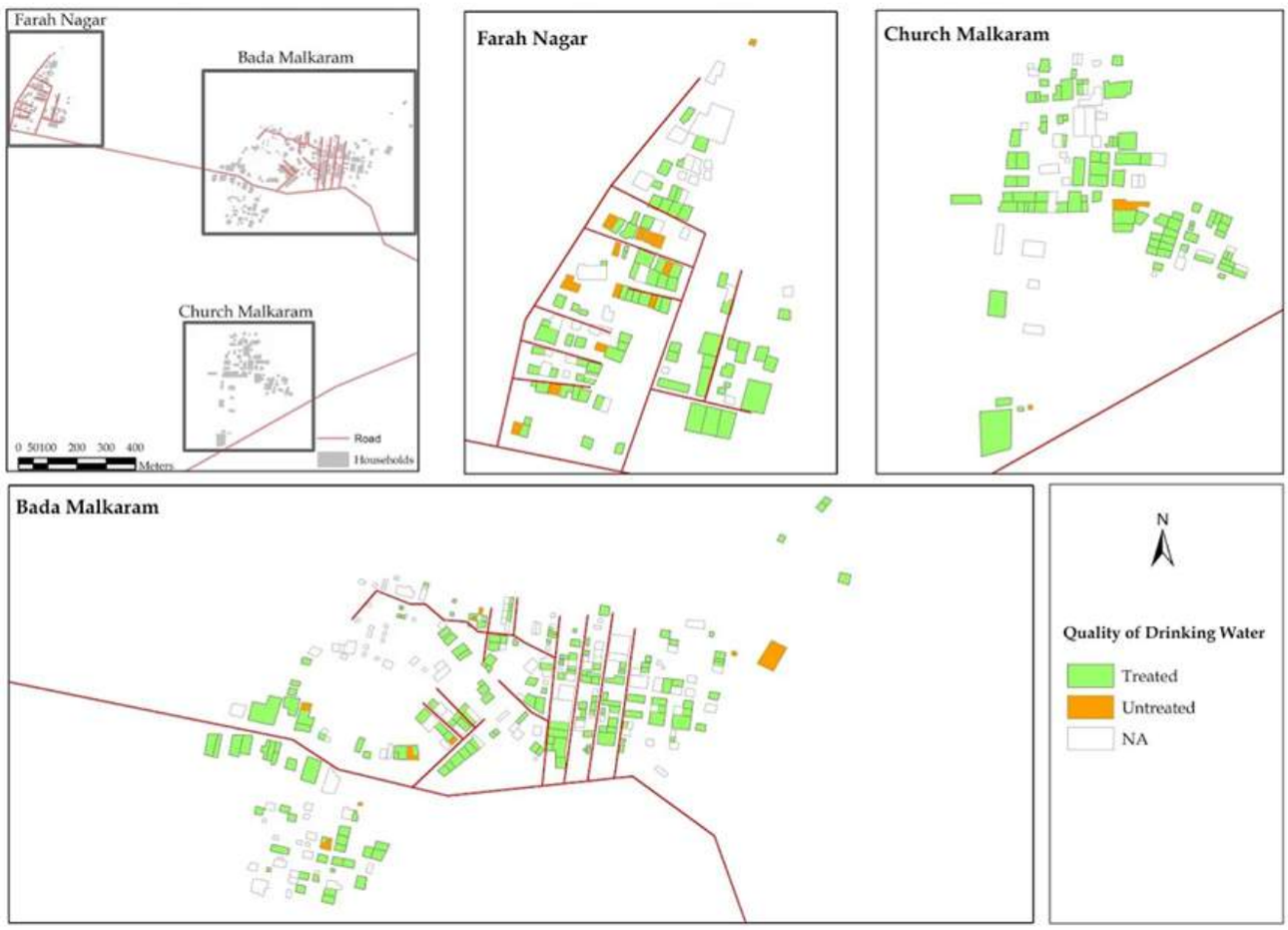
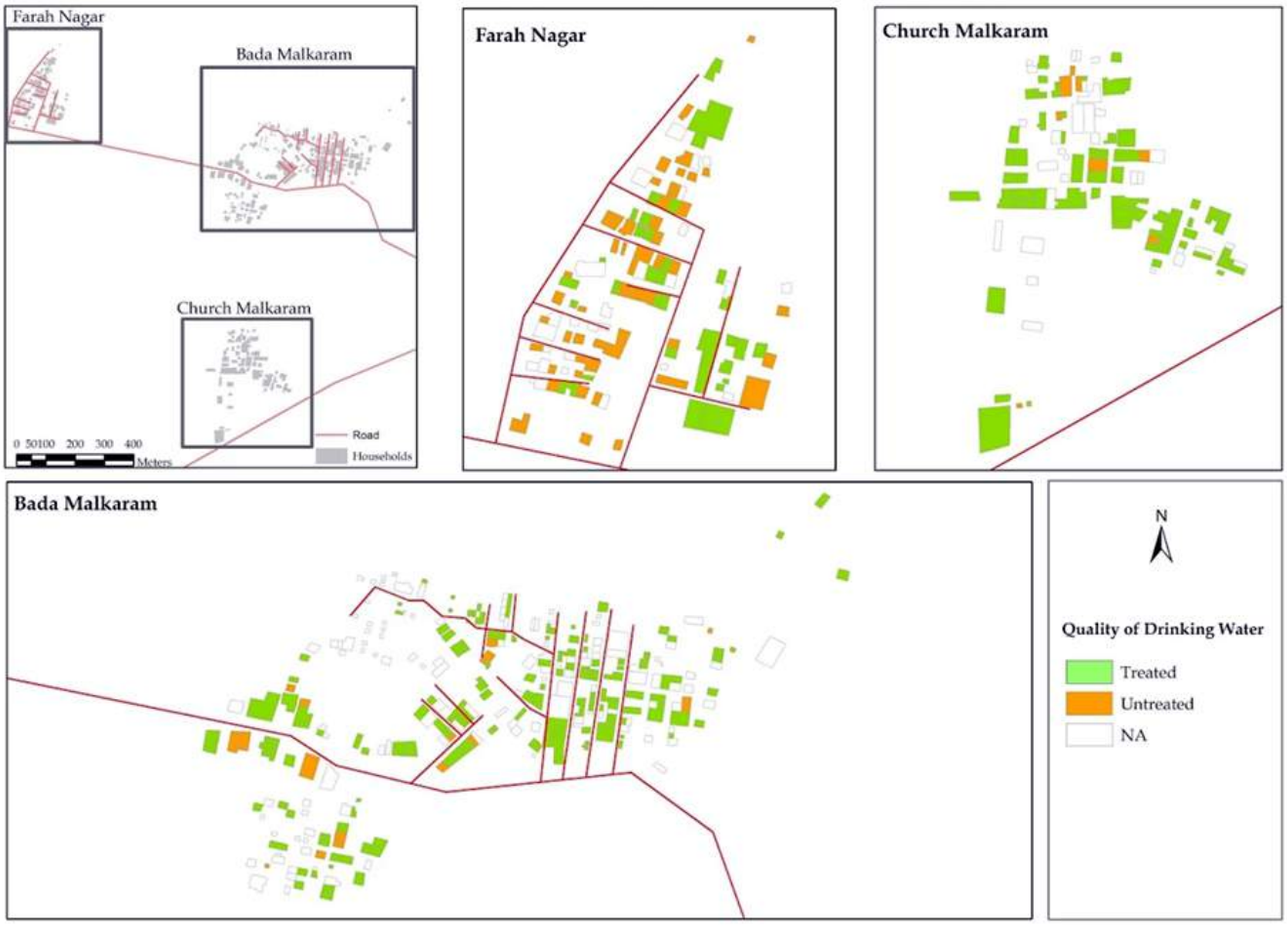


Figure 21: Quality of Drinking Water during Lean Season in Village Malkaram



8.6 Summing up

One of the arguments in favour of promoting privatization in the drinking water sector has been that of efficiency. Our analysis reveals that marketization of water has been all pervasive and purchased drinking water is used upon by a large majority of households, which increases in the lean season. Marketization includes three institutional forms in drinking water-government owned ROs, PPP models and completely private models. Almost none of these offer sealed water, which also means that they do not vouch for its quality in legal terms. The price increases, as one would expect, from the government RO end to the private end. Private sector influence increases far more in the lean seasons, and that influences prices increases for most of the PPP alternatives and for all private alternatives, more in the latter than the former. The PPP arrangements are different both in terms of their forms and function, and the latter depends on the intent and bargaining power of the panchayat. In two of our study villages multinational corporations are the private partners in the PPP enterprises, and in both cases, irrespective of the panchayat role (one bargaining in favour of the residents and the other favouring the private sector), the risk was borne by the residents by having to pay higher prices whether they continued to buy from the PPP or the private plant. The analysis show that PPP models has not covered residents that have low purchasing power and need it the most. The sole government RO plant in our study villages is ineffective and cover insignificant number of households even in the village where it is present, though its price is the cheapest. We have come to the conclusions that villages, clusters and residents that can afford to pay the least have got least support from the public sector, both in terms of panchayat water in the domestic sector and through government or PPP models in the drinking water sector. The people at the margin are either forced to pay for expensive sources of

water, and in lean seasons, when prices go up, many simply fall back on untreated sources of water. *One of the important observations that emerge is that the demand for treated water sources stem from the high incidence of pollution in the peri-urban zone that has two major roots, the urban waste and industrial pollution. This makes the untreated water extremely unsafe for consumption. Thus the poor and spatially marginalized are at great health risks particularly in the lean seasons.*

Lack of support from the public sector is visible in the peri-urban context. The main forms of government support is seen in provision of untreated water by the panchayats used for domestic purposes and PPP models for drinking water, but even this is a decentralized form as opposed to a more centralized form of support through state programmes. It is observed that there is no uniformity that can be expected in terms of how this form of support will manifest itself in seasons of scarcity, and the variance can be explained not only with physical scarcities of water, but is related to private (corporate) interests in many cases.

The scarcity of drinking water in the lean season leads a widespread effect in terms of dependence on more expensive sources of water, particularly for drinking and cooking. The impact of private tanker water in terms of the way it impacts consumption in the study villages is fairly marginal, and is visible only in the lean season in terms of supplementary sources. Such impacts are even less when panchayats are strong and impose strict norms on tanker operators. *Thus, the tanker water operation is not dependent on the demand from the residents of the peri-urban areas, even in the lean seasons; they have emerged and thrive to satisfy the demands in the city core, but more importantly the big industrial and services enterprises coming up rapidly in the peri-urban zones*. However, it would be fallacious to conclude that the spatial outflow of water by private tankers does not have an impact on the availability of drinking water sources or options in the villages. The analysis of the ground water depth shows that even during low rainfall years, the lean season ground water table, though depleting, should not lead to a scarcity that could justify the increase of prices to 2 to 4 times. The outflow of water from the villages increases during the lean seasons, and unless the panchayat plays a strong role in controlling this, the scarcity is created due to the lack of availability of the raw water needed for the village RO plants. Secondly, increased demand from the residents of Hyderabad in the lean seasons of both sealed and unsealed water offer remunerative possibilities for the private ROs and loosely managed PPP plants and this also leads to unreasonable increases in drinking water prices within the villages. *Thus though the operations of tankers does not, in any notable manner, impact the domestic water consumption in the study villages, it is deeply intertwined with the drinking water sector that critically impact livelihoods of the residents of the study village.*

Lack of public support and inability to pay for the private options have led to community efforts and collective action, seen in Malkaram village, whether it be bargaining for supply of tanker to deliver treated water from Ramki Industry or getting a connection form Krishna Water supply entering into an informal understanding with BITS Hyderabad. Example of more localized arrangements based on the strength of social cohesion has been also observed in terms of sharing water with the neighbors. However, even in these 'mutually beneficial' collective actions, those without bargaining power like the Muslim community in Farah Nagar are left at a loose end.

Chapter Nine
Water Pricing

The multiplicity of institutions and arrangements playing out in the supply of water in the peri-urban create a complex and fuzzy water-provision landscape associated with a variety of forms of access and ownership, shortages, water prices, and insecurity. This chapter will focus on aspects of pricing or cost of water access. Pricing of water is particularly relevant in the study area wherein there is a significant dependence on purchased water.

9.1 Characterising Water Sources: Cost and Reliability

The variety of sources seen in the study villages gives an indication towards the multiplicity of water sources that together are required meet the household's water demand in peri-urban Hyderabad. In the absence of a single reliable low-cost proximate source of good quality water, people depend on a number of sources characterised by different combinations of ownership, access, treatment, prices, duration and frequency of supply. Tables 24 and 26 show a picture of the variety of institutional arrangements in water provision found in the study villages in peri-urban Hyderabad. These sources vary in terms of prices, reliability of supply, quality, etc. A combination of these characteristics would lead to varying levels of dependence on different sources of water for different uses. The tables characterize these variety of source based on their ownership, exclusivity of access, average duration of supply and average cost of water for various sources as reported by sample households. The duration of supply is indicative of reliability of water supply from a source. It is evident from Table 24 and Table 26, that government sources offer the primary low-cost access to water.

Different sources of water are used for drinking and domestic purposes of the household, as presented in Tables 24 and 26. For drinking purposes the dependence is largely on treated exclusive access sources – PPP and Private RO. While these sources are relatively more reliable with regard to duration of supply, these sources are characterised by high unit costs for water access. Private ROs are the most costly sources of drinking water. Among treated RO water sources the Government RO is sold at a lower price than PPP and Private RO sources. The trend shows that the price of water reduces with an increased government participation in water provision. Public stand posts and the Krishna water common point are examples of public water sources which are provided at zero costs and also have reliable supply. There is a notable dependence on the Krishna water common point which is a public treated water source that is highly reliable as well as a low-cost source. Though this is a rare, informal and illegal source available in only one village in a single cluster, making it time-consuming and laborious to access, this low-cost treated public source present a water-secure alternative to costly treated water sources. In Malkaram village almost 50 percent of households (47.6% in normal year and 49.2% in lean year) have reported primary dependence on Krishna water for drinking water purposes. Another promising trend for government sources is its higher access among the lower classes of the population, though many of these sources are untreated sources. This is clearly evident from Table 25 showing the distribution of drinking water sources among different economic groups, wherein the highest percentages of the poorer sections of the population depend on public stand posts and Krishna common water point. This reveals that the prevailing prices of treated water are high enough to discourage the poor from accessing it and the alternative sources that they are forced to depend on entails more drudgery and/or poorer water quality, as in the

case of common public stand posts. During the lean season there is a drastic fall in the level of dependence of the poor on these public sources with a corresponding increase in the dependence on RO water and tankers. This is an indication of lower reliability of these sources during the lean season, compelling the poor towards more expensive purchased sources of drinking water. Strengthening of secure supply of these low cost public sources is thus essential to ensure equity in water access and improved water access security for the poor.

Table 24: Prices and Dependability of Sources of Drinking Water

Ownership	Access	Source	Drinking				
			Avg cost (Rs/100litres)	Duration (hrs/month)		N	
				Abundant	Lean	Abun	Lean
Govt.	Exclusive	Direct piped water	0.87	24	7	10	5
		Bottled water from RO **TREATED**	**25**	48	60	5	5
	Non-exclusive	Public stand post	0	**184**	**141**	13	6
		Krishna common water point **TREATED**	0	**720**	**720**	30	31
		Tanker	0	*	21**		10
Personal (Own)	Exclusive	Borewell/ tubewell	2.77	**720**	**540**	4	4
		Borewell (Filtered) **TREATED**	6.32	**720**	**720**	6	6
Private (Purchased)	Exclusive	Borewell water purchased from private vendors (drums)	2.50	20	*	1	
		Bottled water from RO **TREATED**	**46.84**	290	293	63	73
PPP	Exclusive	Bottled water from RO **TREATED**	**29.77**	333	331	146	148
Industry	Non-exclusive	Ramkey Tanker **TREATED**	0	6	*	10	
Community	Non-exclusive	Common taps/ stand post managed by the community	0	**720**	**720**	1	1
***water source not used; ** time dependent on both availability and demand.**							

In the case of domestic water prices, the highest unit costs of water are for private exclusive-access sources of purchased water like exclusive tankers and borewell water purchased from private vendors in drums of upto 250litres. Non-exclusive shared tankers water also show a very significant increase in prices from a normal abundant season to a lean season. All sources show a reduction in duration of supply during the lean season. A shift to towards tankers for meeting supplementary lean season demands of water is evident (Table 26 and Table27). However, a significantly high proportion of households continues to depend on government sources of water.

The distribution of primary domestic water sources by economic groups reveals that while upper classes are predominantly dependent on exclusive piped water and owned borewells for domestic water access, the poorer sections are more spread over a variety of low cost non-exclusive shared or community sources of water. During the lean season households move from government piped water supply (except Krishna water) which becomes lesser reliable during the lean season, to tankers and own borewells. For the upper class the shift is more marked towards owned borewells, while for the poorer households there is an increased dependence largely on government tankers.Dependence on the high cost sources of domestic water is largely for supplementary water access particularly during the lean season.

Table 25: Distribution of Drinking Water Sources by Economic groups

Source	% of households in economic group							
	Abundant season				Lean season			
	Poor	Lower middle	Upper middle	Upper	Poor	Lower middle	Upper middle	Upper
Direct piped water	**10.53**	2.54	1.04	5.41	2.63	0.85	1.04	5.41
Public stand post	**21.05**	**3.39**	**1.04**	**0.00**	**10.53**	**1.69**	**0.00**	**0.00**
Krishna common water point (treated)	**21.05**	**11.02**	**9.38**	**0.00**	**21.05**	**11.02**	**10.42**	**0.00**
Community managed common taps	0.00	0.85	0.00	0.00	0.00	0.85	0.00	0.00
Borewell/ tubewell	2.63	0.00	2.08	5.41	2.63	0.00	1.04	5.41
Borewell (Filtered)	0.00	0.00	5.21	2.70	0.00	0.00	5.21	2.70
Ramky tankers	5.26	2.54	5.21	0.00				
Tanker					**13.16**	**3.39**	**1.04**	**0.00**
Bottled water from RO	**39.47**	**79.66**	**76.04**	**86.49**	**50.00**	**82.20**	**81.25**	**86.49**
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Table 26: Prices and Dependability of Sources of Domestic Water

Ownership	Access	Source	Domestic				
			Avg cost (Rs/100litres)	Duration (hrs/month)		N	
				Abundant	Lean	Abun	Lean
Govt.	Exclusive	Direct piped water	0.79	30	22	158 (3)	134 (9)
	Non-exclusive	Direct piped water	0.43	28	25	18	16
		Public stand post	0.08	209	181	47	37 (16)
		Krishna common water point **TREATED**	0	720	643	12 (5)	12 (3)
		Hand-pump	0		720		1
		Tanker	1.08		18		25 (16)
Personal (Own)	Exclusive	Borewell/ tubewell	2.68	701	663	24 (13)	29 (16)
	Non-exclusive	Borewell/ tubewell	3.07	559	384	8 (8)	9 (16)
Private (Purchased)	Exclusive	Borewell water purchased from private vendors	19.88	360	210	(1)	1 (14)
		Tanker	13.33		54		(8)
	Non-exclusive	Tanker	12.55	140	115	(1)	(43)
		RO Waste	0	360	23	(1)	
Industry	Non-exclusive	Ramkey Tanker **TREATED**	0	5		(1)	(4)
Community	Exclusive	Piped water (borewell)	2.35	49	48	11	12
	Non-exclusive	Piped water (borewell)	2.67	60		1	
		Common taps/ stand post	0	203	210	10	10
( ) N value for use as supplementary source							

Table 27: Distribution of Primary Domestic Water Sources by Economic groups

Source	% of households in economic group							
	Abundant year				Lean year			
	Poor	Lower middle	Upper middle	Upper	Poor	Lower middle	Upper middle	Upper
Direct piped water	**42.11**	**59.32**	**64.58**	**75.68**	**36.84**	53.39	57.29	48.65
Community managed piped water	2.63	5.08	5.21	0.00	2.63	5.08	5.21	0.00
Public stand post	**31.58**	**18.64**	**10.42**	**8.11**	**21.05**	15.25	8.33	8.11
Krishna common water point (treated)	**7.89**	**5.08**	**3.13**	**0.00**	**7.89**	**5.08**	**3.13**	**0.00**
Community managed common taps	**7.89**	1.69	5.21	0.00	**7.89**	**1.69**	**5.21**	**0.00**
Borewell/ tubewell	**7.89**	**10.17**	**11.46**	**16.22**	**7.89**	**10.17**	**16.67**	**21.62**
Hand-pump					0	0	0	2.70
Tanker					**15.79**	9.32	4.17	**18.92**
Total	100	100	100	100	100	100	100	100

9.2 Water Prices and Caste and Class

In general, during a normal year, there is a clear trend in the water prices faced by different economic groups. The poorer sections of the population depend largely on low-cost sources of water for both drinking and domestic purposes and thus face lower average cost of water, while the upper economic groups face relatively higher prices. However, the highest costs for drinking water are faced by the upper middle economic group due to their higher dependence on private RO. The poorer sections have lower dependence on RO water during the abundant year and distribute their water demands over other low-cost public sources. The shifts in average prices from abundant to lean season though is most marked for the poorer sections as many government/panchayat sources of water are groundwater based (except surface water based Krishna water supply) and face issues of reliability during the lean season and dependent households are compelled to shift to purchased sources of RO water.

In the case of domestic water sources, the poorer sections face the lowest prices. However the lower middle economic group is faced with relatively high prices which can be explained by its heavy dependence on private tankers for supplementary source. The sharp increase in prices from the abundant to the lean season for domestic water is noteworthy. It is indicative of the shifts to costly private water sources such as private tankers and drums from private vendors for supplementary water use in a lean year. The increase in the dependence on these sources is a direct consequence of the insufficiency of the low-cost sources. In such a situation even the poor households are forced to spend money for water access to carry on their daily activities. A 28 years old poor Muslim woman in Malkaram who purchases water from private vendors said, "*Pichle saal toh 500 litre ke lie Rs.120-Rs.130 le rahe the. Agle saale toh Rs.150 se zyaada hi lenge*" (Last year they charged Rs.120-Rs.130 for 500 litres. Next year they will definitely charge more than Rs.150). While the upper middle group depends largely on personal owned borewells for its supplementary uses, the lower middle and upper groups have high dependence on private tankers.

An analysis of prices by caste shows that during the abundant year BCs face highest drinking

Table 28: Cost of water by economic groups (in Rs/100litres)

Economic group	Drinking Water			
	Abundant	Lean	Main primary source (abun)	Main primary source (lean)
Poor	15.66	19.31	PPP RO, Public standpost, Krishna water point	PPP RO, Krishna water point
Lower middle	26.97	28.95	PPP RO, Private PPP	PPP RO, Private PPP
Upper middle	27.54	30.55	PPP RO, Private PPP	PPP RO, Private PPP
Upper	27.09	27.21	PPP RO	PPP RO
	Domestic Water			
	Abundant	Lean*	Main primary source (abun)	Main primary source (lean)
Poor	0.60	2.15	Direct piped water, Public standpost (shared borewell)	Direct piped water, Public standpost, govt tanker (shared borew., tanker)
Lower middle	1.33	3.28	Direct piped water, (shared borew., pvt tanker)	Direct piped water (pvt tanker)
Upper middle	0.86	3.31	Direct piped water (own borew.)	Direct piped water (own borew., pvt tanker)
Upper	1.58	3.15	Direct piped water (own borew.)	Direct piped water (pvt tanker)
( ): Main sources for supplementary use *** User weighted average or primary and supplementary price**				

Table 29: Cost of water by caste categories (in Rs/100litres)

Caste category	Drinking			
	Abundant	Lean	Main source (abun)	Main source (lean)
Upper Caste	25.82	26.79	Private RO, PPP RO, Krishna common water point	Private RO, PPP RO, Krishna common water point
BC	26.03	28.06	Private RO, PPP RO	Private RO, PPP RO
SC/ST	25.07	28.58	PPP RO	PPP RO
	Domestic			
	Abundant	Lean	Main source (abun)	Main source (lean)
Upper Caste	1.44	4.39	Public direct piped water, personal borewell (own borew.)	Direct piped water, personal borewell (exclusive tankers, exclusive water from pvt vendor)
BC	1.09	2.82	Public direct piped water (shared borew., own borew.)	Direct piped water (Pvt Tanker)
SCST	0.89	2.90	Public direct piped water, public standpost (shared borew.)	Direct piped water (Pvt tanker, Public standpost)

water prices compared to both upper castes as well as scheduled castes. While upper caste has a notable dependence on low-cost Krishna water point, the SC/STs mostly depend on PPP RO as opposed to the more costly private RO, thus creating lower average prices for these two caste categories relative to the BC households that are predominantly dependent on private RO.

For lean years the SC/STs face the most marked increases in average prices for drinking water as their normal year dependence on public piped water sources reduces during the lean season due to lower reliability of supply (particularly for groundwater based panchayat water sources) creating a shift to private RO sources. Although the PPP ROs are obligated to sell water at a low rate, this is not always the case in all the villages. A 50 year old woman migrant in Mallampet said, "*Pehle toh ye Dr.Water (PPP RO in the village) paanch rupay mein paani bhejta tha. Phir aath rupay tak badha diya. ab dus rupay hai. Agle saal*

shayad aur badh jaye, Panchayat bhi unhe rokte nahi" (Earlier, Dr. Water used to sell water at Rs.5 (for 20 litres). Then they raised the price to Rs.8. Now it is Rs.10. Next year it may increase even more. Even the panchayat doesn't stop them).

Domestic water prices show a significant increase in average prices for all caste groups. For the upper castes this increase is particularly noteworthy. This can attributed to the dependence of the upper castes on the most costly sources of water i.e. exclusive private sources such as exclusive access tankers and borewell water purchased from private vendors, for supplementary domestic uses in lean seasons. There is a shift to private non-exclusive tankers for BC and SC/ST households causing an increase, albeit lower than that of upper caste households, in average prices faced during the lean season.

9.3 Expenditure on Water

Whether increased prices of water lead to higher expenditure on water also depend on the changes in quantity of water used in the household (discussed in next chapter). Table 30 gives a picture of whether expenditure on water changes from normal to lean seasons and compares the same across ownership types of water sources. The total average per capita expenditure on water increases in lean season for both drinking and domestic water, but this increase in expenditure is exceptionally pronounced for supplementary sources in the lean season. Most of this increase comes from a large increase in expenditure on private purchased sources of water. For primary domestic water sources there is an actual decline in average per capita monthly

Table 30: Average Monthly per capita Expenditure on Water by Ownership of Source

Ownership	Drinking		Domestic			
	Primary		Primary		Supplementary	
	Abundant	Lean	Abundant	Lean	Abundant	Lean
Government	3.27	3.44	6.68	5.91	17.08	20.18
Personal (Own)	7.10	6.26	47.79	52.26	17.10	22.30
Private (Purchased)	**62.17**	**79.75**			**55.21**	**162.85**
PPP	39.74	55.57				
Industry	0.00				0.00	
Community	0.00	0.00	15.88	9.33		
Total	**34.74**	**49.50**	**11.93**	**17.63**	**18.37**	**83.50**
Average daily per cap utilisation (litres)	**4.54**	**6.07**	**46.01**	**55.56**	**29.81**	**36.58**

expenditure on government sources as well as community managed sources. The shift to major expenditure on private purchased sources (tanker, water from private vendor) in lean seasons is again particularly marked.

The general increase in water prices and expenditure during the lean year as compared to a normal abundant year is so far evident. This increase in prices and expenditure on water can cause a burden on household expenditures, particularly for poorer households that have to shift from free public sources of water to purchased private water during the lean season due to inadequacies in water supply. 3.3 percent households in the sample reported having compromised on household expenses to ensure upkeep of assured water access for the household. These households reported having compromised on basic expenditures such as on fruits, vegetables, meat and local travel expenses. These households are among BCc and SC/ST households and mostly belong to the lower middle economic strata. Many of these households are largely dependent on public water sources during the normal abundant year,

but nearly half of these households reported a shift to tanker and private vendor sources of domestic water.

The presented analysis may be summarised with some key conclusions. Firstly, prices for government sources of water are lower than sources under other forms of ownership. A comparison of different RO sources – Government, PPP, Private – each characterised by different levels of government participation, shows that price of water reduces with increased public participation in water provisioning. Secondly, high reliability at low prices of water supply provided through public sources is accessed by larger percentages of poorer sections of the population. Such reliable low-cost public sources need to be strengthened in peri-urban areas to enable wider and more equitable access to secure water supply. Reliability of such accessible public sources need to be particularly focused on during lean seasons, as a large percentage of economically and socially backward sections of the population that depend on these sources are forced to shift to expensive private sources which can lead to a sharp increase in the average water prices faced by households creating a burden on household.

Chapter Ten

Nature of Access (Adequacy and Quality)

The previous chapter characterized various sources of water by prices and reliability of supply examining inequalities by socioeconomic categories. While the previous analysis provided a glimpse of the nature/quality of access to sources – ownership, exclusivity, cost of water, and supply reliability – this chapter will examine the level or extent of dependence on various sources for drinking and domestic purposes during a normal and lean seasons. Earlier analyses have already discussed the percentage of households depending on various sources of water. This section will focus on the volumetric dependence of households on different sources and expenditure incurred demonstrating the level or depth of dependence on sources.

10.1 Level of Water Access: Quantity Used and Expenditure

Depth and quality of water access may be determined at many levels. The first level of examining access is the whether a source of water is at all accessible to a household or not. The second level is the ease of access - factors such as cost, duration/frequency of supply, location, exclusivity of access, and nature of ownership. Given an ease of access, the next level is the quantity accessed through a source and then the quality of the water accessed. It is the many levels at which secure water access is determined that is referred to as depth and quality of access. The intent of this analysis is to focus on access in terms of quantity and quality of the water.

Table 31 reveals a number of water utilisation patterns. Firstly, the total average water utilisation increases from normal abundant to lean years for both drinking and domestic uses. This increase in water utilisation from normal to lean years is a secular trend across all ownership types. A more disaggregated analysis from Table 32 reveals this pattern across the whole range of sources in use in peri-urban Hyderabad, with the exception of a few supplementary sources that show a decline due to shifts to additional sources in the lean year. For domestic water use during the abundant season the dependence is largely on low-cost government sources, particularly common sources such as public standposts, Krishna common water point, and shared direct piped water. Dependence in the season is also high for own and shared bore wells. However, during the lean season the volumetric dependence shows the most notable shifts towards private water sources, particularly non-

Table 31: Average Daily Per Capita Utilization on Water by Ownership of Source (in litres)

Ownership	Drinking		Domestic			
	Primary		Primary		Supplementary	
	Abundant	Lean	Abundant	Lean	Abundant	Lean
Government	4.49	6.06	45.96	54.37	28.63	33.47
Personal (Own)	4.20	6.22	49.04	62.80	31.31	32.56
Private (Purchased)	4.40	5.76		**75.00**	**17.36**	**41.47**
PPP	4.62	6.20			50.00	24.79
Industry	4.75				12.50	
Community	5.00	6.67	42.20	51.64		
Total	**4.54**	**6.07**	**46.01**	**55.56**	**29.81**	**36.58**

exclusive tankers. Similarly for supplementary sources for domestic water the increase in the quantities accessed from private purchased sources is most marked. Table 32 identifies these private sources as exclusive and non-exclusive tankers as well as water purchased from private vendors.

Table 32: Average daily per capita quantity used : Drinking and Domestic water by the sample households

Ownership	Access	Source	Quantity (Litres/cap/day)					
			Drinking		Domestic			
			Primary		Primary		Supplementary	
			Abundant	Lean	Abundant	Lean	Abundant	Lean
Government	Exclusive	Direct piped water	5.0	7.3	46.2	52.8	22.85	36.5
		Bottled water from RO **TREATED**	4.8	4.8				
	Non-exclusive	Direct piped water			44.1	50.9		
		Public stand post	4.3	5.1	47.1	57.4	32.1	34.5
		Krishna common water point **TREATED**	4.4	6.0	40.5	47.2		18.9
		Hand-pump				**83.3**		
		Tanker		6.7		**62.7**		33.4
Personal (Own)	Exclusive	Borewell/ tubewell	3.9	6.9	49.1	**63.6**	26.93	33.9
		Borewell (Filtered) **TREATED**	4.4	5.8				
	Non-exclusive	Borewell/ tubewell			48.9	**60.4**	**38.4**	31.3
Private (Purchased)	Exclusive	Borewell water from private vendors (drum)	5.0			50.0	**12.5**	**21.8**
		Bottled water from RO **TREATED**	4.4	5.8				
		Tanker						**42.9**
	Non-exclusive	Tanker				**83.3**	22.2	**47.6**
PPP	Exclusive	Bottled water from RO **TREATED**	4.6	6.2				
		RO Waste					50.0	24.8
Industry	Non-exclusive	Ramkey Tanker **TREATED**	4.7				12.5	
Community	Exclusive	Community managed piped water (borewell)			41.9	48.3		
	Non-exclusive	Community managed piped water (borewell)			20.0			
		Community managed Common taps	5.0	6.7	44.8	55.6		

10.2 Water insecurity: Perceived shortage, insufficiency, and quality of water

Having analysed the depth of dependence on various sources and the shifts thereof during lean seasons, it is evident that there is a high dependence on high-cost private sources of water, particularly in lean years. This may be indicative of inadequacies in supply of reliable treated and proximate low-cost alternatives. Perceptions of insufficiency and quality of water can determine choices to depend on supplementary sources or entirely shift to other sources of water.

Perceived shortage of water has been analysed at two levels – monthly shortage and daily access insufficiency for abundant and lean seasons.

Figure 22: Reporting of Monthly Drinking Water Supply Shortage:

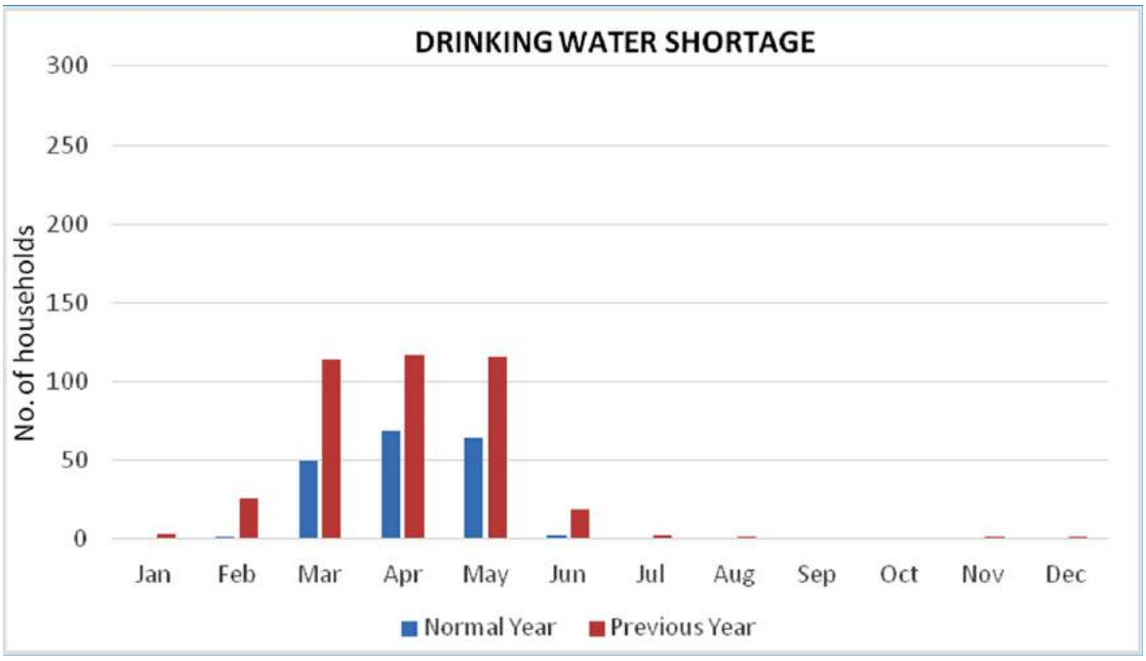
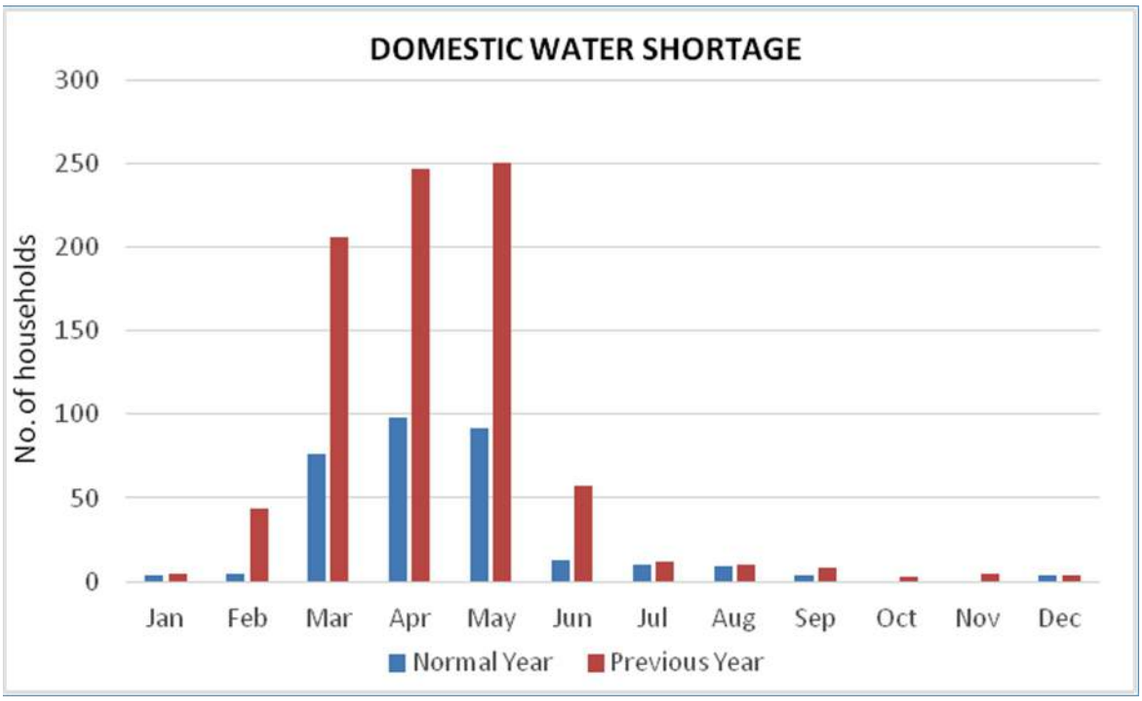


Figure 23: Reporting of Monthly Domestic Water Supply Shortage:



A larger number of households have reported shortage of domestic water than of drinking water. The increase in the number of households reporting shortage of drinking and domestic water from a normal rainfall year to a lean year is clearly evident from figure 22 and figure 23. Shortage of water for domestic purposes is reported over a longer period during the year than for drinking water. Given that the per capita volume utilised for domestic water is much higher than for drinking water, a shortage perceived can lead to immense household water insecurity as it might entail shifting to costly private sources of water putting an additional burden on household income.

Figure 23 shows that people perceived shortage of drinking water is during the summer months.

This could also be because the affordability of the safer alternatives has reduced during this lean season. There have also been cases where the poorer households have resorted to drinking untreated bore well water from their direct piped connections or public stand posts for the lack of a better alternative. The villagers have complained of stomach infections, throat infections and typhoid in the summer, specifically after consuming groundwater.

During a lean year shortage is felt very early on beginning in February and extends through the deficient monsoon months. Nearly all the water sources (except the singular case of Krishna water supply) accessed in this region, are groundwater dependent. Given the low potential hard-rock aquifer base the groundwater resource in this region is highly dependent on regular recharge from rainfall. During a lean rainfall year the aquifer does not receive its annual recharge causing water levels to fall rapidly. Given that the water demand from all sources increases sharply in the lean year, this puts an additional burden on the already stressed groundwater resource. Thus, monthly shortage of water access in lean years affects all major sources of water which could potentially leave few, if any, alternatives to supplement the shortfall in water supply.

On the other hand, general daily insufficiency perceived can lead households to depend on supplementary sources of water. Table 32 suggests that there is a marked increase in per capita volume utilised from supplementary sources, particularly from personal and private purchased sources such as borewells/tubewells and private shared tankers. Sources such as RO waste water, private tankers for exclusive access, and common treated water supplied by Ramki Ltd. through tankers emerge as additional sources resorted primarily to supplement shortfalls in water supply from other sources. Table 33 shows a marked increase in the percentage of households that have reported insufficiency of water for daily use.

Table 33: Households Reporting Insufficiency of Water in Daily Use for Any Purpose

Reporting of adequacy of water	Normal season		Lean season	
	No. of HHs	Percentage HHs	No. of HHs	Percentage HHs
Sufficient	248	88.6	127	43.9
Insufficient	41	14.18	163	56.1
Total	289	100	289	100

Households perceive this inadequacy to emerge for multiple reasons. In a normal rainfall year, of the small percentage of households that have reported insufficiency, a majority cited inadequate government supply (direct piped water, public stand post etc from gram panchayat) as the primary reason. During the lean season while inadequacy of public sources continues to be the prime reason stated, other reasons related to falling groundwater resource such as drying borewells and low pressure of water as well as frequency of tankers, get cited.

Another central aspect of perceived water insecurity as well as levels of water access is that of water quality. Since much of the dependence for drinking water is on treated sources, very few households have reported poor to average quality of drinking water. Perception of quality by household has been based on sensory perceptions of smell, taste, and colour of utilised water. For domestic water sources, particularly in the lean season, households reporting poor to average water quality is much higher (around 35% for primary sources and nearly 50% of households using supplementary sources). In Malkaram specifically, the groundwater is highly polluted due to the proximity to GHMC's largest dump yard. The leachate from the dump yard has seeped into the groundwater for years and presents various health risk for those who use it

for any purpose- drinking or domestic. A 33 year old Hindu woman in Malkaram said, "*Paani kabhi kabhi peela nahi toh kaala aata hai aur bohot baas marta hai. Aur agar paani ko zyaada der rakhe toh upar ek tel ke jaise jam jaata hai. Jab RO ka paani bhi laate, tab bhi wo paani ke upar ek safed powder jaise kuchh jam jata*" *(Sometimes the groundwater is yellow and black in colour and has a bad smell. If we keep the water still for a while, it forms a greasy film over it. Even when we get RO water, it has a white powdery layer over it".)*

Table 34: Reasons cited for insufficiency of domestic water in abundant and lean seasons

Reason	Season	
	Abundant	Lean
Insufficient, irregular and infrequent supply from Gram Panchayat	10.0	43.9
Insufficient, irregular and infrequent supply from other sources	0.0	1.7
Low pressure of water (Gram Panchayat)	0.3	3.1
Laborious and too much time spent in fetching water (common treated water point)	1.7	2.4
Scanty rainfall (insufficient water in borewell)	0.3	3.5
No insufficiency	87.5	45.3
Total (%)	100.0	100.0
Total Households	289	289

Table 35: Perception of Quality of Water Accessed

Perception of Quality	Drinking		Domestic			
	Primary		Primary		Supplementary	
	Abundant	Lean	Abundant	Lean	Abundant	Lean
Poor to very poor	3.46	3.11	**8.65**	**11.07**	**5.1**	**12.5**
Below average to average	2.42	2.77	**20.07**	**23.18**	**33.3**	**34.7**
Good to very good	94.12	94.12	71.28	65.74	61.5	52.8
Total	100.00	100.00	100.00	100.00	100.0	100.0
N	289	289	289	289	39	144

10.3 Inequalities in water access

Security of water access, in conditions of such scarcities and perceived inadequacy, is not equally distributed. Peri-urban spaces such as these are characterized by high levels of in-migration of labour and out-migrating population of the village to the nearby urban core both in search of employment in the core urban areas creating a new class and caste composition. Given the high dependence on high-cost private sources of water for reliable water supply and scarce unreliable conditions of low-cost public provision of water, inequalities in access would be created by class and caste hierarchies within the village.

Table 36 gives a picture of the inter-sectionalities between caste, economic group and migration status among the sample households in the study villages. This offers a base for understanding and analyzing inequalities in the quality of access to water. Compared to the upper classes a larger percentage of the lower and lower middle class population falls in the lower caste section of the

population. In case of intersectionalities with migration status noteworthy is that larger percentage of lower and lower middle classes of the population fall in the categories of migrants and tenants as opposed to the upper classes wherein a larger percentage are non-migrants with owned dwellings.

Table 36: Intersectionalities of caste, class, and migration status in study area

	Lower class	Lower middle class	Upper middle class	Upper class	Row sample
Upper Caste	10.53	16.10	25.00	18.92	54
BC	50.00	50.00	45.83	59.46	144
SCST	39.47	33.90	29.17	21.62	91
Total	100	100	100	100	289
Column sample	38	118	96	37	289
Non-migrant: Own Dwelling	68.42	75.42	78.13	94.59	225
Non-migrant: Tenant	7.89	2.54	0.00	0.00	6
Migrant: Own Dwelling	5.26	9.32	9.38	2.70	23
Migrant: Tenant	18.42	11.02	12.50	2.70	33
Migrant: Dwelling Provided by the Employer	0.00	1.69	0.00	0.00	2
Total	100	100	100	100	289
Column sample	38	118	96	37	289

10.4 Analysis of Water Access by Economic Group

Analysis of the levels of access and water insecurity by class categories shows a very distinct pattern of inequalities between the upper classes and lower classes. The percapita utilisation of water and per capita expenditure on water both secularly increase with class. For drinking and domestic water from primary source, the increase in consumption from abundant to lean year is also more marked for the upper classes than the lower classes. However, in the case of dependence on supplementary sources the increase in volumetric dependence from abundant to lean year is higher for the lower and lower middle classes as compared to the upper classes. This reflects a more secured access (in terms of quantity) of the primary source for upper classes which caters to higher volumetric demands of the upper classes as well as the higher increase in this demand during the lean season. On the other hand the access for the poorer sections for their primary source is lower compelling them to shift to other sources for supplementary sources to meet even their relatively lower demand. With regard to monthly per capita expenditure the increase is most striking for the supplementary sources. The increase in quantities utilised are not commensurate with the increases in expenditure. This indicates to the shift to more expensive sources for supplementary use, particularly for the upper classes, where over 50% households are depending on tankers, both shared and exclusive.

The divergence of the lines in the next graph represents the insecurities in water access faced by the poor. While the rich use more water than the poor, the increases during a lean period is also more for the rich reflecting their ability to access

Table 37: Economic status wise level of water access: Quantity used and expenditure

Economic Group	Drinking water		Domestic water			
	Primary use		Primary use		Supplementary use	
	Abundant	Lean	Abundant	Lean	Abundant	Lean
Average daily per capita utilisation (Litres/cap/day)						
Poor	4.1	5.4	44.0	52.3	16.5	24.5
Lower middle	4.4	5.5	45.8	51.3	24.7	36.5
Upper middle	4.5	6.3	45.2	56.3	33.0	35.5
Upper	5.4	8.0	50.6	70.4	43	51.3
Total	**4.5**	**6.1**	**46.0**	**55.5**	**29.81**	**36.6**
Average monthly per capita expenditure (Rs/cap/month)						
Poor	16.8	27.1	7.1	7.7	6.3	39.4
Lower middle	35.4	46.4	11.9	17.7	23.7	84.4
Upper middle	38.2	57.3	8.8	18.5	16.3	83.2
Upper	42.2	62.0	25.0	25.5	26.9	122.2
Total	**34.7**	**49.5**	**11.9**	**17.6**	**18.4**	**86.1**

Table 38: Major sources of domestic water by economic group (in order of importance)

Economic Group	Primary Abundant	Primary Lean	Supplementary Abundant	Supplementary Lean
Poor	Direct piped water, public standpost	Direct piped water, public standpost, govt. tanker	Shared borewell	Shared borewells, pvt. tankers, private vendor
Lower middle	Direct piped water, public standpost	Direct piped water, public standpost	Shared borewell, public standpost, own borewell	Pvt Tankers, public standpost, shared borewells
Upper middle	Direct Piped water	Direct piped water, own borewell	Own borewell, shared borewell, public standpost	Pvt Tanker, Own borewell
Upper	Direct Piped water	Direct piped water, own borewell, govt. tanker	Own borewell, public standpost, direct piped water	Pvt. Tanker (both shared and exclusive), Direct piped water, Own borewell

water for the increased water demands whereas the poor have to rationalize their increased water demands through lower utilization. Even for the purpose of primary domestic water, despite the fact that the dependence is entirely on low cost sources, an inequality in access is still evident. This is related to the ease of access to domestic water. Whiile the rich households largely depend on sources that are proximate and have exclusive access, the poor depend on common water sources that are located outside their premises requiring more time of travel, waiting time due to queues and lesser ability to carry large volumes of water in a trip. The figure below shows this disparity clearly.

The divergence of the lines in the above graph represents the insecurities in water access faced by the poor. While the rich use more water than the poor, the increases during a lean period is also more for the rich reflecting their ability to access water for the increased water demands whereas the poor have to rationalize their increased water demands through lower utilization. Even for the purpose of primary domestic water, despite the fact that the dependence is entirely on low cost sources, an inequality in access is still evident. This is related to the ease of access to domestic water. Whiile the rich households largely depend on sources that are proximate and have exclusive access, the poor depend on common water sources that are located outside their premises requiring more time of travel, waiting time due to queues and lesser ability to carry large volumes of water in a trip. The figure below shows this disparity clearly.

With regard to the quality of water accessed by households a similar pattern of inequality is observed. A higher percentage of the poor and lower middle group households have reported poor to average water quality as compared to the upper classes across both drinking and domestic water uses as well as for both abundant and lean rainfall year.

In the reporting of insufficiency of water the trend is less distinct. In a normal rainfall year the incidence of adequacy of water is higher among the lower economic groups groups compared to the higher economic strata of population; however during lean seasons the reporting of insufficiency drastically increases for all classes, particularly among the upper classes leading to similar levels of perception of inadequacy across classes. Associating this increase in reporting of insufficiency among the higher classes correlates with the previously observed increases in water consumption among the higher classes indicating at a higher demand for water from these sections.

Table 39: Perception of quality of water accessed by economic group

Economic Group	% of hhs within class category reporting poor to average quality of water					
	Drinking		Domestic			
	Primary		Primary		Supplementary	
	Abundant	Lean	Abundant	Lean	Abundant	Lean
Poor	18.42	18.42	52.64	55.26	40	56.25
Lower middle	5.93	5.93	32.2	37.29	66.67	57.38
Upper middle	3.12	3.12	26.05	30.21	29.41	42.31
Upper	0	0	0	13.51	0	13.33

Table 40: Perception of daily water insufficiency perceived by economic group

Economic Group	% of hhs in class category reporting any insufficiency for drinking and/or domestic uses		
	Any	Abundant	Lean
Poor	60.5	21.1	57.9
Lower middle	61.0	12.7	61.0
Upper middle	54.2	15.6	52.1
Upper	54.1	8.1	54..1

10.5 Caste-wise analysis of water access

Analysis of the levels of access and water insecurity by caste reveal a less distinct pattern of caste hierarchies in water access. In terms of per capita utilisation (Table 26) of water the backward castes show lower consumption. With regard to reporting insufficiency of water (Table 27) the BCs show higher inadequacy. There is a shift to higher utilisation across all caste categories from the abundant to lean year for both drinking and domestic water uses. The increase in drinking water quantity is comparable across castes. However for the case of domestic water while the shift in quantity utilised is comparable across castes, the shift in expenditure is more marked for the SC/STs, especially for the supplementary sources, indicating their shift to more expensive sources of water. In the case of supplementary water use for domestic purposes this trend is even more evident as the quantity utilised per capita reduces from abundant to lean year and still show a drastic increase in per capita expenditure for water revealing the a shift to high-cost water that is much larger in extent compared to the upper caste categories.

With regard to perceived inadequacy of water and quality issues, the lower castes show higher incidence of reporting poorer quality water for drinking purposes. However, for domestic uses the opposite is true. Even with regard to the increased reporting of low quality water from abundant to lean season for domestic water uses, the increase is most marked for the upper castes. The upper castes, particularly among non-migrant households, are dependant on personal owned borewells. The quality of untreated groundwater is poor in the region and this quality issue for the source worsens during the lean season with falling water tables.

Table 41: Caste wise level of water access: Quantity used and expenditure

Caste	Drinking water		Domestic water			
	Primary use		Primary use		Supplementary use	
	Abundant season	Lean season	Abundant season	Lean season	Abundant season	Lean season
Average daily per capita utilisation (Litres)						
Upper Caste	4.4	5.9	46.9	56.3	27.7	31.7
BC	4.5	6.1	43.6	52.9	27.13	35.6
SCST	4.7	6.0	49.3	59.3	47.5	43.2
Total	4.5	6.1	46.0	55.5	29.81	36.6
Average monthly per capita expenditure (INR)						
Upper Caste	35.5	45.5	17.2	30.1	12.8	81.6
BC	34.3	50.0	10.0	9.9	17.3	77.8
SCST	35.0	51.1	11.8	22.4	33.5	98.4
Total	34.7	49.5	11.9	17.6	18.4	83.5

Table 42: Caste-wise perception of quality of water accessed

		Percentage of hhs within caste category					
Perception of Quality	Caste	Drinking		Domestic			
		Primary		Primary		Supplementary	
		Abundant	Lean	Abundant	Lean	Abundant	Lean
Poor to very poor	Upper Caste	1.90	1.90	**7.40**	**11.10**	**0.0**	**3.2**
	BC	4.9	4.2	**9**	**12.5**	**4.3**	**14.1**
	SCST	2.2	2.2	8.8	8.8	**16.7**	**17.1**
Below average to average	Upper Caste	0.00	0.00	**25.90**	**29.60**	**20.0**	**41.9**
	BC	3.5	4.2	**18.8**	**22.9**	39.1	30.8
	SCST	2.2	2.2	**18.7**	**19.8**	**33.3**	**37.1**
Good to very good	Upper Caste	98.10	98.10	66.70	59.30	**80.0**	**54.8**
	BC	91.7	91.7	72.2	64.6	**56.5**	**55.1**
	SCST	95.6	95.6	72.5	71.4	**50**	**45.7**

Table 43: Caste-wise perception of daily insufficiency perceived in water accessed

Caste	% of hhs in caste category reporting any insufficiency for drinking and/or domestic us		
	Any	Abundant	Lean
Upper Caste	53.7	11.1	53.7
BC	63.9	15.3	63.9
SCST	45.1	5.5	45.1

Chapter Eleven

Gendered Implications of Water Insecurity

The preceding the analysis of dependence and access of water among households has revealed a shift to expensive private sources of water, particularly among the poor who do not have secure supply from government piped water supply during the lean seasons. This shift is particularly relevant for supplementary water requirements. Thus far the analysis has been restricted to the household access and water insecurity implications. However, even within the household these shifting patterns would have different implications for men and women as the responsibility for collection and management for household water varies among them. The scope of the current study however is limited to the implications based on the collection of water.

11.1 Participation in Collection of Water

In the study area the primary responsibility of water collection for different uses varies. Table 44 shows these differences not just between men and women but also across class categories. In a majority of the total sample households, men are the primary collectors of water for drinking purposes while for domestic purposes in women are almost entirely responsible for water collection in households. This is at odds with the reality of rural areas in general where women are the primary collectors of household water, This pattern is because of the fact that most households use RO water for drinking which generally need to be collected and carried in 20litre bottles from RO plants located at a distance from the households requiring a vehicle to collect. Also, the collection of RO water entails a monetary transaction.

For drinking purpose, the female participation in collecting water decreases with economic affluence. Among the poor households the participation of women in collection of water is significant. This is largely due to the fact that among the poor the collection of drinking water is predominantly from government piped water, public standposts and government treated common water points (Table 25), which is accessed largely by women (Table 46 and 47). For cooking purposes as well, female participation in the primary collection of water declines secularly with the economic status of the household. This is because households generally use the same water for drinking and cooking purposes (84 percent of the sample households use drinking water for cooking purposes). However, among the poor and the lower middle economic groups the households with women majorly collecting cooking water is much higher that the corresponding participation for drinking water collection. This reflects that for nearly 25 percent of poor households, women collect water for cooking separately which is not explained by the drinking water collection. For domestic water the predominance of female participation as primary water collectors for the household is striking. This participation increases with reduced economic status of household.

While Table 44 presents the distribution of households by the primary water collectors (single individual in household who majorly collects water for a given use), Table 30 provides the actual responses from male and female water collectors of the household by use and season.

For drinking water collection the percentage of households reporting any water collection (including both sole participation and combined participation with other individual respondent in household) by men is significantly higher than the households reporting women's participation in drinking water collection. This pattern gets further pronounced during the lean season as the poor households depending on public standposts and shared government piped water shift to RO water (Table 25) and RO water is predominantly

Table 44: Distribution of Households by primary Participation in Collection of Water

% of households in economic group									
Economic groups	Drinking			Cooking			Domestic		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
Poor	42.1	57.9	100	18.9	81.1	100	0	100	100
Lower middle	73.7	26.3	100	54.5	45.5	100	9.9	90.1	100
Upper middle	67.7	32.3	100	61.4	38.6	100	9.1	90.9	100
Upper	78.4	21.6	100	75.7	24.3	100	10.8	89.2	100
Total	**68.2**	**31.8**	**100**	**54.8**	**45.2**	**100**	**8.4**	**91.6**	**100**

Table 45: Households Reporting Any Participation in Water Collection by Gender and Use

Gender	% of total sample households					
	Drinking		Domestic			
	Primary source		Primary source		Supplementary source	
	Abundant	Lean	Abundant	Lean	Abundant	Lean
Male	68.51	72.32	9.00	8.30	1.73	3.46
Female	33.56	29.76	85.81	85.81	8.65	38.06

collected by men in the household (Table 46).

For domestic water uses the households reporting any male participation in water collection form a very small percentage, and this pattern does not shift significantly in lean seasons. If anything this pattern becomes more pronounced during the lean season as water from new primary and supplementary sources that households shift to in lean periods is collected by women. Also, the minimal male participation from public standposts and personal borewells for supplementary domestic water reduces during the lean season, and women's participation in supplementary water collection from public standposts increases (Table 47). In general the participation of households for supplementary source water collection increases sharply in the lean season but the shifts in households reporting participation for women is significantly higher than the increaseof men's

Table 46: Collection of Drinking Water by Source and Gender

Source	Drinking (% of total collector responses for season)			
	Primary			
	Abundant		Lean	
	Male	Female	Male	Female
Direct piped water	1.69	2.37	1.02	1.36
Community Piped water (borewell)	2.03	2.71		
Public stand post	3.39	**6.78**	1.02	1.02
Krishna common water point (treated)	0.34		3.73	**6.78**
Community Common taps/ stand post	0.34	1.02	0.34	
Borewell/ tubewell		1.69	0.34	1.02
Borewell (Filtered)				1.69
Tanker			1.36	2.03
Purchased from private vendor		0.34		
Ramkey tanker		3.39		
Bottled water from RO	59.32	14.58	63.05	15.25
% of total responses for water collectior	**67.12**	**32.88**	**70.85**	**29.15**
No. of responses: N (100%)	**295**		**295**	

participation (Table 45). Here, women's participation goes up significantly from tankers, public standposts and common Krishna water point (Table 47).

Apart from major participants in water collection in the household, other members of the household also participate in by assisting in the activity. More than a quarter of the individual respondents have reported receiving help in water collection activities. While most of the individuals assisting in water collection are above the age of 15, for domestic water collection a sizeable percentage of those assisting with water collection are below the age of 15 and are predominantly girls.

Table 47: Collection of Domestic Water by Source and Gender

Source	Domestic (% of total collector responses for season)							
	Primary				Supplementary			
	Abundant		Lean		Abundant		Lean	
	Male	Female	Male	Female	Male	Female	Male	Female
Direct piped water	3.65	56.57	2.94	48.53	3.33	3.33	0.83	4.17
Community Piped water (borewell)	1.46	2.92	1.47	2.94				
Public stand post	1.09	15.33	0.74	12.13	6.67	6.67	1.67	10.83
Krishna common water point (treated)	0.73	3.65	0.74	3.68				2.50
Community Common taps/ stand post		3.65		3.68				
Borewell/ tubewell	2.55	8.39	2.57	9.56	6.67	60.00	3.33	20.83
Tanker			0.37	9.93		3.33	0.83	44.17
Purchased from private vendor				0.37		3.33	1.67	8.33
Ramkey tanker						3.33		
RO waste water						3.33		0.83
Hand-pump				0.37				
% of total responses for water collection	9.49	90.51	8.82	91.18	16.67	83.33	8.33	91.67
No. of responses: N (100%)	274		272		30		120	

Table 48: Participation in Collection of Water by Assistance

Use	Season	% of total respondents getting help in water collection	% of total individuals reported as assisting					
			Male		Female		Total	
			15 and below	Above 15	15 and below	Above 15	15 and below	Above 15
Drinking	Abundant	25.76	9.21	43.42	6.58	40.79	15.79	84.21
	Lean	24.75	9.59	45.21	5.48	39.73	15.07	84.93
Domestic (primary source)	Abundant	30.66	5.95	25.00	13.10	55.95	19.05	80.95
	Lean	30.40	6.02	24.10	13.25	56.63	19.28	80.72

11.2 Time taken for Water Collection

As water supply and access becomes more unreliable and access to proximate treated low-cost water sources becomes rarer (further defined in lean rainfall years), the collection of water becomes a significant basic activity for a household to ensure secure water availability for the household. Longer durations in the day would be spent collecting water from multiple sources. Water collection thus becomes a significant aspect determining vulnerabilities of households. Table 33 shows that this is particularly true for women. More than half of all individual women respondents have reported reduced time for other activities.

Collection from distant, shared sources, with unreliable and lower frequency of water supply - in the absence of low cost exclusive access to reliable water sources – can be a time consuming and labourious activity. Table 34 presents the average time taken (as reported by respondents) for collection from various water sources in different seasons.

Table 49: Perception of Men and Women about impact of increased time for managing water during lean season of availability

Response	% of total individual respondents	
	Male	Female
No impact	56.67	35.20
Reduced time/ withdrawal from paid activity	13.33	6.00
Reduced time for domestic unpaid activities	14.76	53.60
Reduced time for leisure	34.29	57.60
Do not know	1.90	0.40
N (total individual respondents)	210	250

It is evident that the average collection time (including travel and waiting time) is highest for shared or common access water sources. The collection time is also higher from primary domestic uses as compared to other uses. The higher quantities of water that need to be collected for this use would require greater number of trips and longer collection time at the source. During the lean season the average collection time for all sources increases. For public and other common piped water sources a significant increase in time spent would be due to longer queues, reduced frequencies of supply particularly for groundwater based sources, larger quantities of water demanded. Many households have reported insufficiency of water during the lean season citing reasons on infrequent supply from gram panchayat, labourious and long time taken to collect water, low pressure of water from taps and lower borewell aupply due to insufficient water in borewell in lean rainfall years (Table 34). The only exceptions are borrowed direct piped water supply for domestic and community managed common taps for drinking use. This could be attributed to the lower demand from these

Table 50: Average Time spent in collecting by individual by source (mins/day)

Access	Source	Drinking		Domestic			
		Primary		Primary		Supplementary	
		Abundant	Lean	Abundant	Lean	Abundant	Lean
Exclusive	Direct piped water				13.00	15.00	15.00
	Borewell/ tubewell				10.00		
	Borewell water purchased from private vendors	10.00					
	Bottled water from RO	16.53	17.42				
Non-exclusive	Direct piped water			42.50	28.33		
	Public stand post	18.50	23.00	49.84	**55.06**	26.67	**36.37**
	Krishna common water point (treated)	15.73	17.94	32.27	**44.17**		**36.67**
	Common taps/ stand post managed by the community	40.00	25.00	37.57	**42.14**		
	Borewell/ tubewell			27.00	**45.00**	30.00	**40.00**
	Tanker		18.57		**39.15**		**48.70**
	Ramkey Tanker	11.40				30.00	

Table 51: Average time taken for collection of water by men and women (mins/day)

Gender	Drinking		Domestic			
	Primary		Primary		Supplementary	
	Abundant	Lean	Abundant	Lean	Abundant	Lean
Male	16.07	16.88	30.83	38.57	25.00	28.75
Female	17.32	20.36	46.47	46.72	22.40	40.12

sources as most poor households that are dependent upon shared piped water sources in the abundant season shift to RO water and other private sources like tankers during the lean period (Table 25). Public standposts, Krishna common water point, community managed common taps, and tankers need the maximum time for water collection particularly for domestic water needs. Given that the responsibility of water collection from these sources mostly falls on women, the average time taken to collect water is much higher for women as compared to the men. The increase in time taken for collection of supplementary water is striking for women. This may be explained by the larger demand for supplementary water during the lean season, reduced reliability of regular public sources and increase in demands from shared tankers.

Chapter Twelve

1.Externalities of Spatial Outflow of Water: Implications for Agriculture

This section will elaborate on one of the effects of the spatial flows of water- the decline in agriculture. At this point, it may be clarified, that the decline in agriculture has happened not solely because of the flow of water outside the village. There are also other factors that have contributed towards this fall in agriculture, which will also be explained in this section using incidents from our study villages.

These spatial flows of water from the peri-urban to urban spaces have had their effects on the village. There has been a sharp fall in the groundwater table in these villages, and the difference is perceptible for the villagers. People have noticeably been moving from being agriculturalists to being water sellers. The reasons for this shift are slightly varied from village to village, but they have all been triggered by magnified and unplanned urbanization.

Table 52: Reasons for shifting out of agriculture: (as reported by sample households)

Reported reasons	% of total HHs that have reported shifting out of agriculture in the past 10-15 years
Due to water shortage	44.44
Sold out (due to increase of land rate/indebtedness)	33.33
Land acquired by government	16.69
Total	100.00
No. of sample households that have shifted out of agriculture in the past 10-15 years (N)	**18**

12.1 The Acquisition of Land

Although agriculture has been seen to be declining for quite some time now, the construction of the ORR can be looked at as an event that had irreversible effects on agriculture. The consequences of such a construction have been two fold. On one hand, vast tracts of agricultural land was acquired for the construction. When this happened in the early 2000s, the farmers were either compensated monetarily, or with an alternate piece of land elsewhere in the same village, or a combination of the two. In Kokapet, some compensation was provided in the form of alternative pieces of land. Farmers were given two or more plots of 250 sqft each, in proportion to their former landholding. But these plots were scattered and not located close to each other. Hence the plots were too small to be able to practice productive agriculture. There have also been cases, where agricultural land was acquired but the farmers were poorly compensated, such as Adibatla.

On the other hand, even though not all land was directly acquired, groundwater which is a resource with no boundaries has been severely exploited. This has happened in Mallampet and Kokapet, after the construction of the ORR, when private ventures started springing up in and around these peri-urban sites. At that point, a lot of farmers were enticed into selling their land for a lump sum amount of money, which they felt would take them decades to earn through agriculture. "Yevaru ippudu pollam panduthaledu. Bhoomi unte kuda adi lease ki icchestunnaru, illu kadtunnaru. Neele ledu, pollam elaga panduthamu"(People have stopped practicing agriculture, Even if they have land, they lease it out or construct houses on it. The water is not enough for agriculture)(L1M).

There have been industries, commercial zones

and also residential colonies that are extracting water on a daily basis for their varied needs. Due to a large rate of extraction by these private ventures, the groundwater levels have experienced a sharp dip and have had severe consequences on agricultural output. This is evident in the depths of the bore wells that are dug in these villages, which are as deep as 1400 feet.

12.2 The Degradation of Lakes

Traditionally, lakes or tanks have been the major sources of irrigation for agriculture in Hyderabad. But the lakes too have been effected by urban processes that have rendered them futile for irrigation. Apart from the rapid drying up of lakes, there have been other incidents through which the quantity and quality of lake water available for irrigation has depleted. During the construction of the ORR, a lot of rubble and construction material was dumped near the lakes, which blocked the inlet channels of the lake. This happened in Kokapet which accelerated the drying up of the lake, which affected all the crops that were dependent on this lake for irrigation.

Another reason for the decline in agriculture is the pollution of lakes. This happened specifically in Mallampet. An interview with a woman from an agriculture-practicing family revealed that the agriculture of the entire village was dependent on the lake for irrigation. This is Kathua Cheruvu and is shared with Bowrampet, a neighboring village. Soon after the ORR came up, Dr. Reddy's Laboratories set up a pharmaceutical unit in Mallampet. She says that in its initial days, this unit used to dispose its chemical waste into the lake. As a result all the fish of the lake were poisoned. That year, nobody was able to produce any crop, although the land was cultivated but the water completely burnt the saplings. After this incident, many more people started to sell their land to real estate ventures.

In several villages, the state has even prohibited the use of lake water for irrigation. This has happened in Mallampet and Malkaram. The villagers, when asked, said that the government has done this in order to cultivate fish cultivation in the lakes. This seems like a sudden and under strategized move, as it makes cultivators completely depend on groundwater for irrigation. It must be noted at this point, that the electricity for pumping water from bore wells is completely subsidized the villagers have has no access to any loans meant for installing bore wells. This has been another contributing factor that has pushed people out of agriculture.

12.3 Water Selling

The decline in agriculture and cultivation has obviously displaced a large number of farmers, cultivators and other person involved in the sector. Those who cultivated their own land earlier, are now forced to work as agricultural labour in a richer farmer's field. This has been the case with in Adibatla, where the a major portion of the cultivated land now is owned by rich farmers, as the poorer ones have been pushed out of farming. In Mallampet and Kokapet, most of the unemployed population has been absorbed by the industries and commercial units in and outside. This did not happen in Adibatla, as the villagers say that Tata Group, which has several commercial and industrial units in the village, has outright refused to hire people from the village, other than for a few odd jobs. A Backward Caste farmer stated, “Nenu MBA complete chasanu. TCS lo job kosam try chastunanu. Kani valu village valaku chances evataladu. Nenu chala sare TCS lojob kosam try chasanu. Oka sare nenu na Resume lo AP nundi ani abadam chapanu. Kani valu na school certificate chusi talusukunaru nenu abadam chaputuna ani na school certificate lo near adibatla ani undi. So anduka valu naku job evaladu. Anduvala nenu na father land ni chusukuntunanu.”(I am an MBA graduate. I was hoping for a job in TCS. But they refuse to employee anyone from the village. I tried to get a job there many times. Once, I lied on my resume that I am from Andhra Pradesh. But when they saw my school certificates they knew I was lying

as my school is close to Adibatla. Because of this they did not give me a job. So now I am cultivating my father's land and earning some money from that). Only very few people have got jobs in the company, but those are low-paid and mostly house-keeping jobs. The company has brought in large number of workers from Bihar and Orissa to work there and has given them accommodation inside the industrial premises. Hence, there has been a distress driven dependence on agriculture, where people are forced to continue or return to being agricultural laborers or cultivators for the lack of other job opportunities.

Apart from the above, one of the occupations that have come up as a rather preferred choice is water selling. Water selling has come up increasingly as a result of the processes related to decline in agriculture. This can be explained using various incidents from the study villages. The sale of water cannot be looked at as a direct consequence of the reduction in farming, but one that correlated to it. Obviously, the strongest reason for people to sell water was the high demand of water from the urban colonies located very close to the village and the price that those dwellers were ready to pay for water. Selling of water is thus seen as one of the most profitable businesses in these villages.

As already mentioned, during the construction of the ORR, the compensation that was given (either monetary or otherwise) was unsuited for the continuation of farming. In Kokapet, the small plots that were scattered could not be used for profitable cultivation. Instead, the farmers sold one or two plots to private individuals or ventures. This gave them the finances to install a bore well in the plots that they had and start selling water to tankers. Seeing this practice, many farmers started selling water from their agricultural bore wells. These bore wells are run on subsidized electricity, as they are meant solely for irrigation. But by using this, the cost of the water-selling business literally amounted to nothing.

In Mallampet too, the same dynamics led to people selling water. But, apart from this, Mallampet demonstrated some different arrangements for water selling. As mentioned above, the year that the lake was polluted, most of the farmers ran into losses as their crop was destroyed. "Jo bhi ugate hai sab mar jata hai. Wo laboratory se sab chemical zameen ke neeche pani mein jata hai. Uski vajah se kuch nahi ugta yaha" (Any crop that was sown was a failure. It was because of the chemicals from the laboratory that seeped into the groundwater)(F1K). Even for one or two seasons after that, no crop was cultivated successfully. The farmers, hesitant to sell their land, were more than open to leasing their land out to private individuals. These private individuals were those who had already sold off their land and gained enough compensation. Such a lessee would install a bore well, take a subsidized electricity connection in the name of the owner, and start selling water. The lease is usually as short as three months. This also proved beneficial to the leaser who could take back his land and cultivate again, using the bore well that was installed by his lessee.

But those who are cultivating their land adjacent to those who sell water are being adversely affected. A woman who is involved in agriculture claimed that their bore well which was 200 feet deep gave them sufficient water for irrigation. But ever since the owners of the land next to their plot leased out their land, she says that the water in their bore well has reduced. Last year, they had to dig up to 400 feet in the same bore well to get water. Similarly, in Adibatla, farmers have complained about the selling of water to Wonderla Amusement park, which has reduced the water for irrigation. Sometime farmers even try to buy tanker water to irrigate their fields. "Memu dabbulu is the kuda valu oppukoru. Anduru Wonderla lone neelu ammutunnaru" (Even if we pay for the water, the tanker sellers don't give us water. They all supply water to the water park)(F1A). Thus, water-selling can also be looked as a cause for the decline in agriculture.

This detour of the usage of water from agricultural to non-agricultural uses, as an allied implication of state policy is inherently unjust. It serves as an impetus for the further privatization of water on the one hand and the phasing out of agriculture on the other. Water, which is

essentially a public good, benefits a larger group of people when used as an input for food production. But its misappropriation towards uses that are benefitting only certain groups of people is transforming it into a private good. A secondary effect of this as observed in peri-urban areas is the marginalization of farming community and their employment in unskilled activities while dispossessing them of their access to land and water.

Chapter Thirteen
Conclusion

This study aimed to achieve three major goals. The first one was to understand the backdrop under which the rapid changes in domestic and drinking water institutions for the past two decades are being operationalized; the role of the state vis-à-vis shaping this change was was of particular importance. Additionally, at the micro level, it was also imperative to take a cognizance of the larger environmental and development context of the study villages to be able to project the potential impact the changing water-delivery institutions will have on local livelihoods. The second goal was to unpack the exact nature of institutional changes that are shaping the domestic and drinking water sectors; in doing so, we have examined the interlinkages between the public and the private on the one hand and the formal and the informal, on the other. The power dynamics embedded in the working of these institutions and its implications for the functioning of the same, which is plural and often fuzzy, was also analysed. One of the novel elements of this study has been to look at the drinking water and the residual domestic water sectors separately and in conjunction, based on the argument that these two sectors have distinct identities, but at the same time are connected. The third goal was to look at the impact of these institutions on the actual mechanics of water delivery and its pricing and the way it impacted the peri-urban residents. We attempted to understand the latter through the lens of space, caste, class and gender, and examined whether these axes when seen in the backdrop of the new water institutions throw up some new forms of inequality. We have also attempted to touch upon the issue of externality impact on agriculture in the study sites of the spatial outflow of water from the peri-urban spaces.

We have used a mixed methods approach for this study wherever possible, though either qualitative or quantitative methods have got precedence, depending on the issue at hand. For example, the institutional analysis was largely based on qualitative interviews, though we ensured triangulation through seeking out respondents from competing domains. For example, not only was the RO plant owner an interviewee, his/her opinion was validated by talking to water users from different hierarchies of the socio-economic ladder. The impact section was primarily examined from a quantitative perspective, though supplemented by qualitative insights. Remote sensing data analyzed in a GIS domain enabled an overview of the ground water status, where the peri-urban space was compared with the city core on the one hand, and rural outskirts, on the other.

By and large, there has been a clear shift in the last two and half decade in the way water, particularly drinking water is perceived by the policy narrative. There is an agreement now that water should be treated as an economic good, and following that, over the subsequent policy documents, an allowance has been made for increasing private sector participation in the sector. In the latest water policy document, there has been an added emphasis of treating access to drinking water from a human rights perspective too, but without much engagement about how the contradictions of profit-oriented operations of a water delivery system on the one hand and preserving the welfare state objectives in this respect, on the other, should be negotiated. Telangana government is currently in the process of implementing a massive public funded and egalitarian (by design) drinking water programme, Mission Bhagiratha, though this initiative is in deviance with the direction most of the country is moving. It needs to be mentioned here that our study was conducted prior to the implementation of this project, and what comes up in the analysis captures a situation that is common to the peri-urban spaces of the most of the other major metropolitan cities in the country.

The 4 study villages, characterized by both commonalities and differences, provide us a platform for understanding the peri-urban space as a whole, as well as how the village level differences may play up to shape both the institutions that emerge in these contexts and the potential impact that is visible on the village residents. From an analysis of the backdrop of the villages, a few counter-intuitive trends emerge for most of villages. Firstly, there is a lot of irregularities in terms of the population growth rates of the villages. Gender status, as captured by the child sex ratio, has worsened over the last decade, which is incidentally true of the most of the country. However, the peri-urban situation, for the most part is worse than the totality of urban or rural Telangana as a whole. There is an evidence of a male-selective outmigration in three of our study villages, which is unexpected, since this is the area where maximum economic growth is taking place. Related to this, there is a fall in both male and female work participation in three of the selected villages, with an increase in agricultural work participation as agricultural labourers (as opposed to cultivators, the share of which has declined). This can, in totality be explained only by the existence of a significant economic distress in terms of employment opportunities. The significance of this backdrop to our study is that since agriculture is still accommodating labour in the sector, in all probability driven by unavailability of jobs in the non-primary sector of a sustained nature, the outflow or over-extraction of water from the peri-urban space has to be seen with extreme concern.

The ground water status, which is the main source for both the drinking and domestic water source till date in peri-urban Hyderabad, is worsening over time, but both in terms of the level and rate of depletion, peri-urban fares worse compared to both the urban core and rural areas around Hyderabad. Though rainfall to a large extent explains the post-monsoon ground water status, the particularly vulnerable conditions in peri-urban areas cannot be explained with rainfall variations. This, arguably, would have roots in the way in which water is being utilized in the peri-urban space, which is different from its other two counterparts. Since agriculture is declining rapidly in these spaces, it cannot be held responsible for perpetuating this exceptional decline.

From our institutional analysis, we see a significant linkages between the drinking and the domestic water sectors, the public and the private water enterprises as well as the formal and the informal entities. The domestic water (other than drinking and cooking) is primarily untreated sources, while drinking water are is from treated sources. However, the untreated water is the raw material for the treated water. In the same way, the formal and the informal are connected; the extraction of untreated water is done, though not exclusively, but dominantly by the informal sector. One of the major treated water source has an institutional mode of a public-private partnership (PPP), which particularly in the lean season, use untreated water extracted by the informal private sector; also, the PPP arrangement may directly involve an informal player. There are three important and related conclusions that we draw from this analysis. Firstly, since informality is in some way a part of most of the emerging institutional arrangement, this sector is difficult, if not impossible to regulate, in spite of the existing awareness about the depleting ground water table. Secondly, within these linkages, we have observed a great deal of plurality, such that addressing the problem of one case may not necessarily solve the other.This plurality, among other things, stems from the decentralized nature of the drinking water markets, particularly in relation to the public participation. In other words, the joint provisioning of the water is most often managed at the panchayats level, and hence differ from one case to the other. Even in instances of well-intended panchayat actions attempting to fix norms for the private sector to ensure better and cheaper private delivery to the public, they generally lose out to the multinational partners. This leads to either the PPP RO plant making higher profits in seasons of scarcity, or the completely private models taking over, in both cases, residents bearing the cost of scarcity, in spite of government involvement.

There are, however, evidences where the panchayats have dominated while dealing with small informal players, whether they are tanker operators, or RO plant partners. In cases where the panchayats align with private interests, the system produces extremely anti-people outcomes. Thirdly, the demand for RO water and hence priced water actually stem primarily from a much polluted peri-urban environment. In spite of existence of laws the Andhra Pradesh WALTA (Land Water and Trees Act 2002) provides for, unabated industrial and waste related pollution happens around the city, along with informal and illegal extractions of ground water to feed the water market we see operating in the city hinterland. Thus, both the demand and supply of the drinking water and hence the very foundations of these markets are based on contours of illegalities and non-implementation of the existing provisions.

The impact of this kind of drinking and domestic water sector produces very varied and unequal outcomes. Firstly, the most deprived villages and clusters that are least capable of paying for water are forced to do so, due to lack of government infrastructural and water provisioning coverage. In the lean season, this plays out in critical ways, where some from the marginal spaces are either forced to pay high prices which involves sacrifices in other essentials in the consumption baskets, while others are pushed to depend on polluted unsafe sources of cheap or free water. Space is a determining factor with respect to water quantities too, since the villages farther from the city core appear to be better positioned in times of drought or scarce seasons. Secondly, the poor pay lower prices for both drinking and domestic water which stem from consumption of poorer quality and lower quantities of water. Even though in the lean seasons, the payment for water goes up across the board, for the poor, the marginalities with respect to access to water nevertheless gets amplified. The picture with respect to caste is more mixed, as there is imperfect class-caste convergence. The backward castes in some cases are more deprived that the scheduled castes, though the latter are lower in the caste hierarchy. In general the upper caste depends more on private and more expensive water for drinking and own sources for domestic uses. In terms of religion, Muslims are more marginalized in every way compared to both Christians and Hindus.

The gender division with respect to water is generally very sharp, with the drinking and domestic water collection and management burdens typically borne by women, with very little space for them to participate in the decision-making processes about the sector. The peri-urban space of Hyderabad, however, reveal a somewhat different picture with respect to the collection of drinking water. In the majority of cases, the collection of water from the RO plants is done by the men, though this is a class and caste intersectionality driven phenomenon. In other words, the men with the exception of the poorest households and scheduled caste households collect water for which payments have to be made. This is also dependent on men having the ownership of a motor-cycle or a cycle. The management of that water, however, is completely in the women's domain without any exceptions. In the scarce seasons, for example, when the price and the consumption of water goes up, the scarcity of the drinking water needs to be managed within the household by the women. The domestic water collection burden, however, is completely shouldered by the women, and significantly, the quantity of domestic water requirement is many times more than that of the drinking and cooking water. The hours spent, correspondingly, for collection of domestic water is far more than that of drinking water, which significantly go up in the lean season, and more so for women from deprived households. Thus, the participation of men for collection of drinking water cannot be interpreted as a sign of a diluting patriarchy, but has more to do with alienation of women from any form of cash transaction, which isa feature of this form of water. This interpretation is supported by the fact that the unpaid sources of drinking water, though much less in importance in terms of their usage, is almost entirely collected by the women.

Irrespective of the socio-economic identities and spatial rootedness, the generic trend that we observe is that the dependence of paid water and private sector goes up in times of scarcity, both for drinking and domestic water; ironically, on the other hand, so does the dependence on untreated water sources, for the economically and socially marginalized sections. This is the most visible in the uses of supplementary water sources during the lean seasons. The free, dependable and safe sources of water provided by the state government are not available for the most part in the peri-urban villages. Evidences from our study villages show that in exceptional cases where it is available, it is the result of informal community actions. Though such actions have successfully brought water in the most backward village among those selected for our study, they have excluded the most deprived sections within the village, due to the lack of their bargaining power and exclusive spatial and social identities.

The tankers are the primary vehicle supporting the spatial outflow of water from the peri-urban spaces. Notably, it is observed that the degree of dependence on tanker water is minimal for the peri-urban residents and in the normal seasons, it is non-existent. Thus the tanker economy that appears to be perpetuating the ground water depletion in the peri-urban spaces, does not function to support the residents' water demands. The raison-d'etre for the spatial outflow of water is to support the non-domestic uses (industrial and services) in the peri-urban and urban spaces on the one hand and urban demand for domestic water, on the other.The negative externality for the peri-urban residents is also visible in terms of loss of agricultural livelihoods due to lack of water, as distinct from the loss stemming from land acquisitions in favour of non-primary activities. This is particularly problematic in the backdrop of an apparent economic environment of jobless growth, which encapsulates a trend of both male and female workers coming back to an increasingly impoverished agricultural sector, as labourers rather than cultivators. The ground water, which was once considered and accepted as a common resource, is steadily being converted into a privatized resource that in increasingly moving towards an oligopolistic situation to create multiple vulnerabilities in the peri-urban space.

References

Adger, W. N., Brown, K., & Tompkins, E. (2005). The political economy of cross-scale networks in resource co-management. Ecology and society, 10(2).

Agarwal, A., & Narain, S. (2000). Redressing ecological poverty through participatory democracy: Case studies from India. PERI Working Papers, 18.

Agrawal, A., & Goyal, S. (2001). Group size and collective action third-party monitoring in common-pool resources. Comparative Political Studies, 34(1), 63-93.

Aguilar, A. G., Ward, P. M., & Smith Sr, C. B. (2003). Globalization, regional development, and mega-city expansion in Latin America: analyzing Mexico City's peri-urban hinterland. Cities, 20(1), 3-21.

Ahlers, R.; Cleaver, F.; Rusca, M. and Schwartz K. 2014. Informal Space in the Urban Waterscape: Disaggregation and Co-Production of Water Services. Special Issue on Informal Space in the Urban Waterscape. Water Alternatives

Allen, A. (2003). Environmental planning and management of the peri-urban interface: perspectives on an emerging field. Environment and urbanization, 15(1), 135-148.

Allen, Adriana. 2003. Environmental Planning and Management of the Peri-Urban Interface: Perspectives on an Emerging Field." Environment and Urbanisation 15(1): 135-148

Annamraju, S., Calaguas, B., & Gutierrez, E. (2001). Financing water and sanitation. Key issues in increasing resources to the Sector, Water Aid briefing paper.

Bain, R. E. S., Wright, J. A., Christenson, E., & Bartram, J. K. (2014). Rural: urban inequalities in post 2015 targets and indicators for drinking-water. Science of the Total Environment, 490, 509-513.

Bakker, K. (2007). The "commons" versus the "commodity": Alter-globalization, anti-privatization and the human right to water in the global south. Antipode, 39(3), 430-455.

Bakker, K. (2010). Privatizing water: governance failure and the world's urban water crisis. Cornell University Press.

Bakker, K. 2003. Archipelagos and Networks: Urbanization and Water Privatization in the South, The Geographical Journal, Vol. 169, No. 4 (Dec., 2003), pp. 328-341

Batra, L. (2009). A Review of Urbanization and Urban Policy in post-independent India, Working Paper Series, Centre for the Study of Law and Governance (CSLG/WP/12), JNU, New Delhi

Benvenisti, E. (1996). Collective action in the utilization of shared freshwater: The challenges of international water resources law. American Journal of International Law, 384-415.

Bhan, G. (2009). "This is no longer the city I once knew". Evictions, the urban poor and the right to the city in millennial Delhi. Environment and Urbanization, 21(1), 127-142.

Brenner, N. (1999). Globalisation as reterritorialisation: the re-scaling of urban governance in the European Union. Urban studies, 36(3), 431-451.

Brenner, N. (2004). Urban governance and the production of new state spaces in Western Europe, 1960–2000. Review of international political economy, 11(3), 447-488.

Budds, J., & McGranahan, G. (2003). Are the debates on water privatization missing the point? Experiences from Africa, Asia and Latin America. Environment and Urbanization, 15(2), 87-114.

Castree, N. (2005). The epistemology of particulars: Human geography, case studies and 'context'.Geoforum, 36(5):541-666.

Cochran, J., & Ray, I. (2009). Equity reexamined: a study of community-based rainwater harvesting in Rajasthan, India. World Development, 37(2), 435-444.

Crow, B., & Sultana, F. (2002). Gender, class, and access to water: Three cases in a poor and crowded delta. Society &Natural Resources, 15(8), 709-724.

D. Bandyopadhyay (2001)," Andhra Pradesh: Looking beyond "Vision 2020" , Economic and Political Weekly, Vol. 36, No. 11 (Mar. 17-23, pp. 900-903

Daniels, G., & Friedman, S. (1999). Spatial inequality and the distribution of industrial toxic releases: Evidence from the 1990 TRI. Social science quarterly, 244-262.

Douglass, C. 1991. "Douglass C. North." The Journal of Economic Perspectives 5 (1): 97–112.

Dupont, V. (2007). Conflicting stakes and governance in the peripheries of large Indian metropolises–An introduction. Cities, 24(2), 89-94.

Gandy, M. (2004). Rethinking urban metabolism: water, space and the modern city. City, 8(3), 363-379.

Gandy, M. (2008). Landscapes of disaster: water, modernity, and urban fragmentation in Mumbai. Environment and Planning A, 40(1), 108-130.

Goff, M., & Crow, B. (2014). What is water equity? The unfortunate consequences of a global focus on 'drinking water'. Water international, 39(2), 159-171.

Goldman, M. 2005. Imperial Nature: The World Bank and Struggles for Social Justices in the Age of globalization: Yale University Press

Harvey, D. (2008). The right to the city. The City Reader, 6, 23-40.

Heynen, N., Kaika, M., & Swyngedouw, E. (2006). Urban political ecology: politicizing the production of urban natures. In Heynen, et al. (Eds.), In the nature of cities: Urban political ecology and the politics of urban metabolism. Routledge.

Joshi, D. (2011). Caste, Gender and the Rhetoric of Reform in India's Drinking Water Sector. Economic and Political Weekly, 56-63.

Kaphthalia G.N. & Kapoor R. (2002) Water Policy and Action Plan for India 2020: An alternative http://planningcommission.nic.in/reports/genrep/bkpap2020/10_bg2020.pdf

Kashwan, P. (2006). Traditional water harvesting structure: Community behind'community'. Economic and Political Weekly, 596-598.

Kayser, G. L., Moriarty, P., Fonseca, C., & Bartram, J. (2013). Domestic water service delivery indicators and frameworks for monitoring, evaluation, policy and planning: a review. International journal of environmental research and public health, 10(10), 4812-4835.

Keller, D.R. (2008) Deep Ecology, in J.B. Callicott and R FrodeMan (edt.) Encyclopedia of Environmental Ethics and Philosophy, 206-211: Macmillan, USA.

Kellert, S. R., Mehta, J. N., Ebbin, S. A., & Lichtenfeld, L. L. (2000). Community natural resource management: promise, rhetoric, and reality. Society & Natural Resources, 13(8), 705-715.

Kennedy, L. (2007). Regional industrial policies driving peri-urban dynamics in Hyderabad, India. Cities, 24(2), 95-109.

Kundu, A. (2007). Dynamics of growth and process of degenerated peripheralization in Delhi: An analysis of socio-economic segmentation and differentiation in micro-environment. Scaling urban environmental challenges: from local to global and back, 156-178.

Lefebvre, H. (1996). The right to the city. Writings on cities, 63-181.

Lobina, E., & Hall, D. (2000). Public sector alternatives to water supply and sewerage privatization: case studies. International Journal of Water Resources Development, 16(1), 35-55.

McKenzie, D., & Ray, I. (2004, June). Household water delivery options in urban and rural India. In 5th Stanford Conference on Indian Economic Development, June (pp. 3-5).

McKenzie, D., & Ray, I. (2009). Urban water supply in India: status, reform options and possible lessons. Water Policy, 11(4), 442-460.

Mehta, L & Karpouzoglou, T. (2015). Limits of policy planning in peri-urban waterscapes: the case of Ghaziabad, Delhi, India. Habitat International, 48 (August 2015): 159-168.

Mosse, D., Gupta, S., & Shah, V. (2005). On the margins in the city: adivasi seasonal labour migration in western India. Economic and Political Weekly, 3025-3038.

Naraian V. Peri-Urbanization, Land Use Change and Water Security 2016: A New Trigger for Water Conflicts? IIM Kozhikode Society and Management Review 5:5-7

Narain V., Khan A.S.M., Sada R., Singh S., Prakash A. (2013). Urbanization, peri-urban water (in) security and human well-being: A perspective from four South Asian cities. Water International.

Narain, V, Banerjee, P, & Anand, P. 2014. The Shadow of Urbanization: The Periurban

Narain, V. (2009). Gone land, gone water: crossing fluid boundaries in peri-urban Gurgaon and Faridabad, India. South Asian Water Studies, 1(2), 143-58.

Narain, V. (2010). Periurban water security in a context of urbanization and climate change: a review of concepts and relationships. Peri Urban Water Security Discussion Paper Series, Paper, (1).

Narain, V. 2009. Growing city, shrinking hinterland: land acquisition, transition and conflict in peri-urban Gurgaon, India. Environment & Urbanization, International Institute for Environment and Development (IIED), 21(2): 501–512.

Naraina, V, & Nischal, S. 2007. The peri-urban interface in Shahpur Khurd and Karnera, India. Environment & Urbanisation 19(1): 261-73.

Ostrom, E. (1994). Neither market nor state: Governance of common-pool resources in the twenty-first century. Washington, DC: International Food Policy Research Institute.

Peri-urbanisation in Europe- Towards European Policies to Sustain Urban-Rural Futures. 2010

Pflieger, G., & Matthieussent, S. (2008). Water and power in Santiago de Chile: Socio-spatial

segregation through network integration. Geoforum, 39(6), 1907-1921.

Prakash, Anjal. 2014. “The Periurban Water Security Problem: A Case Study of Hyderabad in Southern India” Water Policy 16 (3): 454. doi: 10.2166/wp.2013.140

Purcell, M. (2003). Citizenship and the right to the global city: reimagining the capitalist world order. International journal of urban and regional research, 27(3), 564-590.

Ramachandriah, C., A.C.M Van Westen, Sheela Prasad. “High-Tech Urban Spaces: Asian and European perspctives” Manohar, New Delhi (2008)

Randhawa, P., & Marshall, F. (2014). Policy transformations and translations: lessons for sustainable water management in peri-urban Delhi, India. Environment and Planning C: Government and Policy, 32(1), 93-107.

Ranganathan, M. 2014. 'Mafias' in the waterscape: Everyday public authority and informality in Bangalore. Special Issue on Informal Space in the Urban Waterscape. Water Alternatives

Roy, A. (2009). Why India cannot plan its cities: Informality, insurgence and the idiom of urbanization. Planning theory, 8(1), 76-87.

S. Janakarajan 2007 “Challenges and Prospects for Adaptation: Climate and Disaster Risk Reduction in Coastal Tamilnadu.” In: M. Moench & A. Dixit, eds. Working with the Winds of Change, chapter 9, pp. 235-270. Boulder, CO: ISET
http://www.proventionconsortium.org/themes/default/pdfs/winds_of_change.pdf

Sen S and S Chakraborty (2017), Budgetary Directions for the Water Sector in Telangana, The Asian Age, April 17.

Sen, S. (2016). Gendered Exclusions in the Work Spaces of Peri urban Areas in a Neoliberal Environment Learning from the Experiences of Large Metropolitan Cities in India. Environment and Urbanization Asia, 7(1), 42-53.

Sen, S. (2017) Peri Urban Water Woes and Development Contradictions, Geography and You, March-April: 74-79

Shaw, A. (2005). Peri-urban interface of Indian cities: growth, governance and local initiatives. Economic and Political Weekly, 129-136.

Simon David, 2008. Urban Environments: Issues on the Peri-Urban Fringe Annual Review of Environment and Resources Vol. 33: 167-185 (Volume publication date November 2008) First published online as a Review in Advance on July 30, 2008 DOI:
10.1146/annurev.environ.33.021407.093240

Simon, D. (2008). Urban environments: issues on the peri-urban fringe. Annual Review of Environment and Resources, 33, 167-185.

Solo, T.M. (1999). Small-scale entrepreneurs in the urban water and sanitation market. Environment and Urbanisation,11 (1), 117-132.

Sparke, M. (2008). Political geography—political geographies of globalization III: resistance. Progress in Human Geography, 32(3), 423-440.

Stoler, J., Fink, G., Weeks, J. R., Otoo, R. A., Ampofo, J. A., & Hill, A. G. (2012). When urban taps run dry: Sachet water consumption and health effects in low income neighborhoods of Accra, Ghana. Health

& place, 18(2), 250-262.

Swyngedouw, E. (1999). Modernity and hybridity: nature, regeneracionismo, and the production of the Spanish waterscape, 1890-1930. Annals of the Association of American Geographers, 89(3), 443-465.

UN-HABITAT (2008) State of the World cities 2008/2009. Earthscan, London.

Vij, S. & Narain, V. 2016. Land, water & power: The demise of common property resources in Peri-Urban Gurgaon, India, Land Use Policy 50 (2016). – ISSN 0264-8377 – p. 59-66

Vij, S., 2015. Urbanization, common property resources and gender relations in a peri-urban context. Vision: J. Business Perspective 18.

Zerah, H.M. and Jaglin. S. (2011) Water in cities: Rethinking services in Transformation in India Infrastructure Report 2011 Water Policy and Performance for Sustainable Development, Oxford University Press, pp 260-273

Zérah, M. H. (2008). Splintering urbanism in Mumbai: Contrasting trends in a multilayered society. Geoforum, 39(6), 1922-1932.

Zhao, P. (2013). Too complex to be managed? New trends in peri-urbanisation and its planning in Beijing. Cities, 30, 68-76.

Situation Assessment of Drinking and Domestic Water Facilities

Questionnaire for Socio-economic at Household Level
South Asia Consortium for Interdisciplinary Water Resources Studies

(SaciWATERs)

Secunderabad, Telangana – 500094

House-listing Survey

Village Name:				*Date:*			*Investigator Name:*						
Street Number/ Cluster Number	Household Serial Number	House Number (Register-ed)	Migration Status of the Household (Non-migrant=1; Settled In-migrant=2; Tenant=3)	If settled in-migrant or tenant, year since residing in the village	Informant (Member of Household=1; Other=2)	Name of HH Head	Name of the Informant	Religion	Caste	Caste Group	Land (in acre)		Does household has piped water supply? (Yes=1, No=2)
											Owned	Cultivated	

Village Name:		*Date:*		*Investigator Name:*					
Drinking water source				Domestic water source				Primary cooking water source	Usual time when available
Abundant season		Lean Season		Abundant season		Lean Season			
Primary	Supplementary	Primary	Supplementary	Primary	Supplementary	Primary	Supplementary		

Situation Assessment of Drinking and Domestic Water Facilities

Questionnaire for Socio-economic SampleSurveyat Household Level
South Asia Consortium for Interdisciplinary Water Resources Studies

(SaciWATERs)

Secunderabad, Telangana – 500094

Household Level Questionnaire

Table 1 – Identification of Sample Household					
1. District *(Medchal-1; Rangareddy-2)*				10. Religion *(Hindu-1; Muslim-2; Christian-3; Others-4)*	
2. Mandal *(Kapra-1; Ibrahimpatnam-2; DundigalGandimaisamma-3; Gandipet-4)*				11. Informant's Name	
3. Village *(Malkaram-1; Adibatla-2; Mallampet-3; Kokapet-4)*				12. Informant's contact number *(Telephone and/or Mobile phone)*	
4. Cluster number *(As assigned during house-listing)*				13. Name of Head of the HH	
5. Household serial number *(As assigned during houselisting)*				14. Age of Head of the HH	
6. Type of HH by migration status *(Non-migrant: Own Dwelling=1; Non migrant: Tenant=2; Migrant: Own Dwelling=3; Migrant: Tenant=4; Migrant: Dwelling Provided by the Employer=5)*				15. Gender of Head of the HH *(Male-1; Female-2)*	
				14. Result of the interview *(Completed-1; Incomplete-2; Refused to participate3)*	
7. If code 3, 4, 6in item 6	a. Year since residing			15. Name of the Enumerator	
	b. Last place of residence	i.State Name		16. Date of interview *(DDMMYYYY)*	
		ii. District Name			
8. Caste group *(OC-1; BC-2; SC-3; ST-4)*				17. Interview started at *(Time in 2400 format)*	
9. Caste *(Specify)*				18. Time taken for interview *(Minutes)*	

Table 2 – General Socio-Economic Characteristics of the Household	
1. Type of Family *(Single-1; Joint-2; Nuclear-3; Extended-4)*	
2. Nature of Occupation Related to Primary Income Source of the HH *(Code)*	
3. Sector Related to Primary Income Source of the HH *(Code)*	
4. Nature of Occupation Related to Supplementary Income Source of the HH *(Code)*	
5. Sector Related to Supplementary Income Source of the HH *(Code)*	
6. Type of Ration Card *(BPL-1; Antyodaya-2; Other-3; No Card-3)*	
7. Highest Education among HH Members *(Codes)*	
8. Number of persons living in the HH: Male of age below 15	
9. Number of persons living in the HH: Male of age 15 & above	
10. Number of persons living in the HH: Female of age below 15	
11. Number of persons living in the HH: Female of age 15 & above	

Table 3 – Basic Household Amenities								
Latrine		Bathroom		Electricity			Type of Kitchen Facility *(Codes)*	Type of Drainage Facility *(Codes)*
Type of Facility *(Codes)*	Type of Access *(Codes)*	Type of Facility *(Codes)*	Type of Access *(Codes)*	*Do you have electricity connection? (Yes-1; No-2)*	Supply *(Hrs. in a day)*			
					In abundant water supply season	In lean season of water supply		
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*

Table 4 – Description of Dwelling (House -site) Occupied by the Household				
Type of ownership *(Code)*	Type of house *(Code)*	Number of floors in the building	Number of rooms	Whether registered? *(Yes=1; No=2)*
1	*2*	*3*	*4*	*5*

Operational Land Holdings

Did your household cultivate any land this year (kharif 2016)?(Yes-1; No-2)

If yes how much land (in acre) was cultivated?

Is it your own land?(Yes-1; No-2)

If no or partially so, how much land did you lease in?(acre)

Which are the crops cultivated this year? (Specify)

Has your cultivation area declined over the last 10 years?(Yes-1; No-2)

If yes, specify how much and why?(Specify)

(For households who do not cultivate any land)

Did your household cultivate anytime in the last few decades?(Yes-1; No-2)

If yes, on how much land?(acre)

Please specify the reason for shifting out of cultivation?

Is your current economic position better/worse/ same as it was when your household was engaged in agriculture? (Please explain)

Source of Irrigation by order of importance *(Specify)*	**Has the source depleted/ got polluted over time? *(specify)***

(In case the hh irrigate the land) Who is responsible for overall irrigation management? (Male-1; Female-2; also specify age)

Please specify the months in the last year when the problem of water shortage was acute for your household-

- Drinking:
- Cooking:
- Domestic:

In a normal rainfall year, which are the months when water shortage problem is acute-

- Drinking:
- Cooking:
- Domestic:

Situation Assessment of Drinking and Domestic Water Facilities

Questionnaire for Socio-economic SampleSurvey at Household Level
South Asia Consortium for Interdisciplinary Water Resources Studies

(SaciWATERs)

Secunderabad, Telangana – 500094

Individual Level Questionnaire

(To be asked from one adult female and one adult male who are mostly engaged in managing water in the household)

Table 1 – Identification of Individual			
Village *(Malkaram -1; Adibatla -2; Mallampet -3; Kokapet -4)*		Cluster number *(As assigned during house -listing)*	
Household serial number *(As assigned during house -listing)*		Name of Head of the HH	

Table 1 - Individual's details						
Name	Relation to head *(Code)*	Gender *(Male-1; Female-2)*	Age	Education *(Code)*	Primary Economic Activity *(throughout the year)*	
					Sector *(Codes)*	Occupation *(Specify)*
1	*2*	*3*	*4*	*5*	*6*	*7*

Table 2– Duration and Frequency of Water Supply, and Water Fetching										
Purpose of use	Season	Priority	Frequency of supply *(Codes)*	Usual duration of supply in a day *(hrs.)*	Usual number of trips a day	Usual time taken in a day *(Minutes)*		Whether anyone helps in fetching *(Yes-1; No-2)*	If yes in col. 8, who helps in fetching	
						To reach the source and get back	In waiting		Gender & age	Relation to head *(Codes)*
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
Drinking	Abundant	Primary								
		Supplementary								
	Lean	Primary								
		Supplementary								
Domestic	Abundant	Primary								
		Supplementary								
	Lean	Primary								
		Supplementary								

During lean season when water availability is not good, do you have to give up your time for some activity you normally do in the normal season for managing water?

Response	Rank
No	
Yes, have to reduce time/withdraw from paid activity	
Yes, have to reduce time for domestic unpaid activities	
Yes, have to reduce time for leisure	
Any other *(Specify)*	
Do not know	

Do you think that the water insufficiency/ irregularity/water quality problem has a negative effect on children in the household?

Response	Rank
No	
Health problems due to poor water quality	
Added burden on them as they help collect water	
Added burden leading to absence from school	
Added burden leading todrop-out from school	
Any other *(specify)*	
Cannot say	
Not applicable	

Only ask if respondent is a cultivator/ or working in agriculture in any way:

Major source of irrigation:

Do you think that the availability of water has changed for irrigation in last few decades(Yes-1; No-2)? If yes, then specify why?

-Have you changed the source for irrigating the land in few decades? (Yes-1; No-2)

-If yes, please specify the last usual source.

-In the last year did you have to alter the cropping area due to unavailability of water(Yes-1; No-2)? If yes, by how much(acre)?

In the last year, did you have to change the cropping pattern due to lack of water(Yes-1; No-2)? If yes, indicate the nature of change?

The normal or the peak season depicts the situation in the post monsoon to winter months while the lean season depicts the summer months when water resources are scarce. In our case, the data the lean season has also been followed by a year of drought, while the normal season has been followed by a normal monsoon in 2016.

http://india-wris.nrsc.gov.in/wris.html

This point is elaborated in the next chapter.

The analysis of status of ground water also points towards this.

From this one instance it is difficult to come to the conclusion that the coverage of the private RO plants declines with distance from the city core. Also, Malkaram, which is the not the closest to the city centre, but within comparable ranges as Mallampet and Kokapet, has a large number of private RO plants located within the village. This has, in all probability, more to do with the particular nature of panchayat than anything else.

For Malkaram, the supplementary source in lean season is not available due to unavoidable circumstances. This will make a difference in the total for the relevant category and has to be interpreted accordingly.

It is clear from a subsequent section, however, that the extent of payment made does increase in the lean seasons.

However, this is so because there is no data for the supplementary sources in the lean season for Malkaram, which demonstrates these examples.

The untreated sources of water are a sum of three sources in Table 6,direct piped water (temporary) managed by the community, common taps/ stand-posts managed by the community and others. The latter includes primarily includes borewell or well water, own, borrowed or even purchased at a low price.

From our field data it is revealed that the cooking water source is mostly the same as the drinking water. This is a positive trend so far as the health implications, as contaminated water with heavy metal pollution typical of an industrial area is more potent in its effect in cooking, since the incidence of contamination increases as a result of boiling in the process of cooking.

The collected variables regarding "Quantity used per day" by the hh and "Actual monthly expenditure" on water have been used to compute cost of water per 100 litres (Monthly expenditure/Quantity used per day*30) for household. This value was averaged for all sample hhs for Drinking and Domestic for lean and abundant year.

Similarly average duration was computed from the "Frequency of Supply" and "Usual duration of supply in a day" (Frequency in days per month*Duration of supply in a day). This value was then averaged over all sample households for Drinking and Domestic uses for lean and abundant years.

Economic groups have been categorized on the basis of variable "No. of Rooms/person" in the household. The categories thus divided are:

0-0.25 (4 persons to a room or more): Poor

0.26-0.50 (4 persons per room to 2 persons per room): Lower middle

0.51-1.00 (2 persons per room to 1 person per room): Upper middle

1.01 and above (less than 1 person to a room): Upper

SaciWATERs
B- 87, 3rd Avenue,
Sainikpuri, Secunderabad - 500 094
Telangana, India
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