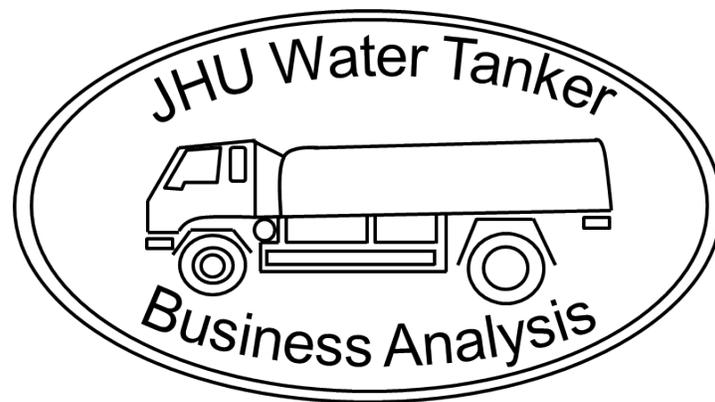


Innovation for Humanity Report



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SaciWATERS
10 years 2002 to 2012

Executive Summary

Introduction and description of the problem

SaciWATERs is an NGO that aims to shift the current paradigm in water resource management in South Asia. Headquartered in Hyderabad, India, SaciWATERs served as sponsor for our Innovation for Humanity Project. The goal of the project was to assess the greater Hyderabad water tanker business in regards to pricing, policy environment and social impact on the local community. Farmers in the peri-urban area pump ground water illegally and sell it to private and industrial consumers.

Methodology

In order to gain the necessary information the project was split into three phases: I) Preliminary research and questionnaire development in Baltimore; II) On-site data collection in Hyderabad; and III) Data analysis and evaluation in both, Hyderabad and Baltimore.

Results and Recommendation

Based on the research that was conducted, there are apparently three predominant source to consumer models: I) the owner of the bore well runs own tankers and delivers the water directly; II) the bore well owner sells the water to tanker operators and they sell it to the customers; III) the third model is a hybrid of model I and II where the owner of the bore well operates his own tankers but also lets other tanker operators pump water at the same bore well.

Model three is the most profitable source to consumer model for the bore owner but it is also the most demanding for the water table due to the risk of over exploitation. In general, it can be said that the water tanker business is very profitable. In this case, the cost drivers are few in number and weak but, the profit drivers are both numerous and very stable. The city's hunger for water seems to be unquenchable.

Surprisingly, in regards to policy environment, there are laws in place to prevent the above described illegal water market practices. Unfortunately, these laws are not enforced mainly due to believed corruption and the unrelenting demand for water from the ever-expanding city of Hyderabad. The social impact on the local population in the peri-urban varies among the different social classes. Whereas the impact on the lowest class is very limited, it is substantial for the middle and the upper class. The middle class is a transitioning demographic, moving from a farming livelihood to a more urban livelihood. They are being forced to find employment outside the agricultural sector and are therefore being forced in this transition. The upper class has profited from the water tanker business and is mainly reaping the profits. More importantly, it was found that within all three classes, education on how the water table works is very limited.

The recommendations presented build on the need for local populations of all classes to understand how disastrous the effects of an over exploited ground water table can be to them. Raising awareness through education will build pressure on politicians that will eventually result in the enforcement of water management policies that are already in effect. Ultimately, with a limited amount of people tapping into the water table, a city-wide water resource management can exist and ensure sustainability.

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Methodology

The Hyderabad Water Tanker Business assessment project (WTB) was structured into three phases: I) Preliminary research and questionnaire development in Baltimore; II) On-site data collection in Hyderabad; and III) Data analysis and evaluation in both, Hyderabad and Baltimore.

Phase I consisted of a detailed review of literature on the water sector in Hyderabad and the development of the project's strategy and methodology. Initially, Anjal Prakash, SaciWATERS project Manager in Hyderabad, provided a detailed overview outlining the project, its objectives and goals. Additionally, the team executed a thorough examination of the research materials received from SaciWATERS as well as secondary research sources, i.e. literature and articles. Using the knowledge gained, a first set of questionnaires was developed with the aim of gauging the social and financial impact of the (WTB) on local consumers. The financial questionnaires targeted well owners, tanker operators and end-consumers; while the social impact questionnaires targeted the local communities that housed the WTB's (See Figures 1-5).

Phase II involved the on-site execution of the WTB project in Hyderabad. The peri-urban village of Bowrampet was chosen as the field site and immediately upon arrival, data collection took place. After a first round test with the questionnaires, it was apparent that the interviewees' were not fully grasping the survey questions. As a result the necessary data required (i.e. profits and costs) was not being touched upon. In order to correct this, an immediate restructuring of the questionnaire was undertaken so as to match the target audience and extract relevant data needed.

Phase III, the final phase of the project, comprised of data analysis and interpretation. Data was sorted and analyzed and several recommendations were developed in reference to the WTB. These recommendations, if followed, would help alleviate the depletion of water being extracted from the underground water table.

Water Situation in Hyderabad

The city of Hyderabad faces serious water shortages, water pollution and water body destruction. Different studies have shown that Hyderabad's water supply is not sufficient, both from a geographic distribution point of view as well as from quantitative point of view. There are several reasons that have led to this situation:

1. The city of Hyderabad is growing quickly, with an increase in population close to 3% per year. This population growth rate has been sustained for almost a decade. Not surprisingly, this puts a lot of pressure on the existing infrastructure as well as on the existing water sources.¹

¹ Anjal, Prakash, "The Periurban Water Security Problématique: A case study of Hyderabad in Southern India", Peri Urban Water Security Discussion Paper Series, Paper No. 4, SaciWATERS.

2. Lake encroachment is another important driving factor. Hyderabad is a city that was developed with an extensive system of man-made lake reservoirs. These lakes are being destroyed, mainly to satisfy the city's expansion rate and demand for land. The process is fueled by corruption and ignorance. Additionally, pollution poses a huge problem and endangers the already threatened water bodies. If the ground water table also becomes polluted, it will be virtually impossible to restore these sources.²
3. The local government of Hyderabad is currently unable (and certainly to some extent unwilling) to provide enough water to all areas of the city. Due to the huge profits that are being made through the informal water business and the lack of enforcement of water resource management policies, it has to be assumed that corruption is a substantial part of the problem.
4. The geological conditions in Hyderabad (hard rock aquifer) limit the potential for ground water storage which quickly leads to depletion of the ground water table.³

Within this scenario, a flourishing water tanker business has evolved and remains a strong and visible symptom of the above described situation. According to a study, 11% of the households in Hyderabad are dependent on water tanker supply and 46% of these tankers are run privately and are therefore illegal.⁴

The Role of the Hyderabad Water Board

The Hyderabad Metropolitan Water Supply & Sewerage Board (HMWSSB) is a government run entity that supplies the city of Hyderabad with potable water in addition to managing the planning, design, construction, maintenance, operation & management of water supply system. It also serves as the key entity in managing all aspects of the sewerage system.⁵ The potable water distributed to the city is sourced from the Krishna River, the Manjira River as well as three reservoirs, namely the Himayath, Singur and Osman Sagar. Distribution to residential, commercial and industrial consumers is done through a series of pipelines that are constantly in a state of expansion, as well as through a system of government owned water tankers. The government pipelines deliver water to residential, commercial and industrial consumers and are supplemented to some degree by the government water tanker business and to a much larger degree by the private water tanker business.

² Anjal, Prakash, "The Periurban Water Security Problématique: A case study of Hyderabad in Southern India", Peri Urban Water Security Discussion Paper Series, Paper No. 4, SaciWATERS.

³ Anjal, Prakash, "The Periurban Water Security Problématique: A case study of Hyderabad in Southern India", Peri Urban Water Security Discussion Paper Series, Paper No. 4, SaciWATERS.

⁴ Available online at the website of Water & Megacities - <http://www.waterandmegacities.org/water-issues-of-hyderabad/> [Accessed on January 09, 2013]

⁵ Available online at the website of Hyderabad Metropolitan Water Supply & Sewerage Board - http://www.hyderabadwater.gov.in/ww/Ui/about_us.aspx - [Accessed on January 15, 2013]

Model Village Bowrampet

Hyderabad has been undergoing a continual population growth. In 2012 it experienced a population growth of 2.76%.⁶ As a result there has been a massive increase in real estate development that has expanded the city limits. The Hyderabad Water Board has been unable to provide the sufficient infrastructure to supply water to the ever growing population. Informal water supply businesses have arisen to bridge the gap created by the government's inefficiency. These informal water supply businesses referred to as, private tanker businesses; exploit underground water reservoirs to supply the constant demand for water in Hyderabad. These businesses usually target areas near the city limits such as areas like Bowrampet.

Bowrampet is a peri-urban village in the Ranga Reddy district located about 25 kilometers outside Hyderabad. Peri-urban communities are a mixture of urban and rural living, with an independent local municipality known as the panchayat. Bowrampet has a robust population of 9,100 villagers which make up a total of 1,200 households. Out of the 9,100 villagers, 55% are male and 45% are female (See Figure 6). The village itself comprises of 300 acres of cultivated land, about 1500 acres of forestland, and one large 100 hectares lake. The socio-economic demographics as of January 2013 are as follows: 1) 3,600 laborers (with 500-600 farmers and 3,000-3,100 industry laborers); 2) 1,000 service providers (storeowners, doctors, etc., within the village itself); 2,000 home keepers; and 2,500 unemployed (this figure includes children, elderly and unemployed laborers).⁷

The village has been experiencing rapid urbanization growth due to its proximity to the Outer Rim Road (ORR) and its proximity to the Information Technology (IT) district. The ORR is an important commuting and servicing road, which facilitates the connection to Hyderabad and flourishing districts within the city itself. As a result, the village has been the target of many construction supplying businesses who have established distribution warehouses, and manufacturing facilities that supply construction tools to Bowrampet's neighboring communities.

Water services in Bowrampet are provided by a local panchayat as well as through a Naandi water purification station. The panchayat supplies everyday usage water (water for bathing, dishes, etc.), while Naandi supplies drinking water. The panchayat collects 20 Rs. from every household for its water distribution. The water is being delivered through their independent and self-sustaining piping system to the residents of Bowrampet. Also, the panchayat has its own bore well which is used to supply water to the village. The bore well is connected to a Naandi water purification station which collects and purifies the water, where it is then distributed to the villagers for a fee of 90 Rupees per month for a 20 liter can per day. In the event the village runs out of water, the panchayat will purchase water from private tankers and distribute that water to the villagers who have paid the 20 Rupees water tax.⁸

⁶ Anjal, Prakash, "The Periurban Water Security Problématique: A case study of Hyderabad in Southern India", Peri Urban Water Security Discussion Paper Series, Paper No. 4, SaciWATERs.

⁷ Interview with village panchayat head of Bowrampet village on 01/07/2013. Bowrampet is located in the Ranga Reddy District.

⁸ Interview with village panchayat head of Bowrampet village on 01/07/2013. Bowrampet is located in the Ranga Reddy District.

Bowrampet Source Pump Descriptions

A total of 6 bore wells are selling ground water for profit within Bowrampet. These pumps are all owned by privately by the landowners upon which the pumps operate. All of the landowners are currently using their land to sell water, cultivate agriculture and lease to others or some combination of the three. The water pumped from the bore wells are used either solely in providing the water tanker business or, during some seasons, the water is also used for agriculture needs. It is important to note that these pumps sell water at different rates during different seasons. The summer months (March-August) most often see the most pumping of water, unless the pump runs dry. The winter months (September-February) see considerably less water pumping. This is mainly because the demand for water is much higher in summer than it is in the winter. The local panchayat bore wells are not used to sell water to water tankers, but only to supply the village with water. Below is a more detailed depiction of each privately owned well outlining their unique business model, interaction with the water table as well as anecdotes/notes taken during our contact with those parties involved.

Pump 1

Owner, Padma Reddy, owns this bore/well on his 4 hectares of land. He leases 1 hectare to a brick manufacturer, cultivates agriculture on 1 hectare, and leaves the remaining 2 hectares empty. When rains were better he would cultivate maize on all 4 hectares of land. He has drilled 15 bores in order to find water but only 2 of the bores currently supply water, one of which is drilled to a depth of 1000 ft. Additionally, he owns and operates two private tankers with which he delivers and sells his well water. After gathering information about his supply, costs and revenue it was found that he is pumping approximately 2.4 million liters/month in winter and 4.2 million liter/month in the summer, generating an annual profit of 3,011,013 Rs. Even at this depth, Padma describe that his pump dries up during the summer months, at which point he purchases water from another well at a discount and sells it to his consumers to supplement his income. He feels that there is no competition in the private water tanker business, given the constant demand for his water, and he believes his water quality is better than that of the government water tankers.

Pump 2

Veera Reddy, brother of Padma Reddy, owns this pump as well as the 2 hectares of land on which it is situated. The land is not being used for anything other than pulling water from the water table. He is currently leasing the pump on a 6-month basis to another individual, during which the lessee can pump an unlimited amount of water from the well. Veera Reddy owns one tanker that he uses to supply water from his well to a local industry (Dr. Reddy Labs) on a 6-month contract. The industrial consumer determines the price per tanker and changes this price on a 6-month basis. This particular consumer receives a constant supply of water from many different private tankers as well as government tankers and keeps the delivery point and path between the two separate so as to keep them from encountering one another. The water supplied by Veera Reddy's well is tested by the consumer to ensure quality. The water is used only for washing and not for drinking. Based on the supply and financial information recieved from those interviewed, it was calculated that tankers are pulling approximately 4.2 million liters/month

during the summer and 2.5 million liters/month in the winter from this well. This results in an approximate annual profit of 803,840 Rs.

Pump 3

Ram Reddy owns the 1.5 hectares of land on which bore well 3 is located. The land is not being used for anything other than to sell the underground water to tankers. His bore well is at a depth of 150ft and he maintains and operates a total of 3 tankers that pull from this well and sell to consumers. Underneath his land, he has built an underground storage reservoir with a 100,000-liter capacity in order to hold extra water for his tankers. He currently supplies to residential consumers as well as to hostels within a local university, JNTU. He has a contract with the university to provide them with a constant supply of water over 6 months and the water is not used for anything other than washing. Based on the information Ram Reddy provided, it is estimated that his bore well is pulling 2.25 million liters/month and 4.5 million liters/month in the summer and winter respectively. It was also determined that Ram Reddy generates an annual profit of approximately 1,598,400 Rs.

Pump 4

Getting in contact with the owner of this bore well, Madjra Chrari, was unsuccessful. However, through information provided by the tanker drivers, Madjra owns this bore well in addition to 2 tankers. He uses the two tankers to sell water to residential customers, most likely in Pragathi Nagar. The driver also explained that these are the only two tankers pulling water from this bore well. The driver was hired not long ago and was therefore unable to provide information about deliveries during the summer months. He was able to give some cost information as well as winter delivery information. Using this information it was estimated that this bore well was extracting approximately 600,000 liters/month and 1.8 million liters/month in the summer and winter respectively. Based on the limited info he provided about the winter month deliveries, costs and prices, it was estimated that Madjra Chrari's annual profit is 233,280 Rs. Interestingly, this driver was the first to mention that there is a lot of competition within the private tanker business. Additionally, Madjra sets his own prices on the tankers.

Pump 5

This particular pump was the most interesting in terms of the business model and the extent to which it was being used. 4 separate people were interviewed, two drivers, a farmer who leases land from the owner, and the owner Veenka Reddy. Veenka Reddy owns 3 hectares of land on which the pump is located, one of which he leases to a farmer to grow rice, the rest used for housing of his buffalo and to provide water to private tankers. Veenka also leases another well in an area close by. He owns and operates 1 tanker that pulls and sells water from both, his own bore well as well as the bore well that he is leasing. In addition, Veenka allows the sale of water to other private water tankers from both wells. Finally, Mangojillia is a gentleman who owns 1 water tanker and has leased this particular well that Veenka owns for 6 months. During these 6 months, Mangojillia is able to pump as much water to sell through his tanker as he wishes. The volume, costs and prices given by all four interviewed varied slightly but remained close enough to make reasonable estimates on ground water usage and profit. Based on the information

received, this bore well is pumping approximately 12 million liters/month during the summer months and 5.7 million liter/month during the winter months. This is an astronomical amount of water being drained on a monthly basis. Additionally, Veenka Reddy is making an approxamite profit of 4,428,407 Rs. annually, purely from the sale of ground water. Veenka Reddy explained that he entered into this business just one year ago in order to try out a new business. He explained that the well did dry up occasionally. Through extrapolation of additional information it was found that when both of Veeka's wells dried, he would go to a third well and lease it in order to continue to pump water for sale. This particular well was easily the most active, profitable and abusive in its extraction.

Pump 6

The final bore well within Bowpramet is owned by Ananth Reddy and his two brothers. Information provided by one of their drivers explained that Ananth and his brothers own 3 tankers. This particular well does not have its water sold to anyone, instead, Ananth owns a building construction business and pulls water from his bore well to mix into construction materials and supply laborers with water. Although the water is not of high quality, its used for consumption by laborers on the project site. This particular well showed difficulty in the fact that the driver attempted to tell a lie depicting one of Ananth's brothers as dead, in order to pretend that there were less tankers pulling from the well. A few individuals that were present cleared up the misstatement and through the information gathered, it was found that approximately 1.2 million liters/month are being extracted through this bore well.

Bowrampet Consumer Description

Most of the bore wells selling water from Bowrampet are providing water to residential buildings in a nearby city called Pragathi Nagar. Visits to Pragathi Nagar, over the course of two days allowed for interaction with consumers, the building managers and the local panchayat. It seems that all of the buildings within Pragathi Nagar have a pipeline connection to government-supplied water from the Manjira river. Unfortunately, this water does not nearly provide enough supply for these residences. In order to supplement their water needs, the large multi-unit residential buildings order tankers from Bowrampet and local villages on a regular basis. These water tankers deliver the water where it is stored in underground water reservoirs, something that all new buildings have. Generally the buildings contain a large tank for inconsumable water, and a slightly smaller tank for potable drinking water. Interestingly, many residential buildings had their own bore wells, fashioned with pumps, in order to supplement their water. Also, many rainwater recharge pits were found around buildings, built to help gather rainwater and recharge the water table. One of the buildings visited had a bore well that had been drilled down 600 feet and was being used to pump water 3 hours per day. Pragathi Nagar has been expanding at a rapid rate and has many residential units in constant construction. The growing population and insufficient supply by the government has resulted in a constantly increasing demand for water. This demand is also apparent within the industry sector, where Bowrampet bore wells also supply. One of the local bore wells supplies water on a 6-month contract to Dr. Reddy Laboratories. It was explained that the route into the facility as well as the water drop off points were kept separate for government tankers and private tankers in order to keep them from

crossing paths. In addition, the water was tested regularly by Dr. Reddy labs and had to meet standards before being delivered.

Role of the Government

In order to have a better understanding of what the government's role in the water situation is as well as their preconceptions towards the illegal private water tanker business, a visit was made to the Hyderabad Municipal Water Source & Sewage Board. Before moving to conclusions and recommendations, it is important to point out that a visit was made to both Government water tanker drivers as well as the Chief Engineer for the HMWS&SB. During the interviews with both parties, vital data was acquired concerning government vs. private water tanker businesses. Additionally, key insights on the HMWS&SB's preconceptions of the tanker industry as a whole were shared. A more in-depth explanation and discussion on these two interviews can be found in the appendices (See Figure 7).

Project Findings

The three different source/consumer models

- Source/Consumer Model 1

In this model the landowner of the land upon which the bore well is situated also operates his own tankers in order to sell water directly to the consumer. The consumer can be either residential or commercial. Contracts may exist between the consumer and this individual, and generally last around 6 months, during which the consumer pays a set price.

- Source/Consumer Model 2

In this model, the landowner of the land upon which the bore well is situated leases his well to another individual for an agreed upon amount. The lessee generally owns his own tankers and usually leases the pump rights for 6 months for a fixed leasing fee. During the 6 month contract, the lessee/tanker operator is allowed to pump as much water as he wants. Often the lessee/operator also has a contract with consumers for the delivery of water.

- Source/Consumer Model 3

This third model is not only the most profitable, but it also exploits the ground water to the greatest degree. In this model the land owner upon which the bore well is situated not only operates his own tankers to sell water directly to the consumer, but also allows other tanker owners to purchase water from his well. When selling his water to other tankers, we have seen the owner to charge Rs.200 in summer and Rs.100 in winter per tanker of water (usually 5000 liters). Again, contracts can be seen between the owner and consumer as well as the tanker operators and consumers.

Profitability of the Private Water Tanker Business

Bowrampet has a total of 6 bore sites where groundwater is pumped and sold. Bore 6 only provides water for the bore owner's own use which leads to no revenue. Thus, only the profitability of the remaining five bores was calculated.

To gain the necessary information, two groups of people involved were surveyed: The owners and/or operators and the tanker drivers. Based on the basic financial data retrieved, (i.e. difference in prices during summer and winter, electricity, cost to run tankers) sales and total cost were defined and a profit amount was reached. However, since the bore owners or operators were sometimes reluctant to give real profit values, some financial data received may be unreasonable. Thus, some adjustments were made when evaluating real profit. The adjustments are outlined below.

1. Electricity Costs = $\text{Rs.}0.003 * \text{Monthly Pumped Water in liters}$
Reasonable electricity costs from bore 1, bore 4, bore 5 and bore 6, were used as a baseline and then divided by the monthly pumped water to get an average factor 0.003 Rs / liter.
[Monthly Pump Water = # of Tankers * # of Trips/Tanker/Day * 30 Days * Tanker size (liters)]
2. Monthly maintenance cost = Average of other bores
3. Monthly gas cost = $\text{Rs.}71^9 * \text{\# of Tankers} * \text{\# of Trips/Tanker/Day} * 30 \text{ days}$

The monthly gas cost used in the profitability calculations (Rs. 71 / trip) is based on information gathered from tanker drivers and tanker owners. More specifically, the cost of gas was based upon a value of Rs. 20000 and an average of 10 trips per day. Using the estimate of 71 Rs. per trip, gas cost estimates were found in the range of those that were given by tanker drivers and operators. Upon further analysis it was found that this estimate is much too lowering more realistic gas consumption values for a 7.5 ton truck, the cost should be closer to double what they currently are. Nevertheless, to remain consistent with the data received, the updated gas figures were not used. (See Figures 8-10).

The following formulas are the major formulas used within the financial analysis:

- Monthly sales = # of tankers * # of daily trips per tank * 30 days * price in summer or winter.
- Monthly total cost = monthly electricity cost + monthly maintenance cost of the tanker + monthly fuel cost + labor salary
- Monthly profit = monthly sales - monthly cost
- Annual sales = 6 * monthly sales in summer + 6 * monthly sales in winter
- Annual costs = 6 * monthly costs in summer + 6 * monthly costs in winter
- Annual profit = 6 * monthly profit in summer + 6 * monthly profit in winter

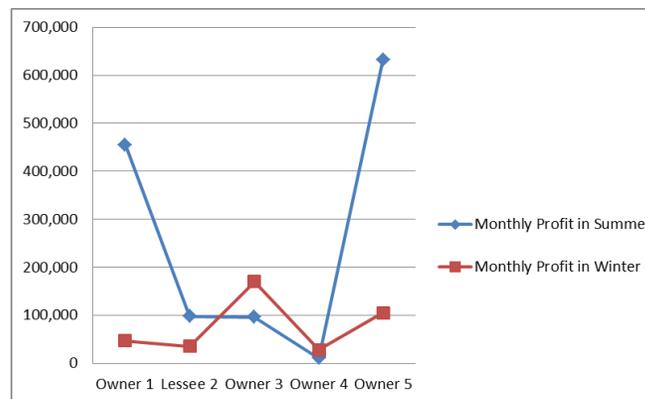
⁹ This number changes for a 10000 liter tanker to Rs. 100 and for a 14000 liter tanker to Rs. 130

Table 1: Profitability of 5 Bores (in Rs.)

		Bore 1	Bore 2 ¹⁰	Bore 3	Bore 4	Bore 5
Annual Sales		4,392,000	1,800,000	3,375,000	702,000	5,265,000
Annual Costs		1,380,987	996,160	1,776,600	468,720	836,593
Annual Profit		3,011,013	803,840	1,598,400	233,280	4,428,407
Total Sales (Monthly)	Summer	588,000	187,500	225,000	42,000	720,000
	Winter	144,000	112,500	337,500	75,000	157,500
Total Costs (Monthly)	Summer	132,862	89,433	128,700	31,320	87,171
	Winter	97,302	76,593	167,400	46,800	52,261
Total Profit (Monthly)	Summer	455,138	98,067	96,300	10,680	632,829
	Winter	46,698	35,907	170,100	28,200	105,239
Sales/Tanker (Monthly)	Summer	294,000	187,500	75,000	21,000	360,000
	Winter	72,000	112,500	112,500	37,500	67,500
Costs/Tanker (Monthly)	Summer	66,431	89,433	42,900	15,660	87,171
	Winter	48,651	76,593	55,800	23,400	52,261
Profit/Tanker (Monthly)	Summer	227,569	98,067	32,100	5,340	272,829
	Winter	23,349	35,907	56,700	14,100	15,239

The reason why bore 1 has a high profit is that it is the deepest well in the village at 1000ft. All other wells are around 120ft to 150ft. It is reasonable that the deeper the well, the more consistent the water flow, and thus the easier to exploit the ground water table for profit.

Graph 1: Monthly Profit in Summer and Winter (in Rs.)



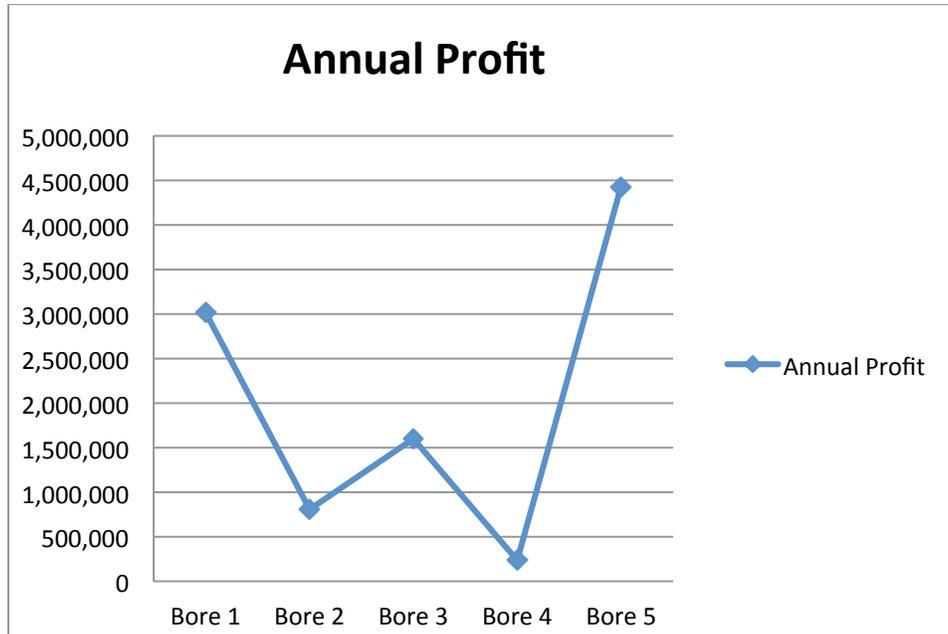
The reason why we get the different monthly profit in summer and winter is that the # of trips per day per tanker and the price in summer and winter are substantially different. The price of water in the summer could be as high as Rs.1000 while the price in the winter could be Rs.300 to Rs.500. Also, the number of trips in summer is usually double the number of trips in winter.

However, bore 3 and bore 4 are the exceptions since both have a higher monthly profit in winter. The reasoning is that some bores may dry out in summer, meaning that they are not able to pump water every day. Therefore they usually have less trips per day in summer than in winter.

¹⁰ Since the tanker operator for bore 2 needs to pay \$80,000 for a 6-month contract to the bore owner, this amount was added into his total costs

The Most Profitable Source to Consumer Model

Graph 2: Annual Profit of 5 Bores (in Rs.)



As shown in Graph 2 (above), bore 5, which uses the third source/customer model, has the highest annual profit. The main reason for the high profit is that the additional cost to allow other tanker owners to pump and purchase water consists of only the electricity costs. The bore owner does not need to cover the maintenance costs, fuel costs or the salary for these tankers. Thus, the bore owner gets high additional sales from tanker owners' payments and few additional costs which lead to a high total profit.

Table 2: Breakdown of Bore 5 Profitability (in Rs.)

Bore 5	
Total Annual Profit	4,428,407
Profit from own tankers	1,728,407
Profit from other tankers	2,700,000

Profitability of Government Tanker Operators

All the financial data put into excel is based on the survey with respondents from the HWMS&SB Chief Engineer and government tanker drivers.

- Monthly total sales = # of tankers * # of daily trips per tank * 30 days * price consumer/tanker
- Monthly total cost = Rs.175 * # of tankers * # of daily trips per tank * 30 days + (monthly maintenance cost + monthly fuel costs + labor salary) * 900 tankers
- Monthly total profit = monthly total sales - monthly total cost
- Annual sales = 12 * monthly total sales
- Annual costs = 12 * monthly total costs
- Annual profit = 12 * monthly total profit
- Monthly sales per tanker = monthly total sales/ # of tankers
- Monthly costs per tanker = monthly total costs/ # of tankers
- Monthly profit per tanker = monthly total profit/ # of tankers

Table 3: Profitability of the HWMS&SB tanker operations (in Rs.)

	Govt. Tanker Owner	HWMS&SB
Annual Sales	1,296,000,000	288,000,000
Annual Costs	945,000,000	
Annual Profit	351,000,000	24,000,000
Total Sales (Monthly)	108,000,000	
Total Costs (Monthly)	78,750,000	
Total Profit (Monthly)	29,250,000	
Sales/Tanker (Monthly)	120,000	
Costs/Tanker (Monthly)	87,500	
Profit/Tanker (Monthly)	32,500	

Since the water transfer costs are unknown from the rivers or water bodies to the government filling station, profit calculation for the HWMS&SB is not possible.

In contrast to the private tanker owners, the government tanker owners have the same profit in summer and winter months. The reason is that the government tankers have a constant number of daily trips during the whole year and the price and costs in summer and winter are the same.

Comparison – Profitability - Private Tankers vs. HWMS&SB Tankers

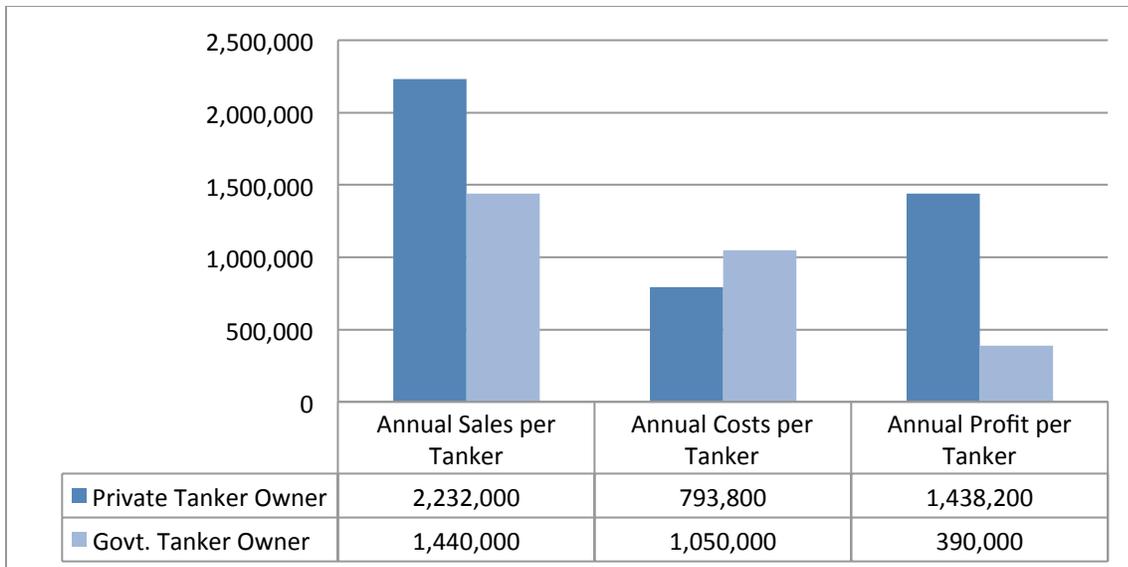
Table 4: Profitability of the HWMS&SB tanker operations (in Rs.)

		Private Tanker Owner	Govt. Tanker Owner
Monthly Sales per Tanker	Summer	300,000	120,000
	Winter	72,000	120,000
Monthly Costs per Tanker	Summer	94,800	87,500
	Winter	37,500	87,500
Monthly Profit per Tanker	Summer	205,200	32,500
	Winter	34,500	32,500
Annual Sales per Tanker		2,232,000	1,440,000
Annual Costs per Tanker		793,800	1,050,000
Annual Profit per Tanker		1,438,200	390,000

As shown in the table, the private tanker owners have a high annual profit which is almost 5 times the government tanker owners'. The main reason is that the annual sales per tanker of the private tanker owner is much higher than the government tanker owners', however, the private tanker owner has a lower annual cost. The private tanker owners and governments tanker owners both need to cover the costs to run the tankers, the difference is that the private tanker owners need to pay the electricity costs to pump the water or the payments to the well operators to purchase water, the government tanker owners need to pay a much larger amount to the HWS&SB.

The huge difference between annual profits is the main reason that tanker owners prefer to work within the private tanker business rather than with the government. Also, it is also one of the most significant reasons why this informal water business continues to flourish.

Graph 3: Profitability of Private Tanker Operators vs. HWMS&SB Tanker Operators (in Rs.)



Social Impact on Local Community

An in depth assessment was conducted on the social impact of the private tanker business in the village of Bowrampet, on its villagers. A series of surveys were devised and used when conducting site interviews with the villagers. The surveys asked key questions and allowed the team to collect the necessary data (See Figure 3). The overall goal of the survey was to understand the impact of the private tanker business on those who lived within Bowrampet. It focused on four major factors – 1) change in livelihood, 2) impact on income, 3) perception of tanker business, and 4) awareness of the water table.

There was a limited amount of field time in the village and so, while the villagers welcomed teams presence initially, they did not seem to be very responsive to the survey. To quickly adapt to this situation, the strategy was modified in order to get the necessary data. The village was separated into three classes, low class, middle class and upper class. The original plan was to have a detailed survey outlining the income level of each interviewee and cross-reference that with the income breakdown in India to determine the class classification. However, as mentioned before, the villagers were a bit apprehensive about disclosing such information to the group. In order to circumvent this hurdle, living standards were used as the measure for classification of socio-economic status or class.

There was an apparent spread across the village; the lower class lived in small, dilapidated huts on the outskirts of the village. The middle class lived in modest one-story homes within the village center and the upper class lived in somewhat elaborate two to three story homes near the panchayat. These observations were used to focus and target the survey in order to capture the necessary data for the study. With the help of a talented translator, a two-day social impact survey of the village was launched. An all-inclusive audience was needed, with a particular interest on the women's perspective on the matter. The plan was to approach a meeting ground, within the targeted class, and ask men and women to gather for a quick discussion about the village. The translator would introduce the group and then simultaneously transition to the survey questions. This technique proved successful, since on average there was a turnout of ten to twenty villagers that were willing to answer the survey questions. Below is a breakdown of the findings, divided by class standing.

Impacts on the Lower Class

Interestingly enough, the lower class was not really impacted by the private tanker business, aside from the negative impact on the water table. They had not been displaced to other industries; instead they had remained in the same field of work – agricultural labor. This class reported higher water security than others due to interaction with water for agricultural purposes. During the summer, when some bore well owners had depleted their underground water reservoirs, these laborers were able to rely on these agricultural wells as their source for water. These villagers would share the water from the agricultural pumps with their neighbors, which allowed them to save a great deal of costs in the summer in the event of water shortage.¹¹

¹¹ Interview with lower class villagers on 01/16/2013. Bowrampet is located in the Ranga Reddy District.

Furthermore, a majority of the lower class believed the private tanker business was providing a philanthropic service to other villages. Their belief was that those individuals selling their water to others in need was a selfless act. This type of act would elevate the stature of the village through helping the needy. They understood that the tankers were charging money for the service, and were in complete agreement of such practice. As quoted by a local villager - the cost of having no water is higher than the cost of paying for the tankers.¹² Interestingly, the act of selling water from the village was also perceived as having a “Karma” effect. Villagers explained that those providing water from their village were providing such an important services that the same kindness would be returned, if Bowrampet were to be presented with a water shortage.

Additionally, an interesting fact was uncovered regarding the perceived relation` between the private tanker business bore wells and the village bore wells. All responses to the survey seem to indicate that villagers have no awareness of the interconnectivity of the Bowrampet water table. They believed that underground water was encapsulated, or divided up in such a way that if two bore wells not directly side by side, they would have no effect on one another. It is apparent that they did not understand that bore wells in or out of the village are completely interconnected and affect the water table in the same way. This is a major finding, as it will lay the foundation to our recommendations, which will be outlined in the coming sections. For now it is important to remember that the villagers have a limited understanding of the functionality of the water table in their village.

Impacts on the Middle Class

The middle class was the one class that was the most negatively impacted by the private tanker business. This socio-economic group had been forced to transition to other industries. It was apparent that many had migrated from agricultural labor into industrial labor as agriculture became a less popular means of business by bore well owners. As a result, they were deeply impacted by the new costs arising from the transition in industry. There were now commuting costs and food costs that had previously been nonexistent. This group previously grew their own food for the entire year and were not dependent on others for food. Additionally, any surplus of crops could be sold and the income from this could be saved. Members of this group told us that even though they had the same amount of money, in terms of income, the additional costs from the industry transition had made it impossible to maintain their old lifestyle. They also implied that working within agriculture was an easier way of life. It did not require clocking it at specific times, stringent hours and many other stringent rules that were placed on the industrial laborers.

This group reported higher water insecurity then others due to their lack of access to a bore well in the summer. Women in the village would state that if there were a shortage of water in the summer, and the panchayat was unwilling to pay for such for a tanker, then they all would pull their resources together and pay for a private water tanker to deliver to their homes. Interestingly enough, they said that a benefit of having a private tanker business in their village is that they would get a discount price when ordering water from within their village. They were unaware that they were, in essence, paying for water that belongs to the village as a whole.

¹² Interview with lower class villagers on 01/16/2013. Bowrampet is located in the Ranga Reddy District.

Similar to the lower class, our team found that a majority of the middle class believed the private tanker business was providing a philanthropic service to other villages. Additionally, just like the lower class, they had no awareness of the functionality of the water table and thus perceived the relation between the private tanker businesses bore wells and the village bore wells, to be completely independent from one another. All responses to the survey seem to indicate that villagers have no awareness of the interconnectivity of the Bowrampet water table.

Impacts on the Upper Class

The upper class is the only demographic that has been positively impacted by the private tanker business. Most have transitioned from the agricultural business to the water tanker business. This class reported the highest water security than their counterparts, due to the easy and convenient access to bore wells and their heavily increased income. For the most part, if they were bore well owners, they would exploit the water table and gain extreme profits from their own tankers or by selling to other tankers. The tanker business is virtually labor free for them and assures them simple and rapid returns due to the constant demand for water. Additionally, the ease of entry into the business is incredibly high given that wells are cheap to drill at around 50,000 to 100,000 Rs. The upper class enjoyed a much less labor intensive lifestyle, and with the heavily increased profits over agriculture, many of them quickly adjusted their lives to match the increased income. There were several bore well owners who had built brand new homes within the last few years, and had enough money to purchase new cars and motorcycles.

Again, the upper class had little to no idea about the interconnectivity the underground water table has. They explained that if two bore wells were too close to one another, the overuse of one could cause the other to dry but, they believed this to only be true with pumps that are in very close proximity. It was their misconception that wells on opposite sides of the village had no effect on one another. As more questions were posed to the upper class, the strategy shifted to asking how they felt if they knew that their depletion of the water table might cause another person's well to dry up. Interestingly, one member of the upper class responded something to the effect of "It's their problem, it's their luck". Very obviously, the population overall was incredibly uneducated on how the geography of underground water works, which is something that was taken seriously in the development of the recommendations.

Conclusion

The research has shown that there are three major findings. First, there are huge profits that are made by mainly well owners, but also by tanker operators. Although the depletion of ground water affects everybody who relies on ground water from the same water table, the profits are spread only among a few individuals or families. Even though the corruption cannot be directly proven, it is only fair to assume that bribes and other payments are being exchanged given that the WTB is illegal. Another clear indicator for that assumption is India's ranking on the Transparency International corruption ranking, where India ranks 94 among other countries like Greece and Colombia.¹³

¹³ Available online at the website of Transparency International - <<http://cpi.transparency.org/cpi2012/results/>> - [Accessed on January 15, 2013]

Second, the inability of the government to provide sufficient water is apparent. It fails to deliver the desired quantities by the World Health Organization and it fails in respect to geographic reach.¹⁴ Furthermore, the government fails and/or is unwilling to enforce current legislation (APWALTA Act) that would prohibit over depletion of the water table and that would allow tough measures against the illegal WTB.¹⁵

Third, the local communities and population clearly lack the necessary understanding and knowledge of water management as well as of the interconnection of the water table with droughts, rain fall, ground water pumping etc. The interviews have shown that misperception and ignorance are the rule and not the exception. These beliefs lead to a wrong perception of the WTB and enable it to stay in place.

Recommendations

In order to eradicate the WTB business, a multi approach strategy is necessary since the WTB is not the disease itself, but a strong symptom. In order to effectively protect the water resources and to manage the water table in and around Hyderabad, a central supervision is necessary. Currently there are too many players tapping into the same resources – the government, local industries, residential buildings and farmers. Water management and protection is not possible with that set up and over exploitation is the result. Therefore, the following three measures are recommended:

- Awareness: In order to build up pressure on local well owners and local politicians, awareness of the consequences of WTB must be raised among all the involved parties. The main target group is the rural / peri-urban population that is selling the water and consumers that are purchasing that water.
- Enforcement: The existing legislation (APWALTA Act) must be enforced in order to stop the illegal WTB. Fines could take away some of the profits and make the WTB less attractive for new entrants.
- Partnering with local industries: Since many local businesses buy illegally pumped ground water, their business models are not sustainable and run on illegal grounds. The goal should be to build awareness among these companies and help them transfer their business models on a legal basis as well as on a more sustainable basis to make them fit for the future.

It can be assumed that these recommendations may help deminish the depletion of the water table due to the following effects:

- Buildup of pressure on local politicians and therefore better enforcement of APWALTA Act plus a decrease in corruption
- Loss of water business for private well owners due to raised awareness and fines

¹⁴ Available online at the website of Water & Megacities - <http://www.waterandmegacities.org/water-issues-of-hyderabad/> [Accessed on January 09, 2013]

¹⁵Sreoshi, Singh, Anjal Prakash, and Lieuwe Brouwer. *The Periurban to Urban water transfer conflict: a case of Hyderabad city in South India*. 2012. 1-11.

- Due to reduced number of parties that tap the water table the government is successively able to gain the ability to control the overall water extraction
- In a final stage, the government would be the only provider of water and therefore would be able to introduce a sustainable water management system.

Innovation for Humanity Group Reflections

As a whole, our group experiences within India were both humbling, as well as enlightening. The Innovation for Humanity curriculum was meant to be a real life project that exposes us to the bottom of the pyramid as well as social entrepreneurship. Our specific project allowed us to interact heavily with the local population within Bowrampet, some of which represented the bottom of the pyramid. Through our interactions, we realized how greatly vital resources such as water are sought on a daily basis and how important the management of these resources are to the livelihood of people. It was also very apparent how quickly these resources will be exploited through mismanagement and when there is opportunity, for rapid profit by individuals. At a personal level, each one of us has left India feeling that our trip was a once in a lifetime experience that has seasoned us, opened our minds, and reinvigorated a need to think about this part of the world and remain involved with it.

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Appendix

Figure 1: Questions to the chief engineer of the HMWS&SB

1. How many tankers do you operate?
2. Where do you pull your water from?
Do you have a map?
3. How many liters do you deliver on a daily basis? Summer / Winter?
4. What is the split / ratio between residential & industry?
5. What tanker sizes do you use?
6. Do you deliver to individuals, how does the process work?
7. Do you deliver drinking water quality?
8. Do you test the water?
9. Do you filter the water?
10. Is it delivery upon order or do you develop contracts with buyers?
11. Do you think there is competition?
12. What areas do you cover for delivery?
Map?
13. Are you making a profit?
14. How do you maintain the trucks to prevent leaking?
15. How does the informal tanker business affect your work?
16. Why are the private tankers not registered?
17. Do you think that the regulation of the informal water tankers through registration would improve the water security?
18. What are your costs to operate a tanker?
Salary? Maintenance? Gas?

Figure 2: Questions to industrial and private consumers

1. How much water do you buy per day? Summer/winter?
2. Do you buy from tankers? Private / Government?
3. How often do you order?
4. Do you have a personal pump set? If so, how much do you pump?
5. What is the ordering process?
6. How much do you pay for per tanker?
7. How often and how do you pay for it?
8. Do you also get water from the government?
9. Do you order the water in regards to quality or in regards to price?
10. For what are you using the water?
11. Do you change the providers?
12. How do you know about the suppliers?
13. Do you test the quality of the water?
14. When did you set up the factory?
15. Why did you set it up in this location?
16. Was there an advantage over a location closer to the city?
17. Does your factory create any waste water? If yes, where does it go?

Figure 3: Questions to the local population of Bowrampet

1. Gender: Male Female
What age group are you in?
 - 18 – 29 yrs.
 - 30 – 39 yrs.
 - 40 – 49 yrs.
 - 50 – 59 yrs.
 - 60 + years
2. Do you and your family have access to drinking water at all times?
3. Does having the water transported out of the village affect your livelihood?
4. Does having the water transported out of the village affect your household's daily activities?
5. Are you aware that the tanker business lowers the water availability for the village?
6. If so, do you agree or disagree with it?
7. What are the overall benefits for you and the village as a whole from distributing this water?
8. What are the overall disadvantages for you and the village as a whole from the distributing the water?

Figure 4: Questions to well owners

1. Who owns the land and or the water (pump)?
2. Who runs the water business i.e. who sells the water?
3. How many liters are being sold per day? In summer / winter? (Or how many equivalent units → Truck loads, cubic meters etc.)
4. What is the price per liter or per unit? Summer / Winter?
5. Who determines the price?
6. What are the costs to run the well?
7. What types of cost are in place? Wages, maintenance, electricity etc.?
8. How are they split up?
9. If you are a farmer, how much money could make when using the water for irrigation purposes?
10. What is the profit from this business?
11. Do you know where the water is going?
12. Do you know the water prices in the city?

Figure 5: Questions to tanker operators

1. What price do you pay the local well owner for the water? Per liter, tanker?
2. Who sets the price to buy the water?
3. What prices do charge your customers?
4. Who sets the price?
5. How many liters do you sell per day? Week? Year?
6. Who owns the truck?
7. What are the costs to run the truck? (fuel, salary, wages)
8. How many competitors do you have?
9. How are they organized?
10. Do you compete with the official water board tankers?

Figure 6: Transcript of the initial interview with panchayat members of Bowrampet

TOTAL AREA OF THE VILLAGE:

LAND USE:

- Cultivated land (irrigated and non-irrigated)- 300 acres
 - Forests- Approx. 1500 acres
 - Water bodies: 1 big lake and 4 small ones. The big water body is around 100 hectares.
1. Number of households: 1200
 2. Caste distribution:
 - Other Castes – 40%
 - Backward Castes (Rajaka, Gouds, Mangali, Yadav, Mudiraj, Padmashali, Kummari, etc) – 50%
 - Scheduled Caste – 10%
 3. Total Population: 9000 individuals (5000 male and 4000 female)
 4. Occupation
 - Agriculture: 500-600 farmers
 - Laborer (agriculture): 600 individuals
 - Laborer (industries): 3000 individuals
 - Service: 1000 individuals
 - Home keepers/housewives): 2000 individuals
 - Not gainfully employed: 2500 individuals
 5. Agriculture- crops grown across the year- any changes over time and reasons

Current		10 years back		Reasons for change
Rabi	Kharif	Rabi	Kharif	
Vegetables	Paddy	Paddy	Paddy	Less rains, no water for agricultural activity

6. Primary Sources of water for drinking and other purposes

Source	Drinking	Cooking	Bathing and washing	Quality (G.A,P)
Panchayat supplied	Yes	Yes	Yes	Good
Bottled water	Yes	-	-	-
Personal pump set	-	-	-	-
Surface water	-	-	-	-
Rainwater Storage systems	-	-	-	-
Any other	-	-	-	-

Note: The bottled water is obtained by filtering the panchayat supplied water.

Before 5 years, everyone in the villages consumed panchayat supplied water for drinking needs. Now, the people in the village say that due to increase in the awareness regarding health and sanitation, people have started purchasing the bottled water. Also the price at which this water is sold out is affordable.

7. Households with piped connection inside the home:
Almost all the houses have pipe connections inside the home. Some households even have 2-3 connections.
8. Capacity of the panchayat storage:
The water demand for the village is met through bores. There are 6 bores in the village. The water from these bores is pumped into the storage tank at ground level. This tank has a capacity of 0.15 million liters. The water from this tank is pumped into Overhead Storage Tanks or OSTs. There are 4 OSTs in the village, each with a capacity of 0.1 million liters.
9. How much water is actually distributed to the village (approx. in liters):
The water from all the four OSTs is distributed to the village, which is approx. 0.4 million liters.
Summer: In summer, there is a 60% shortage in water supply.
Post-monsoon/winter: No shortage in these seasons.
10. What percentage of households is buying water?
Around 90%
11. Households with personal pump set:
Around 100 households
12. Frequency of water available (morning and evening)
There are 12 wards in the village. Each ward is supplied with water for an hour. The distribution of water is done from 5 AM to 10 PM.
13. Do agriculturalists sell water in Bowrampet?
Yes
14. How many pumps are operating now? Any seasonal changes?
Around 10-20 pump sets
15. Approximately, how many tanker companies?
Each pumpset caters to 4-5 tankers/day. Each tanker has a capacity of 5000 litres. In a day, around 35 tankers drain out the water from the village.
16. Basic village map (location of the settlement, location of the agricultural fields) and location of pumps if possible

Additional points covered:

- The people in the village relate to the fact that the depleting ground water is due increase in the number of apartments and other settlements. Also, due to decrease in the rainfall, there is a drop in the quantity of water resources, thus leading to over-exploitation of ground water resources

- Earlier, pump sets were laid at a depth of 100-200 ft. Now a day, people have to dig as deep as 500-1000 feet in order to lay a pump set.
- Presently Naandi Foundation maintains the water filtering unit. The maintenance cost for this unit is Rs. 15000 per month.
- Each can is sold at Rs. 2
- One can has a capacity of 20 litres

Figure 7: Summary of interviews with government tanker drivers and the chief engineer of the HMWS&SB

Conducted on January 11th, 2013.

As a part of the research, it was necessary to have a better understanding of the government's role in the water situation and what their feelings were towards the illegal private water tanker business. The first encounter with the government water tankers took place at a government tanker filling station inside of Hyderabad. After initially approaching the government water tanker drivers, within a few minutes, 15-20 drivers showed up willing to answer questions. The tanker drivers said that they believed there were around 900 government water tankers operating in total, filling up at 25-30 filling stations throughout Hyderabad. The tankers are all privately owned, but the owners paid 5000 Rs in order to register, have inspection, and if they passed, work as government tankers. The tanker owners are given between 8-10 trips everyday, no further than 5km in distance, and deliver their 5000 liter tankers for 400 Rs to residential consumers and 515 Rs to industry consumers. From that, the tanker owner receives 225 Rs to cover all his costs and his earnings, while the remainder goes to the water board. In order to prevent the tanker operators from delivering government water to someone other than the recipient, each delivery is assigned a number that the customer gives the tanker operator upon delivery. The number must then be relayed back to the government before their government assigned "ATM card" is recharged so that they can refill their tankers with water at the government water filling stations. The drivers said that they were able to make a living through this line of work and that they felt there was no competition with the private water tanker business because the private water tankers are not legal and do not have the permission to be conducting their business. After visiting with this group, a visit was made to the main office of the Hyderabad Metropolitan Water Supply & Sewerage Board. After much coaxing the head engineer agreed to have a meeting. He explained that there were currently 400-450 government water tankers operating. He continued to say that the water tankers are insignificant in relation to the volume of water the government supplies on a daily basis. Furthermore, these tankers were only used to deliver drinking water to cover areas where the piping infrastructure is insufficient or during emergency situations. By his calculations, 95% of the population in Hyderabad is served by government pipes, with only 100 areas, each with 25-30 families in need of water tanker delivery. He explained that about 5000 trips were made each day, and 20% of these trips were made to industries. His opinion on the thriving illegal water tank business was that they have no effect, nor were any competition to the government tanker business solely because their bore water was not used for drinking. In result, the government had no interest in regulating this illegal tanker business. According to him, their main focus is on the expansion of pipelines throughout the areas surrounding Hyderabad, and he explained that the water boards solution is to reach all those in need, eventually eliminating the need for tankers all together. Finally, his

personal opinion of the tanker business is that it gives those involved the ability to become corrupt and to have an opportunity to exploit others and to gain extra profit for themselves. He insinuated that those who ran private water tankers would even misuse droughts as a way of taking advantage. From the beginning of this project, it became quickly apparent that the water situation in Hyderabad is currently in poor condition. It is easy to conclude that the reason the private water tanker business exists and thrives so well is because the government is not able to provide sufficient water to a majority of the population, let alone 95%. The sheer volume of government tankers encountered in the field visits, the profit the government makes through them, and the thriving private tanker business lead to the conclusion that 400-450 operating tankers is much too small of an estimate. The chief engineer may feel that the tanker business is insignificant but the fact of the matter is that the amount of water that is being mined from the water table and sold for profit through the informal and formal market is both significant and alarming. Although the tanker business is fragmented and not well understood, it is nevertheless substantial and developing quickly.

	Owner 1	Owner 2	Owner 3	Owner 4	Owner 5
Boorampet	Padma Reddy	Tanker Driver/Little Guy (Lessee)	Ram Reddy	Madira (Driver)	Madira Charri
Intervener	Padma Reddy	Veena Reddy	Ram Reddy	Madira Charri	Madira Charri
Operator	Padma Reddy	Little Guy (Lessee)	Ram Reddy	Madira Charri	Madira Charri
Land (Acres)	Other Caste	Other Caste	Other Caste		
Agriculture	1	No competition	0		1 for 6 months
Leased	1		0		0
Water/Waste	2		1.5		0
Total	4	2	1.5		1
Wells/Bores	1000	1 or more	1		1
Depth (ft)	1000		150		120
Cost Drilling Well	100000		6750		1800
Cost Electricity	30000		7560		4500
Tanker Owner	Padma Reddy/Preshant Reddy (son)	G.S.R Water Supply	Ram Reddy	Madira Charri	Madira Charri
# of Tankers	2	2	1	3	2
# of Trips/Tanker/Day	14	10	6	5	Doesn't know
Tanker Size (liters)	8	6	6	10	6
Price Consumer/Tanker	5000	14000	5000	5000	5000
Costs (monthly)	Summer 700 Winter 300	625 3500	407 31950	500 20000 x 3	350 250
Maintenance	27222	35000	19500	31950	7500
Gas in Summer	59640	11700	11700	63900	4260
Gas in Winter	34880	9000	10000 x 3	10000 x 3	10650
Labor	8000 x 2				
Consumers	Residential Few factories	Dr. Reddy Foundation	Residential NTU 2 to 15	Residential NTU 2 to 15	Residential NTU 10 to 14
Delivery Distance (km)	Summer	6			14
Additional Tanker Income (monthly)	Winter				
Leasing Cost (6 months)					
Profit (monthly)			10000		Yes, a lot.
Competition	Common Committee insures no competition. Government water tanker cheaper but not cleaner preference to his	No competition. Many tankers deliver to Dr. Reddy Foundation, but they are organized and do not compete with one another. Government tankers also deliver to DRF. DRF has set different paths and delivery points for water to prevent illegal tankers and government tankers from crossing paths.	No competition	No competition	
Notes	Previously used land to raise maize when rains were good. Factory sends people with water bottle to test water and then orders. Originally bored 15 wells, only 3 were successful. 2 with water. Orders are taken through phone. Uses his own water to wash etc. Uses Mandi water for drinking, in the summer he will sometimes run out of water, in which case he will buy a tanker for 230 Rps from another well and sell it for 600 Rps.	LESOR: Leases land from land/pump owner for 6 months and is allowed to pump as much water as he wants during that period. TANK OWNER: Tank owner has a 6 month agreement with DRF for delivery of water. DRF decides price and changes price every 6 months. DRF does test the water but, does not charge for test. They only use it for washing, not drinking.	* Ram would charge an additional 50 Rps to deliver to University hostel because of the 15km drive. Contract with University. No test for quality. Water used for washing only, not drinking. 100,000 liter reservoir tank to hold extra water for his tankers. No agriculture because water is insufficient. Well owner decides the price of the water on his own. Owns land in another village but, there is no water under that land. Says that his profit on a monthly basis is 10,000 Rps.	Driver doesn't know price of deliveries because he only signs confirmation of delivery when he delivers tank. Money exchange is done between consumer and owner only. Two tankers only come to this well for water. Also delivers water to the local village Boorampet	Sets own price. On the spot payment when delivering to consumer.
Quotes	80,000 pays to the owner for 6-months contract				
Annual Sales	4,392,000	1,800,000	3,375,000	702,000	
Annual Costs	1,380,987	996,160	1,776,600	468,720	
Annual Profit	3,011,013	803,840	1,598,400	233,280	
Total Sales (monthly)	Summer 588,000 Winter 144,000	187,500 112,500	225,000 337,500	42,000 75,000	
Total Costs (monthly)	Summer 132,862 Winter 97,302	89,433 76,993	128,700 167,400	31,320 46,800	
Total Profit (monthly)	Summer 455,138 Winter 46,698	98,067 35,907	96,300 170,100	10,680 28,200	
Sales per Tanker (monthly)	Summer 294,000 Winter 72,000	187,500 112,500	75,000 112,500	21,000 37,500	
Costs per Tanker (monthly)	Summer 66,431 Winter 48,651	89,433 76,993	42,900 55,800	15,660 23,400	
Profit per Tanker (monthly)	Summer 227,569 Winter 23,349	98,067 35,907	32,100 56,700	5,340 14,100	
Monthly Pumped Water	Summer 4200000 Winter 2400000	Owner 2 4200000 2300000	Owner 3 2250000 4500000	Owner 4 600000 1800000	Owner 5 12000000 57000000

Figure 8: Excel Notes

Figure 10: Excel Notes 3

Interviewer	Driver	Chief Engineer at the Water Board	Govt. Tanker Owner	HMM&SB
Registration Fee	5000	5000	1,296,000,000	288,000,000
# of Tankers	900	400-450	945,000,000	
# of Trips/Tanker/Day	10	10	351,000,000	
Monthly Trips	Summer Winter Residential Commercial	8 8 4000 1000		24,000,000
Tanker Size (liters)	Residential Commercial	5000 400	108,000,000	108,000,000
Price Consumer/Tanker	Commercial Residential	400 515	78,750,000	78,750,000
Paid to Gov. Consumer/Tanker	Commercial Residential	175 290	29,250,000	29,250,000
Cost (Monthly)	Maintenance Gas Labor	10000 15000 10000	120,000 120,000 87,500	120,000 120,000 87,500
Consumers	Mainly residential	5	32,500	32,500
Delivery Distance (km)		5	32,500	
Profit (monthly)		35000	1,350,000,000	750,000,000
Competition	No Competition	No Competition with informal tankers, since the private tanker operator don't have the permission. 25-30 filling stations within Hyderabad.		
Notes		Tankers are for emergency (pollution) only or areas where the infrastructure is insufficient. Sources are: Osman Sagar, Krishna River, Manjira River. 95% of the city water supply are served by pipes.		
			Monthly Delivered Water by Tanker	
			Summer	1,350,000,000
			Winter	750,000,000