

# Our Aqua, Our Life

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*Understanding the water we use*

**Prakriya Green Wisdom School**

**Anchor/writing group: Anusha Gupta, Megha Ramachandra**

**Research group: Apoorva Nag, Vasundhara Agarwal**

**Data collection: Ananya Iyer, Kabir Madaan, Savni Kodhilkar**

## Note to the Earthian Group

The total numbers of students who are participating in the Wipro Earthian 2013 from Prakriya Green Wisdom School is 22. We were divided into 3 vertical groups. For the data collection for activities listed under Section A, we also divided ourselves into three horizontal groups (these horizontal groups had a mix of students from the 3 main groups). These horizontal groups worked on data collection/experiments for Water Demand, Water Quality and Water Trail. The data collected was analyzed and findings were shared across all the three vertical groups. Thus, the figures for water trail and demand for water in the school and the experiments done for water quality are identical for all three groups.

However, each vertical group worked independently on the following:

- The analysis and interpretation of data collected
- Conclusions based on their findings/analysis required for Essay 1 (Section B).
- Linking of their findings to the macro theme for Essay 2 (Section B).

Since we don't have a water meter, for some of the activities listed in the activities booklet, we interviewed multiple sources and arrived at our own estimations. We interviewed

- Founder trustee of the school
- Campus manager
- Garden coordinator
- Gardener
- Water pump operator.



## Part B - Essay 1

*“Water is the driving force of all nature.”*

*Leonardo Da Vinci*

**No** one can argue that water is one of the most important requirements of life on earth. Life started in the sea and later migrated onto land. 70% of the Earth is covered with the ocean- though this water is unfit for human consumption; it serves as the greatest reservoir for water vapor, which keeps hydrological cycle in motion thereby sustaining life.

This project required us to understand and take stock of the water demand, water trail and water quality in our school.

### Water demand

The table below contains the measurements recorded through our study.

**Table 1: School water demand**

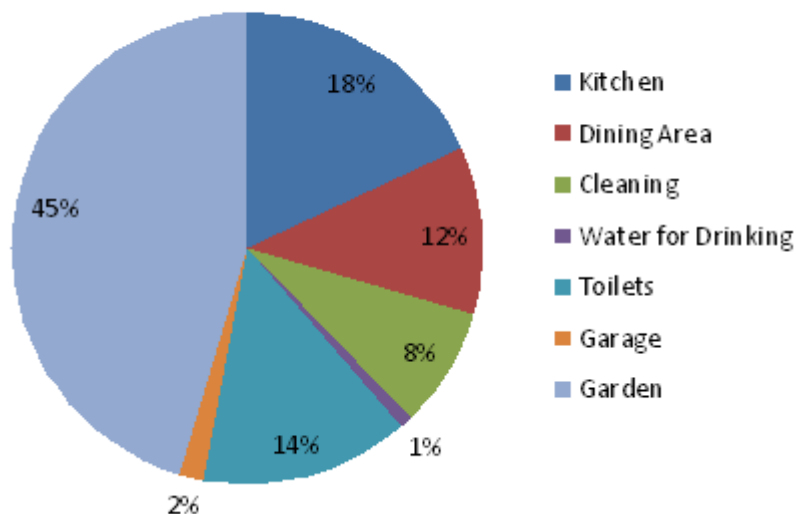
**Total amount of water used per working day at different End Use locations  
( in liters)**

End Use Location	Amount (litres)	%
Kitchen	4,010	18%
Dining Area	2,553	12%
Cleaning	1,860	8%
Water for Drinking	190	1%
Toilets	3,185	14%
Garage	360	2%
Garden	10,100	45%
Grand Total	22,258	100%



If we account for loss due to leakages, the usage numbers would increase by 66 % per working day.

Fig 1: percentage of water used at end locations



It is interesting to see that though 200 liters are used as drinking water every working day, it forms only 1% of the total water usage. It is also to be noted that 45% of our water demand is for the garden. At first glance, it might appear that our garden uses up too much water, but there is a reason behind it. The garden in our school mainly grows fruits and vegetables. We children work in the garden and each class has a pre-assigned plot. The fruits and vegetables grown are given to the canteen. Thus, it forms water → food cycle of sorts within the school.

### Water trail



We then identified the school's water trail- the entry and exit of the water and where it goes in between. Our school gets water from these two different sources:

Source	Total Qty (in litres)
Borewell	18,600**
Rainwater (six – eight months)	7000
Grand Total	25,600

\*\*Kitchen & dining area uses up about 6500 li/day . 80% of the water from here is recycled  
So total waste water recycled per day is 5200

However, the above mentioned quantities are not constant. They change with changing seasons. For example, rainwater is more abundant during monsoon, lesser during summer and most scarce during winter. The demand may also change according to the requirements of different events in the school. For example, more water is required during the “Habbas” (annual day)/ Sports day and less when only teachers come to school.

We made the following observations during the course of this activity:

- We are **NOT** dependent on municipal water or tankers.
- We harvest rain water and
- We recycle the waste water generated in the dining area/kitchen

We were intrigued by the idea of rain water potential and we set to calculate the potential of various locations in the school to harvest rain water. Given below is a table that lists our recording.

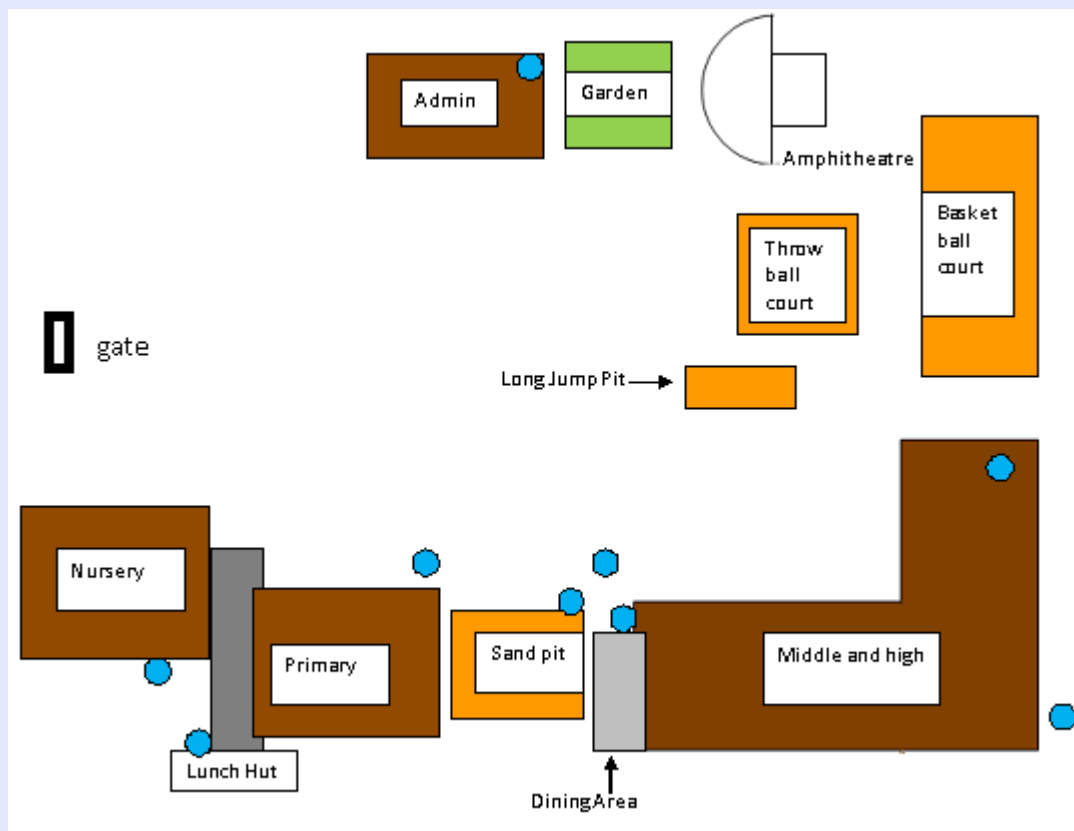


**Table 3: Rain water potential data**

Type of surface	Location	Total Area (sq.m)	Runoff coefficient	Annual rainfall for the region (cm)	Potential for harvesting (kilo lit)
Concrete roof	Admin, Nursery, Primary, Middle and High	2795	0.9	0.8	2012
Hard (Paved areas)	Football field, Basket	2897	0.4	0.8	927
Soft	remaining school	10,964	0.4	0.8	3508
Wooded area	Devarkadu, long jump	1080	0.2	0.8	173
Hard & soft	Amphitheatre	475	0.6	0.8	228
<b>Total</b>					<b>6849</b>

Consider the following data:

- Annual rainfall endowment for our school region: 800mm
- Rainwater Potential: 6849 KI
- Currently harvesting: 1260 KI
- Capacity of the recharge pit: 618 KI.



At first glance, it would seem that we are not harvesting enough rain water. If we take a closer look, we can identify some of the linkages-

1. 27% of the school's water requirement is met due to rain water harvesting.
2. Rain water run-off collects in the recharge pit which in turn, replenishes the underground aquifers.
3. The recharge pit in our observations hasn't overflowed till date. This implies that we are to a large extent catching every other drop that falls on the ground.

### Waste water Recycle:

The waste water from the school's dining area/kitchen contains organic matter. Since we use soapnut for cleaning purposes, we are able to easily recycle water with basic filtration methods. (Refer to appendix 1: Section B)

The recycled water contains salts, organic matter and bacteria. However, this can still be used for plants. Hence it is directed to the organic garden.

The waste water we produce from the toilets and from general cleaning is not recycled. This goes into the septic tanks. The table below shows the amount of non-recyclable waste water generated per day.

**Table 4: amount of non-recyclable waste water generated per day**

Toilets	2,679 l
Cleaning	1,848 l
Total	4,527l

After the first two activities, we were pleased with these observations-

- 80% of the water used in the kitchen/dining area is recycled back into the garden
- No waste water leaves the campus, thus, this way we are doing our bit not to turn Bangalore into a garbage city.
- We have put in place water sustainable practices.
- One area of concern is that our main source of water supply is the bore well. If and when our bore well runs dry, we may have to rely on water tankers like thousands in Bangalore.
- Our water supply will soon reach a dangerous low as the demand in Chikkanayakanahalli will go up due to the visible construction boom over the past few years.



According to the 2006 UN Human Development Report, an average Indian uses about 130 liters of water a day, with the rural population using even lesser. Even if one apartment complex were to come up housing two hundred people, the total water requirement would shoot up exponentially, thus dipping into the water table. Our borewell, as well as the ones in the villages nearby would run the risk of running dry in the immediate future. As Mahatma Gandhi once said, “The earth provides enough to satisfy every man’s need, but not every man’s greed.”

### **Water quality**

To know about the quality of the water we use for various purposes, we started by collecting samples:-pond water, tap water, drinking water, recycled water and rain water

**Table 5: water quality**



Parameters	Recycled waste water	Rain water	Drinking water	Tap water	Pond water
Colour	Grayish black	Mostly clear	Clear	Clear	Muddy
Odour	Pungent stinky odour	odourless	Odourless	odourless	odourless
Turbidity	Very turbid	Slightly turbid	Clear	Clear	Slightly turbid
Suspended solids	Suspended organic matter like food grains and leaves	Few suspended matter like mud and dirt	None	none	Dirt, leaves, living matter like worms and tadpoles
Temperature					23-24 room temperature
Ph.	8	7	7	7	6

Our first step was to perform the basic purification processes of sedimentation, decantation and filtration. The results are as follows:

#### Pond water

The Prakriya school pond is a manmade pond and was made in the year 2005.

- alum PH=5.5
- After coagulation , suspended solids have settled



- Cleaner water, most suspended particles have been removed after filtration

### Black water

- sedimentation-Left untouched for almost two weeks
- mostly clear with a few suspended particles and no odour after decantation
- New ph.- 8.5

### Tap water

- Fluorine testing -Turned pink indicating fluorine- 0.6 mg
- Residual chlorine- No chlorine in the tap water or drinking water because they are both bore well water
- Test for hardness- 400 mg/l

In the last few years, there have been many cases of extremely high fluorine levels in Karnataka. The Department of Mines and Geology has recorded fluoride as high as 5.54 mg/l in bore well water in Bellandur while the permissible limit for human consumption is 1.5 mg/l. Bore wells in Uttarahalli come a close second with 5.06 mg/l of fluoride.

It was reassuring to know that the fluorine levels in the water we use are well below the permissible limit.

To sum up:

1. We use the bore well water for a majority of our activities. The recycled water goes to the garden and the rain water is used throughout the school. The rain water is not acidic, but neutral in its pH value.
2. Our school is quite prudent in its water usage as we have rain water as well as the waste water being recycled. We also have a recharge pit at the end of our school. The lie of the land is such that most of the rain water runoff flows into the pit. The pit can approximately hold about 618 Kl of water. So this way, even though we do not have many roof top spaces to recycle the rain water, majority of the water that falls on the ground goes to recharge the underground water table.
3. We do not have any lawns or swimming pools which are major guzzlers of water. However, we can still do better in conserving water. When it



rains heavily some of the storage tanks overflow and water is lost. Increasing the storage capacity would be beneficial.

4. It is true that we are not only consuming but also giving back the Earth's water. The Question is how much? We are giving water back to the earth, but are we taking more than the giving? But then the question arises, what *can* be done? We are using water prudently to a large extent.

All said and done, we feel our school is a green school which uses water wisely.



## Part B- Essay 2

# Water equity

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*“The wars of this century were fought over oil; the wars of the next century will be fought over water.”*

This quote by the Vice President of the World Bank, Ismail Serageldin holds true but these wars are closer than we imagine. They are not a thing of the next century but of this one. They surround us, although they are not always recognizable as water wars. It is expected that there will be more and more conflicts over how we perceive and experience water. The headlines are replete with examples of such conflicts: inter-state, inter-sector, inter-country over equitable access to water.

Are conflicts over water real or imagined? If they are real, what is the root cause of the water scarcity? Water scarcity is estimated to affect 56 countries by the year 2025. When water availability per person drops below 500 cubic meters, life’s survival is grievously compromised.

Table 1 – water availability per capita

The year	The amount of water available per person annually in cubic meter.
1951	3,450
1990	1,250
2050	760

Source: water: sustainable and efficient use.

According to the July 23rd 2008 issue of the Scientific American magazine (‘Facing the Freshwater Crisis by Peter Rogers on pg 26 to 29), there is enough freshwater to satisfy all our needs. Then where is the scarcity? Or is the real problem, the mismanagement of this water? Geographically, some places are endowed with more water than others. India is a very good example of this. Given the fact that India is one of the well-endowed nations in the world in



terms of average annual rainfall, there is no reason why it should face water scarcity.

We wanted to explore this paradox of “scarcity amidst plenty” in our essay. Water scarcity and inequities are vast topics. So before we aim to understand any of them, we decided to start small and observe the most common inequity we see in our everyday life- the urban and rural divide.

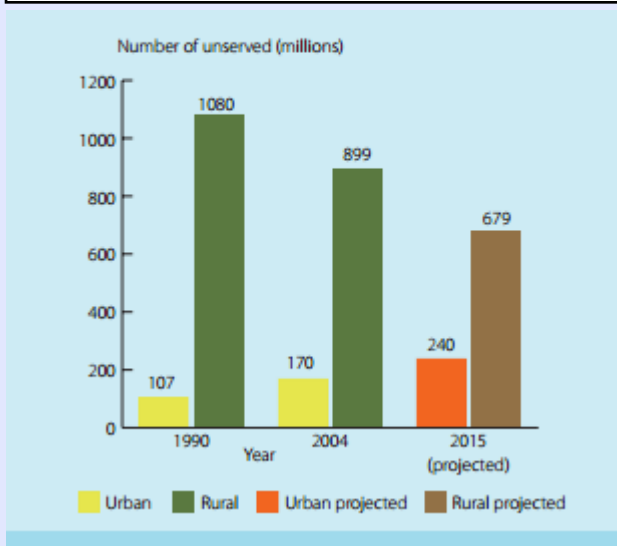
**1. The Rural-Urban Inequity in accessibility to water:**

**in Crores.**

	2001	2011
India	102.9	121.0
Rural	74.3	83.3
Urban	28.6	37.7

Source: Government of India, Census Bureau 2011.

**Figure 1: Global population (in millions) without access to improved sources of drinking water – urban and rural.**



Source: Government of India, Census Bureau 2011.

As the table clearly indicates, there is a rural-urban divide in terms of figures. What is not visible is the division along the lines of income in both rural and urban settings. We visited the Gattihalli village near our school to get firsthand information.



In the village, it is a common practice for the residents to draw water from the borewells provided by the Gram Panchayat. Water is supplied from 7:00 to 8:30 in the morning and 5:00 to 8:00 in the evenings. For the residents of the village, this is the only source of water. The water is provided free of cost by the local Panchayat. During times of water shortages, they borrow water from their neighbors or take it from one of the few tanks situated at regular intervals in the village.

The table below shows the accessibility to water to a large extent depends not only on whether one lives in rural or urban areas but also to which income group one belongs. Gattihalli village is just one of the thousands that make up the 68% of rural households that face inadequate accessibility to water.

**Table 3- Water consumption  
pattern in Gattihalli village\*\***



Parameters	Household #1- middle income group	Household # 2- high income group	Household # 3- low income group
No. of people	5	5	3
No. of pots they can collect water in	20	35	10
Water per capita used	60l	105l	50l
Requirement (no. of pots)	30	Enough	40
Is it enough?	Most of the time, yes	Yes	Never
Do they have a bathroom?	Yes	Yes	No
Do they have taps?	No	Yes	No
Source of drinking water	Bore well	Bottled water	Bore well
Are they in a rented house? How they manage	No Priority is to cook food and have bath. Washing of clothes happens on alternate days. Children bathe and vessel washed during the time water is supplied.	No They can get tank water. If there is no water, they don't face a problem Use 20l for drinking water for a period of 4-5 days.	Yes 1 bucket - three people have a bath. They have to use someone else's bathroom. Have less pots and live farther away from the bore well. Hence, collect less water.
What they say about water	"If I have no water, I can't run the household. Part of me is not complete if I don't fill water in the mornings."	"I certainly cannot live without water but I can order a tanker in times of great crisis."	"Every day is a new challenge to get water. The fear of not having water is always there at the back of my mind. Whenever I hear the word water, I want to drink it as I rarely get to drink water to my heart's content."

\*\* Not statistically validated



**Table 4 – Water consumption pattern in Bangalore\*\***

<u>Parameters</u>	<u>House 1</u>	<u>House 2</u>
No. of people living in the house	3	2
No. of bedrooms and bathrooms	4, 3	3, 2
How is the drinking water purified?	Water purifier	Water purifier
Our source of water	Bore well, Kaveri water pipe	Bore well, tankers
Water used on an average in one month	n/a	n/a
Per capita of water used per day	200li	185l
What they say about water	“I have water for my shower every day... that’s all I care about. Yeah I know I have to save water. I will...”	“Yeah.... What about it?”

\*\* Not statistically validated

An urban-middle class household may use more water than their counterparts in the rural area. There is a difference in the quality of drinking water used as well. Drinking borewell water directly is unimaginable for many of us. Why is there such a vast difference?

Sonya Fatah writes on globalpost.com, “In Kathputli Colony water trickles into the sprawling slum through a collection of thin pipes and hoses. They snake across potholed roads lined by open sewers, where children in ragged clothes beg amid the stench of feces and urine carrying an illegal water supply to the people who live there.....Not far away, water soaks the sprawling green lawns



of beautiful bungalows where corporate elites practice putting on well-watered golf greens all to the constant sound of ticking sprinklers..”

The question we were left asking is: Is this inequity due to poor governance, misdirected and inefficient policies and a mindset which does not allow us to see the part of the ‘whole?’

“Over the last 100 years or so, the world and India, too, have seen two major shifts in water management. One is that individuals and communities have steadily given over their role of collecting water almost completely to the state even though more than 150 years ago, no government anywhere in the world, provided water. Second is that, the simple technology of using rainwater has declined and in its place, exploitation of rivers and ground water through dams and tube wells has become the key source of water.”

Source: Making Water everybody’s Business

Does the answer for the question we asked before, lie in individuals and communities or are abdicating our responsibilities to the State?

Inequity in accessibility to water plays out in increasing gender inequities. There is an unsaid story behind the figures given in the following table.



**Table 5: Source of Household Drinking Water**

Percentage of Households Receiving their Drinking Water from each source

Source of water	Urban	Rural
Pipes in houses	32.0%	3.7%
Pipes to yard/plot	18.0%	7.5%
Public tap	19.0%	13.7%
Tube well/bore	23.0%	56.0%
Protected well	2.0%	2.6%
Protected spring	0.1%	0.3%
Rainwater	0.0%	0.2%
Unprotected well	2.8%	12.6%
Bottled water	0.7%	0.1%
Others	2.5%	3.0%
Total	100%	100%

*Source: National Family Health Survey, 2006*

As seen in the table above, only 4% of rural households have piped water supply. More than half (56%) rely on tube wells or bore wells for water. This means that the water has to be fetched, and the duty of provision of water falls on women. Here are some facts:

- Indian women make up to six trips a day to gather and transport water. These walks in rural regions can average ten miles a day, carrying up to fifteen liters every trip.



- Total distance travelled is 9-10 km, forcing women to search well beyond their homes.
- Total Time spent is 6-9 hours
- **The time lost in fetching water means loss of productive hours for these women. This cost of fetching water is almost equivalent to 150 million women days each year which in turn translates into a whopping loss of 10 billion rupees per year.**
- The entire life of women in rural areas like Jaisalmer is spent on water collection and cooking. Even the girls of 8-10 years cannot be spared.
- The following poem Her Head by Joan Murray poignantly conveys the hardships a woman faces just to provide a basic necessity, water...

“The engineers have reversed the river:

Those with power can keep their power,

But one woman is carrying water on her head.

In the homelands, where the dusty crowds

Watch the empty roads for water trucks,

One woman trusts herself with treasure,

And carries water on her head.”

Besides, the rural-urban, low income-high income divisions, we as a nation are also divided along the lines of religion and caste. We wanted to explore how this impacted accessibility to water. We had difficulty obtaining accurate data on this sub-topic but gathered inputs by interviewing people and reading newspaper reports.

Our findings are listed below.

- In metropolitan cities division along religion/caste may not be apparent. However, there might be another story to tell. It has been observed that the slum dwellers beg for water during summer and most of them belong to the lower caste. One or two sources said that Muslims were given the last opportunity to collect water and usually people from higher caste were allowed to go first. Source: primary interview conducted.



- A Dalit woman in the Pikirali village was allegedly beaten up by members of the upper caste for drawing potable water from a government-dug deep tube well in their area at a village in Odisha. The upper caste groups said that Dalits were not allowed to draw water from their wells. The sole tube well in the Dalit Sahi area, which served about 10 Dalit families, had been lying defunct since last month. The poor families were forced to use polluted water from a pond nearby. Source: NDTV September 5, 2013

**Table 6 – Voices about religion/castes – water accessibility**

Name	Region of India they are from	Have they experience or heard about water accessibility linked to religion/caste?
Anjana	Delhi	Never seen or heard about it directly
Anju	Haryana	Seen it in villages as a child. Discrimination on the basis of caste was prevalent, people belonging to lower castes did not venture anywhere close to the upper caste well
Shikha	Kanpur	Heard about it from grandparents, but never seen it in person
Bhagyashree	Dharwad, south India	Never seen it in person, heard about it from parents
Harish	Andhra Pradesh, south India	Seen it in a minor form; in his village, different points along the river belonged to different people- first the washer men, then upper castes and lower castes were last

*Source: primary interview conducted*

The issues of water inequity we have discussed so far, though complex fall within the scope of governance and management at a local/community level. With more and more countries joining in the race for development, water inequity has taken yet another ominous form. Water privatization of today is akin to the colonization mindset of the yesteryears.

## 2. Commodification of water



The World Bank gives partial and complete privatization rights over water. Major Multinational companies are tapping into the ground water of the locals and are depriving them of the water which is rightfully theirs. Take for instance, (The Economist (Aug 27, 2008) states)the five big food and beverage companies -- Nestle, Unilever, Coca-Cola, Anheuser-Busch and Danone -- consume almost 575 billion liters of water a year, enough to satisfy the daily water needs of every person on the planet.

This is the epitome of water inequity.

They are taking our own water and giving it back to us, charging high prices. It can be compared to the British as they were doing the same when they were colonizing countries. As they say, history repeats itself. And in this could lay the seeds for a movement for water democracy!

Of the above mentioned companies, we decided to study how policies favor these companies. Large multinational beverage companies are usually given water-well privileges (and even tax breaks) over citizens because they create jobs. These companies exploit water, leaving the public to suffer. The MNC's rights over water impacts water inequity in two ways

1. We end up paying for a resources that rightly belongs to us
2. They widen the rural-urban divide by taking away water from the rural areas and making it available to the urban areas.

### Conclusion

In the beginning of our paper, we talked about how women in villages, have to walk a minimum of 6 km to fetch water. In the latter half, we discussed how water is being monopolized and commoditized. Isn't it ironic? Water is a gift of nature and access to it is a fundamental right of all living beings. How can we let this inequity persist?

This inequity, we realized has many hues and shades. It surprised us that our water bills do not reflect the amount of water consumed, but shows the amount of money you owe for using it. So as long as you can afford to pay, you can continue to use water. Does this lead to our indifference towards water?



Another aspect of the inequity that caught our attention is that in some apartments, the amount you pay for the water is predetermined depending on the type of house you live in. How do people then know how much water they are consuming and therefore become water prudent? When one puts a price tag on water, it not only becomes expensive but also a limited commodity.

**Figure 2: An apartment's water bill**

**Century Galaxy Developers Ltd**  
# L-03 Diamond District,, Kodihalli, Airport Road,, Bangalore-560 008

POWER CHARGES					
NAME		BILL NO	5514/13-14	RR NO	3692818
FLAT No		TARIFF	HT	LEDGER/FOLIO No	
BILLING MONTH		UNITS	RATE Rs.	AMOUNT Rs.	
October					
BILLING DATE					
29-Oct-2013					
DUE DATE					
10-Nov-2013					
READING DATE					
25-Oct-2013					
SANCTIONED LOAD					
3					
C.T.RATIO					
PREVIOUS					
33,643					
PRESENT READING					
33,960					
UNITS CONSUMED					
317					
	FIXED CHARGES (KVA)	3	100.00	300.00	
	ENERGY CHARGES	317	4.90	1,553.00	
	<b>BILL AMOUNT</b>			<b>1,853.00</b>	
	TAX(6%)			111.00	
	ARREARS / ADVANCE				
	INTEREST				
	SERVICE CHARGES			75.00	
	AMOUNT-POWER		A	2,039.00	
	AMOUNT-WATER		B	500.00	
	<b>TOTAL AMOUNT DUE</b>		<b>A + B</b>	<b>2,539.00</b>	


  

ENERGY CHARGES			
RATE/UNIT	4.90		
FIXED CHARGES	100.00/KVA		

WATER CHARGES			
APARTMENT	OWN-ER	TENE-NT	SERV-ICE APTS.
2 BEDROOM	400.00	500.00	600.00
3 BEDROOM	500.00	600.00	700.00
PENT HOUSE	600.00	700.00	800.00

ISSUING AUTHORITY	
	

**IMPORTANT INSTRUCTIONS**

- \* Cheque/Draft shall be drawn in favour of **CENTURY GALAXY DEVELOPERS LTD.**
- \* Bill is to be paid in full **L-03 Office, Diamond District** No part payment will be accepted
- \* Any old dues/shortfall/arrears/increase in tariff towards supply of power to the complex shall be proportionately charged to all flat owners/office users.

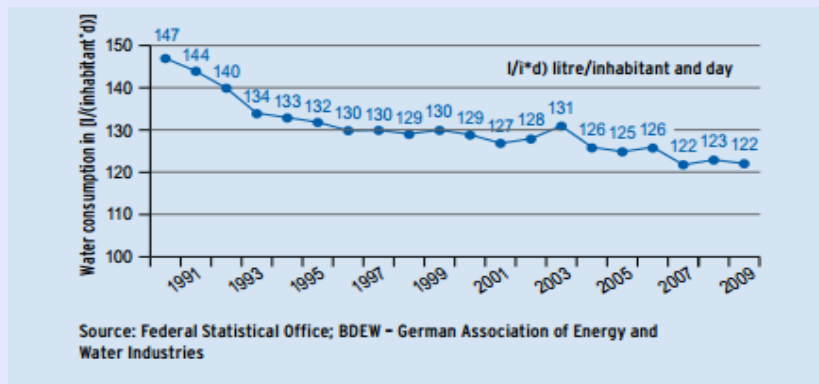
Source: Waterbill from a student's household

So, what is the solution?

- One of the solutions that occur to us is that we need to develop a system in which people are billed for the amount of water that leaves their homes. This builds a certain consciousness in the water usage pattern. This system has proved effective in countries like Germany. The way Germany has managed its resources is something that we can learn from.

**Figure 3: Individual water consumption**





- A similar system needs to be developed to make companies water prudent and water accountable as well. One needs to go

beyond the argument that these companies provide jobs for millions. If companies over-exploit water, the very existence of humans will be under threat. What is the point of giving people jobs when their existence is in question? Isn't it better to shut down a few companies if it means we could save the world?

- Historically, any kind of inequity if not addressed at the right time has led to social unrest. These unrests most of the time result in violent protests.
  - In Bolivia, Bechtel on purchasing the water system, raised the prices of water by 35%. The water now became affordable to only a few. This was met with violent protests.
  - In India we have the long ongoing conflict between Karnataka and Tamil Nadu over the issue of sharing Cauvery water.
  - The most recent example is the territorial and political dispute arising between India and China over the sharing of the Brahmaputra's water.

In view of the water crisis compounded by water inequity we are facing today, it is high time we as a nation become water-prudent and water-accountable. The way forward is to revive traditional practices where community participation and ownership was ensured. This needs to be combined with a secular outlook grounded in the principle that water is **commons**. The right to water is fundamental and water ought to be everybody's business.

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