

The ground beneath our feet: A Borewell Primer



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This is what an open
well looks like



This is what an open well looks like



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This is what a
borewell looks like

What is a borewell?

- The borewell is perhaps the most common source of water in urban India.
- Borewells are manmade wells dug deep into the ground to tap into water-bearing soil or rock layers termed aquifers.
- They typically draw water from “confined deep aquifers”, i.e., rock layers deep underground, where water is trapped under pressure between the cracks of rocks and are formed over many years, sometimes even centuries, due to water percolating down the rock layers.
- India has over 30 million borewells!

History of borewells in India

- India is the largest user of groundwater – primarily through borewell extraction.
- This was not always the case. Open wells used to be the norm till around the 1970s when borewell technology arrived in India, when UNICEF brought borewell rigs to help deal with water shortage. India's first borewell rig, brought by UNICEF, [is still preserved](#) in Pune.
- By late 1970s, borewells started replacing open wells. They became popular in cities because of the perception that borewell water was cleaner and would be available even during summers.
- They however spurred a culture of exploiting water as borewells make groundwater “invisible”. As borewells dried up, deeper ones were dug. Some even go down to 1800 feet, but as you go deeper, the risks of chemical contamination increase.

When the water runs out,
we dig deeper. Here, a
borewell inside a dry open
well (the borewell went dry
too).

Borewells in Bangalore



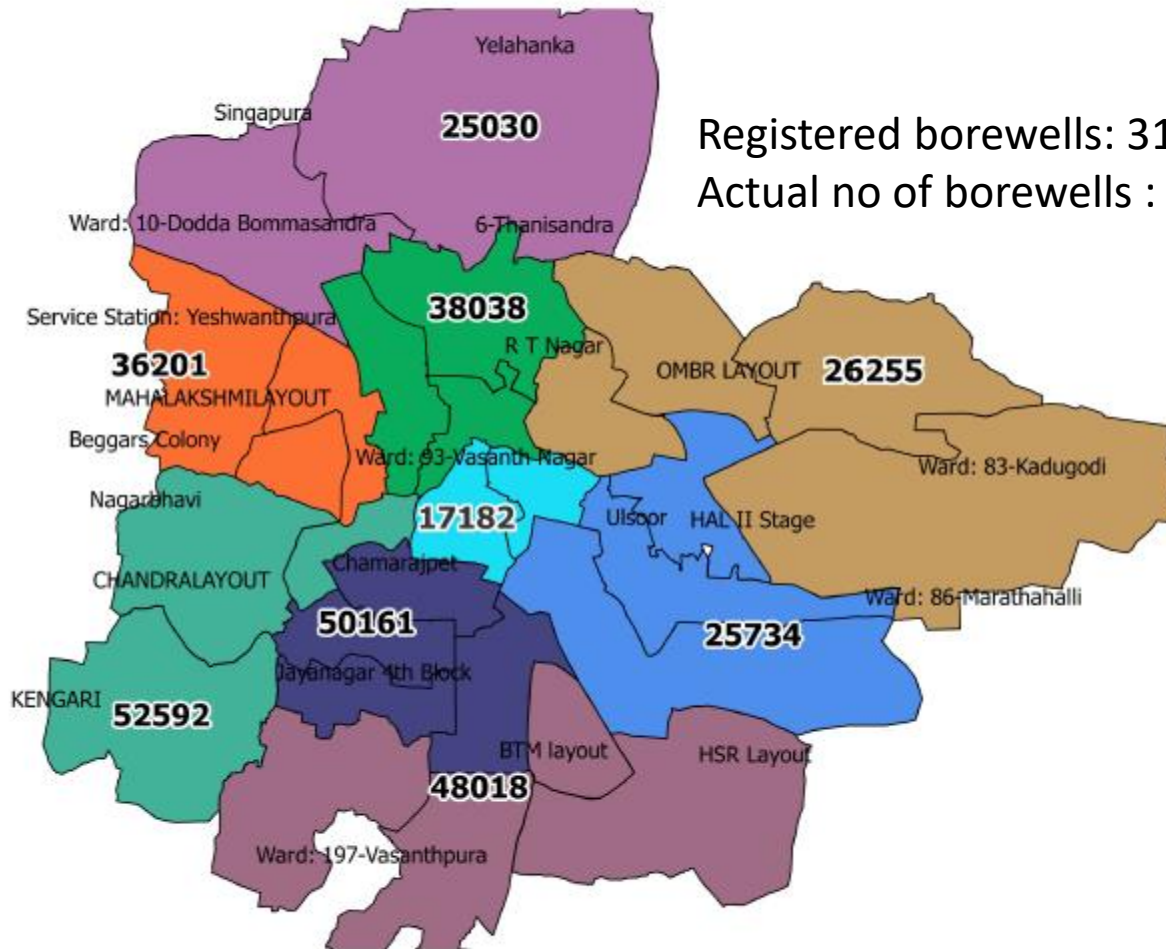
Groundwater and borewells in Bangalore

- The Central Ground Water Board (CGWB) has categorised many parts of India as having overexploited their groundwater resources, because of high numbers of borewells in use.
- Wells in these areas are supposed to be registered and regulated. Bangalore falls in this category.
- As of 2011, over half of the city's water demand was being met by borewells,
- Borewells contributed to 585 MLD, out of the city's total water demand of 1125 MLD.
- As water demand continues to shoot up, reliance on borewells is only going to increase.



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Distribution of Borewells in Bangalore



Total number of Borewells
registered (July 2016)
- 319211

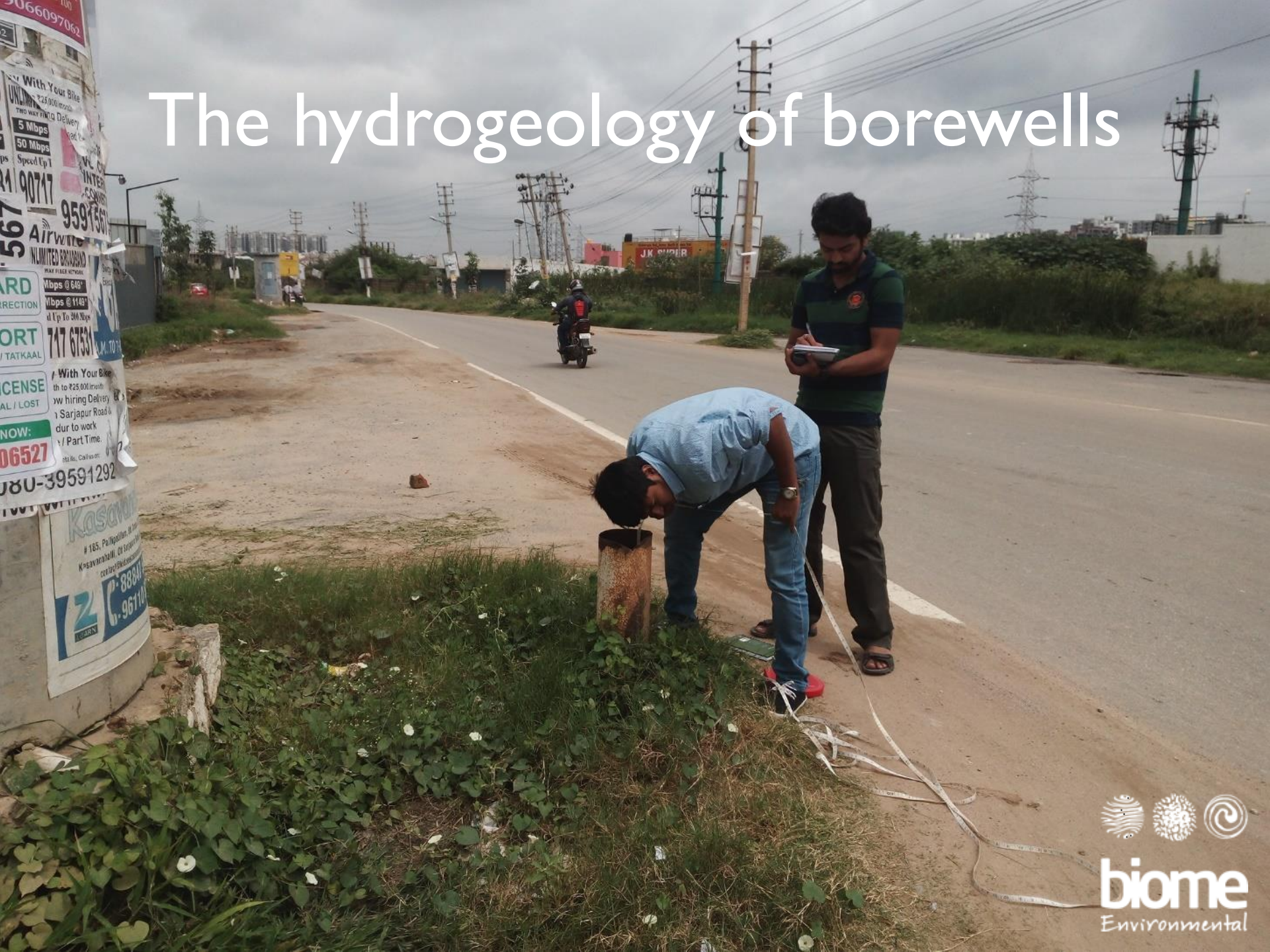
BWSSB Divisions

- Central
- East
- North
- North East
- North West
- South
- South West
- South East
- West

0.025 0 0.025 0.05 0.075 0.1 m



The hydrogeology of borewells



Water within the borewell how does it flow?

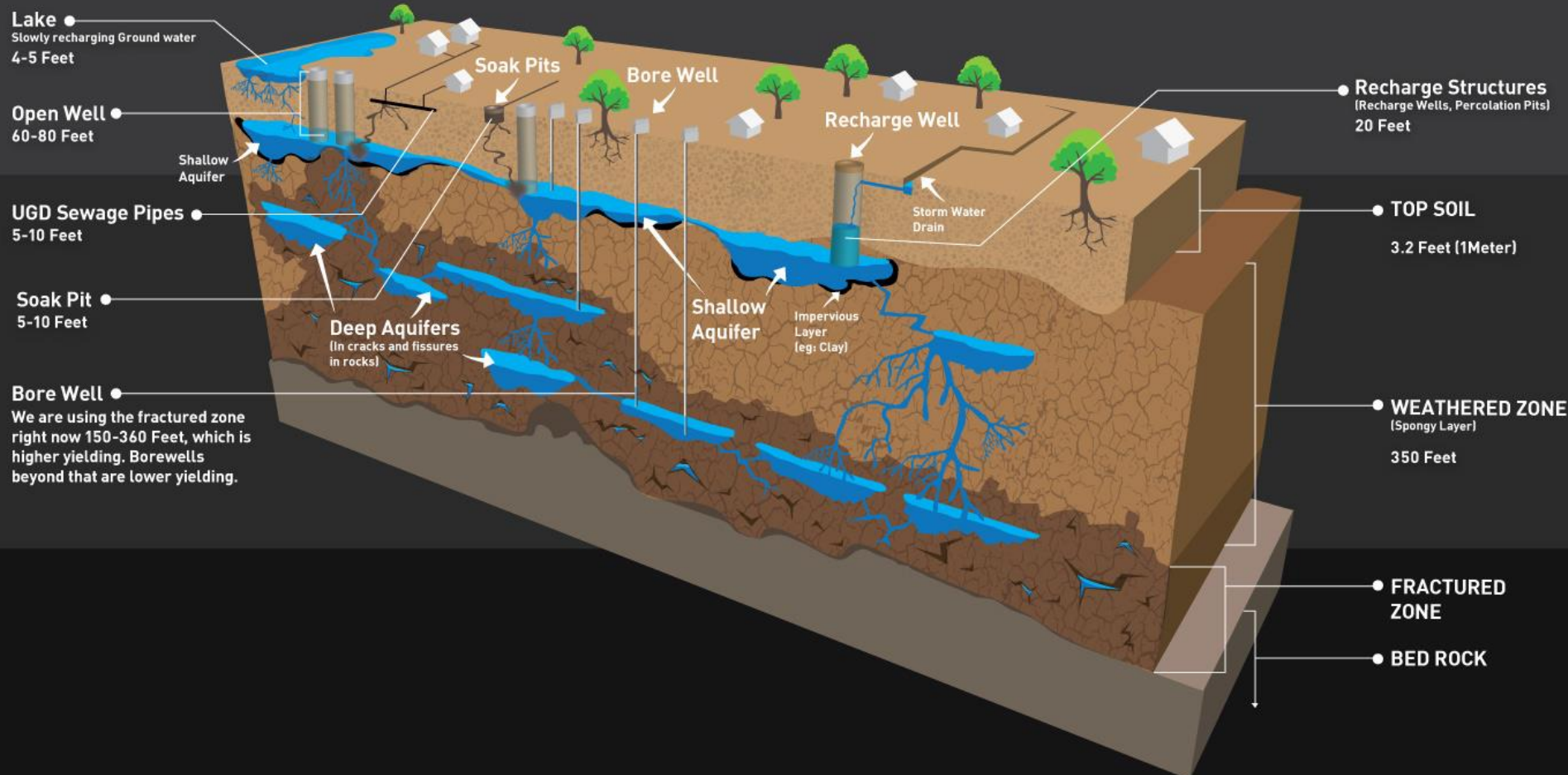
- Rock layers at great depths are usually less permeable, and cannot soak up water. Thus water stays trapped in cracks, surrounded by rocks under pressure.
- When a borewell is dug, such water-bearing cracks are struck at various depths, and water juts out at high pressure into the borehole. This causes a sudden rise in water level in the borehole. The level gets stabilised over time; this stable level is called the static water level of the borewell.
- As the depth increases, the rock becomes even less permeable and the number of cracks decrease reducing the chance of finding water.

Groundwater : Wells & Borewells

Bengaluru's Geology and Ground Water

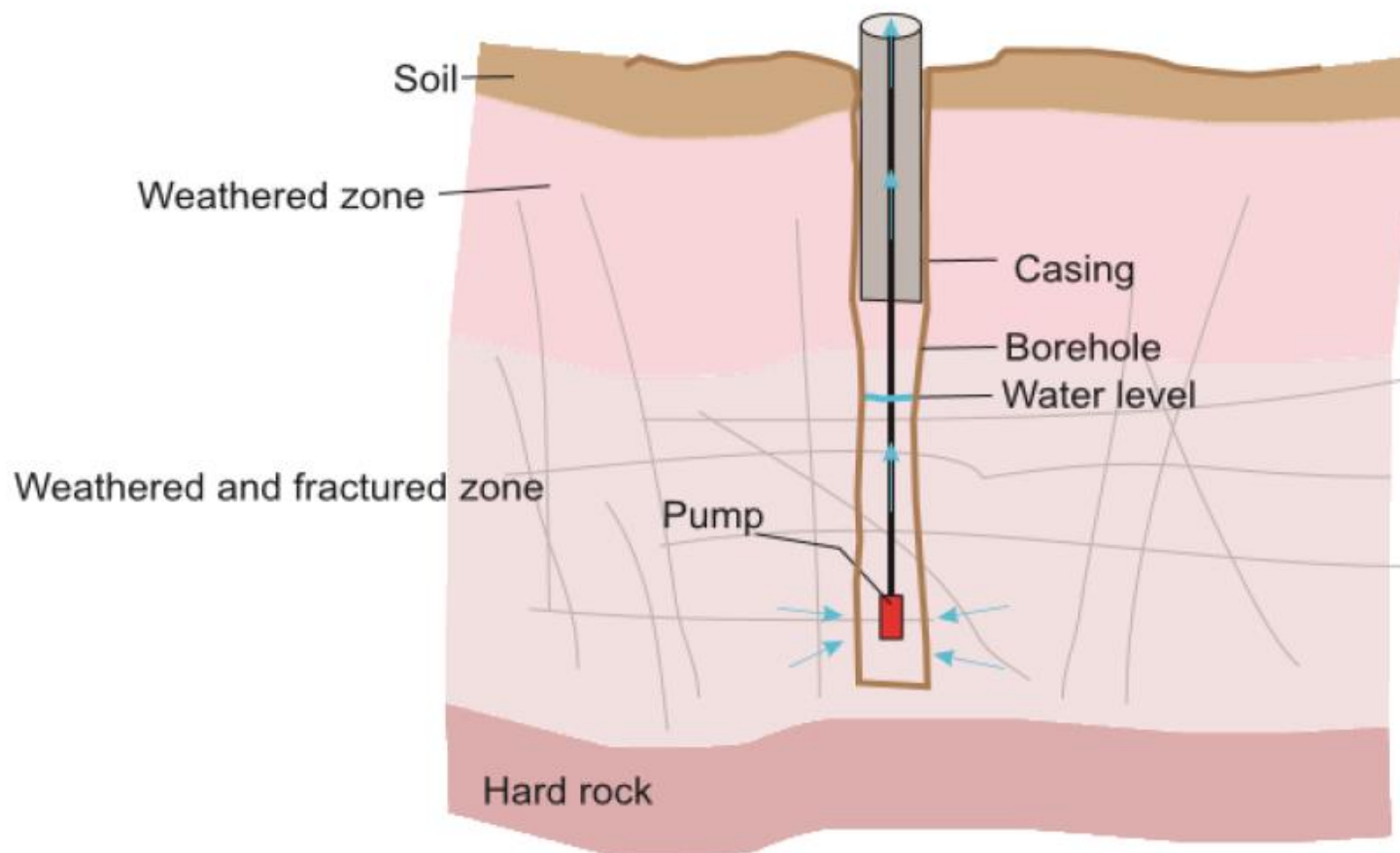


Save. Harvest.
Recycle. Refresh.



Inside a Borewell

(Youtube clip: Channel Zenrainman , Borewell – workings, fissures and water in hard rock)



Ask for Borewell logs : See FAQ in <http://groundwaters.in>

Inside a borewell – a camera inspection

- <https://www.youtube.com/watch?v=6IVTPhsvp38>



Borewell - Workings, fissures and water in hard rock

92,533 views

👍 73 💬 17 ➡ SHARE ⋮

Digging, using, maintaining borewells



How do I dig a borewell?

- Use a registered borewell drilling company
- Understand and comply with the groundwater rules in your area
- Understand your local hydrogeology
- Get the right equipment
- Take help from professional borewell diggers

How to dig a borewell 2/2

- Borewells usually have casings, to prevent the borehole from collapsing. The casing pipe is made of galvanised iron or PVC, and part of it would be visible above the ground. It is installed till the depth at which hard rock layer starts, and is usually 4, 6, 12 or 24 inches in diameter. Diameter of the casing pipe would be half inch lesser than that of the borewell.
- A “submersible pump” of appropriate power rating is inserted into the borehole, typically below the lowest crack from which water has jugged out into the borehole. This pump has a “delivery pipe” attached which comes up all the way up to the surface. The pump delivers the water from this pipe, which is collected by the borewell users.



This is a borewell rig



S.K.B.S

Stop

Ashok Leyland



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Borewell Regulations 1/2

- As per the Karnataka GW (Regulation, Control of Development and Management) Act 2011, rules 2012 you need permission to dig a well
- All of Bangalore (urban and rural) fall under the “overexploited” zones as identified as by the groundwater authorities.
- The concerned borewell registering authority for the city is the BWSSB.
- If you’re digging a borewell, you need to invest in rainwater harvesting solutions as well.

Borewell Regulations 2/2

- All existing borewells have to be registered
- New borewells need a permit
- You need to submit the permit to the local groundwater authority
- Borewell can be dug after permissions from a registered drilling agency
- Drilling agency to submit a report to GWA on the drilling of borewells and relevant data to the authority on a monthly basis
- Borewell users to put a meter on the borewell and submit usage data on a monthly basis.
- For all details, go [here](#)

Karnataka Groundwater (RCDM) Act, 2011



- Only one tube-well is allowed to meet drinking and domestic purposes use only.
- No tube-well/bore-well will be constructed, if any working tube-well exists. If the existing tube-well is non-functional/to be replaced, then it should into a recharge well, if possible or possibly sealed and no water be pumped from it.
- The persons intending to construct a new tube-well will intimate the Authorising officer/committee, 10 days in advance along with the drilling agency's name and address.
- Maximum diameter of the tube-well should be restricted to 152 mm only and the capacity of the pump should not exceed 2HP.
- Concurrent with the construction of the tube-well, the owner shall undertake the installation of Rainwater harvesting in the premises.
- Details of the drilling like the rock formation encountered, the depth and diameter of the constructed bore-well, types of pipes used, yield of the bore-well and groundwater quality shall be kept for record and are to be provided at the time of inspection.
- Spacing of 500 mtrs should be maintained from the existing public source of drinking water as per section 3 of the Groundwater act of 1999.

Sample borewell log

Borewell metering

- As water supply becomes more erratic, or as borewells dry up, managing demand has become increasingly important, and in the search for solutions, many realise the importance of water metering, because, **what is not measured, cannot be managed.**
- Source metering is when you install a meter on the delivery pipe of the well or borewell. It measures how much water is pumped out of it. A separate electricity meter for this pumping from the source is also critical.
- These measurements will help decide what the production cost of water is for the community.
- In addition to source metering, households may want to think about consumption metering, and distribution metering (for larger spread out communities).

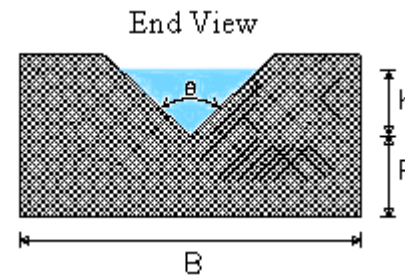
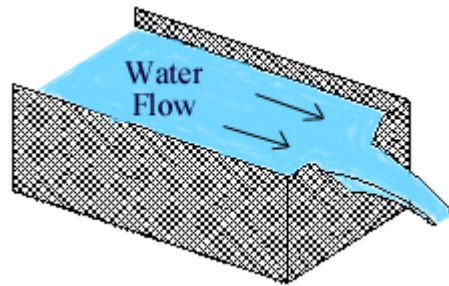
Borewell metering

- Create a process of meter reading and recording of readings at regular intervals. For multiple household complexes, identify a person within the “infrastructure management team” such as a plumber to train to read the metre. This has to be regular, so think of creating incentives for faithful meter reading and diligent recording of data.
- Collate and analyse this data regularly to observe patterns to understand low, average and high water usage patterns.
- Identify and capture all other all costs related to water.
- Communicate all of this back to all the residents.
- Be ready for some technical glitches and overcome them! Metres may jam, get faulty, may need replacement. Identify a good supplier and technical support team.



Measuring yield from a borewell

- A common way to describe the yield of a new borewell is in 'inches' measured by the free, unrestrained flow of water from a borewell over a 90 degree 'V' notch. The basic principle is that the discharge is directly related to the height of the water level from the bottom of the V notch.



See here for more information

- <http://biometrust.blogspot.in/2014/07/borewell-yield-measurement.html>

Maintenance and monitoring

- Do a water balance exercise to understand how much you need and how much you use
- Meter your borewell
- Keep a Borewell log
- Regular camera Inspections
- Recharge dry borewells
- Don't rely only on borewell water – diversify your sources – incorporate rainwater harvesting

A sample camera inspection report

- DETAILS OF BOREWELL.
- Dia of Borewell : 6½” inch.
- Depth of casing : 60 ft.
- Depth of Borewell : 770 ft.
- Static Water Level : 400 ft.
- CAMERA INSPECTION REPORT
- Camera Inspection was conducted on : 24.11.2014
- Horizontal Fractures was encountered :
135,268,326,387,430,463,527,536,580,590,
600,611,620,625,643,710,727,730.
- Recommendation: Suitable for Hydro-Fracturing

Understanding borewell water quality

- Borewell water usually has less microbial contamination than open well water as its water has trickled down through more rock layers
- It is more susceptible to chemical contamination for the same reason.
- While trickling down, the water comes in contact with naturally-occurring salts like fluorides and arsenic.
- Water percolates down mainly during rain, but also from other sources like lakes – a process termed recharge. This is why borewell water has to be tested regularly to ensure that it is not contaminated.

Borewell : Water Quality



TDS : 400-500
(Within desirable
Limits of **BIS 10500**
2012)
Desirable : < 500
Permissible : 2000

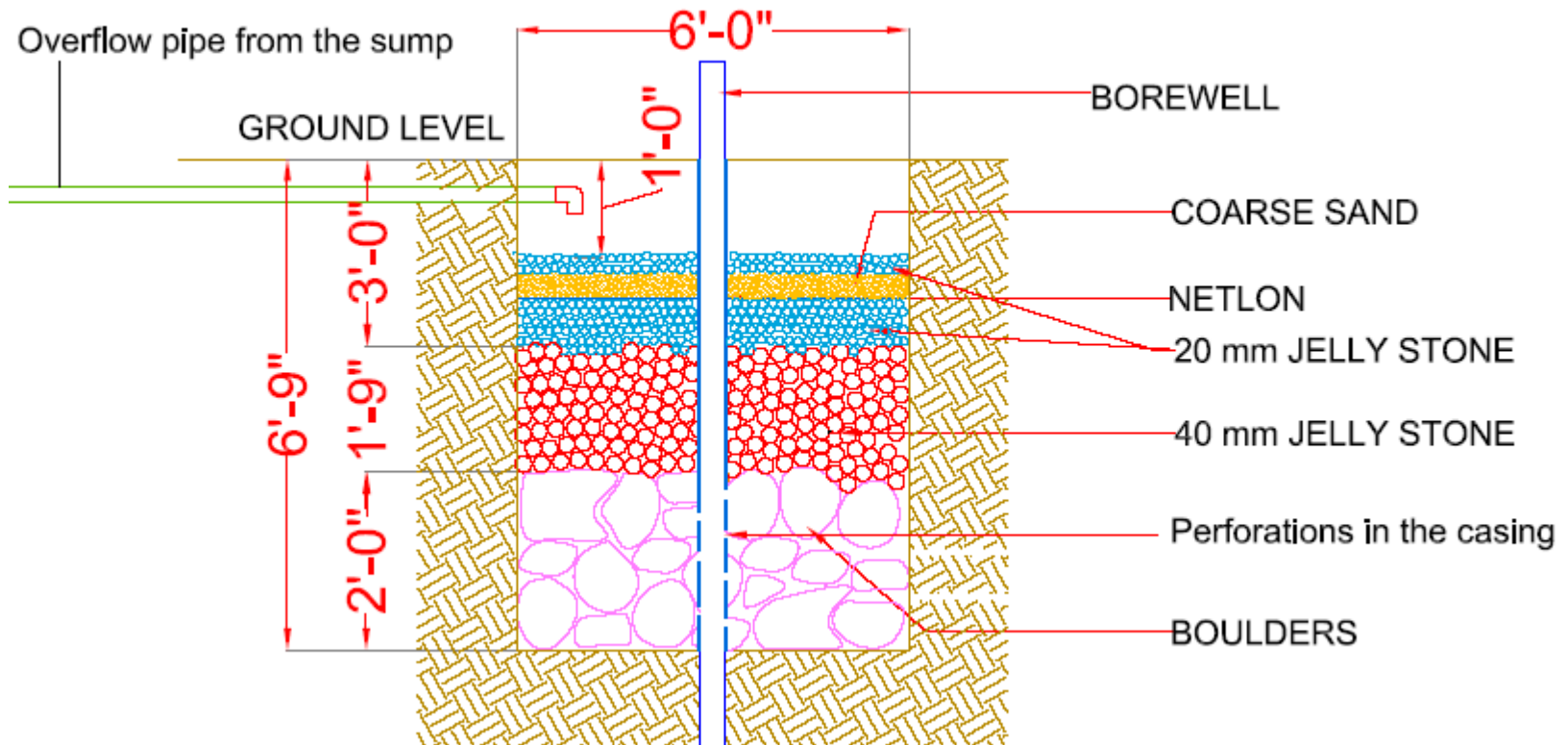
What do I do when my borewell goes dry?



- You could start with a camera inspection. This will help see the inside of the borewell.
- These are the people you can call
- It can cost up to 5000 rupees for a camera inspection.
- You could in the short term opt for hydrofracturing, a process that involves injecting water under high pressure into a bedrock formation via the well. This should clean and increase the size and extent of existing fractures, and connect them with nearby water bearing fractures
- However, in the longer term it's advisable opting for groundwater recharge solutions

Recharging directly into borewells

Need to be very very careful
About water quality



Recharging a bore well



**Outlet pipe in
recharge well**



**Rainwater sent for
recharge**



Whom to call? Some contacts



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Some Borewell Contacts

- Borewell deepening: Eswar (80500 40081), Eric (94481 31302), Rajanna (90603 12355, 97401 56576)
- Hydrofracturing: Mr Ganesh from Ayyapas Aqua Solutions (+91 98862 50844 / fractech@vsnl.net)
- Borewell diviners: Reliability of these diviners is tricky. But each is as reliable as any others you may meet. Big borewell companies will send their own diviners. Also try Murthy (+91 99450 65189), Kumar (+91 98801 13367)
- Borewell pump removal: Chandru Prabhu: +91 99163 60453
- Borewell lifter: Nagaraj: +91 98454 21459

Some Hydrogeologists

Sl. No	Name of the Hydrogeologist	Organisation	Location	Mail ID	Phone number
1	Ashok Kumar	Freelancer	Bangalore	ashokeco@googlemail.com	9448928072
2	Dhoolappa Gorushetty	Freelancer	Bangalore	g.dhoolappa@gmail.com	9480319821
3	Veeranna		Hyderabad	marimekalav@yahoo.co.uk	9849484288
4	Himanshu Kulkarni	ACWADAM	Pune	acwadam@gmail.com	9822529208
5	Prof.A.G.Chachadi	University of Goa			
6	Prof.Lakshman Nandagiri/Dr. A.Mahesha	Dept of Applied mechanics and Hydraulics, NITK, Surathkal	Mangalore		0824-2474050

Bringing up water from Mother Earth

Inserting a borewell motor
back underground



At this site, the borewell pump has developed a problem. The pump has been removed and replacements got and it needs to be re-inserted. The pump removal man arrives to help out with his winch and jeep.



The power cable for the borewell looks endless

The delivery pipe, which was connected to the winch, is wound up. Here the borewell is at 1400 ft, where the first source from a crack was found. However, the water stabilised at 300 ft from the ground – the water is under a lot of pressure ! You can see the delivery pipe wet for a significant length. The building caretaker says he pumped upto 25000 litres a day from the pump.



The pumps are assembled and the delivery pipe connected to the first shaft of the pump.





The entire assembly is reinserted into the borehole. Power cables are then attached and the whole assembly with the delivery pipe is unwound to its full depth and tested.



Get in touch!



Get in touch with Biome
Environmental Trust at

water@biome-solutions.com



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