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SAFEGUARDING FUTURE RURAL DRINKING WATER SUPPLY IN ODISHA

April 29th and 30th 2010
Bhubaneswar, Odisha

Meeting report

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Meeting Report on
"Exchange Meeting on Safeguarding Future Rural Drinking Water Supply in Odisha"

Bhubaneswar April 29th and 30th 2010

Contents

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Reference: *Kuijper M.J.M, R.J. Stuurman, C. Choudhury, A. Cronin and P. More (2010) Meeting Report on Exchange Meeting on Safeguarding Rural Drinking Water Supply in Odisha", Deltares report 1201866-000-BGS-0005, Utrecht, The Netherlands.*

Meeting Report on
"Exchange Meeting on Safeguarding Future Rural Drinking Water Supply in Odisha"

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A better understanding of hydrology and groundwater flow is crucial for identification of water sources, reducing contamination, efficient siting of wells and sanitation service points under the erratic geographical positioning of the habitations. This understanding is particularly relevant when striving for more sustainability of rural water supply and sanitation in Odisha.

This 2010 exchange meeting was a result of cooperation between Gram Vikas, UNICEF, Deltares and ICCO involved in water supply and sanitation and evolved out of a felt need to engage people from diverse fields to provide inputs for designing future courses of action. The meeting, involving a two day workshop on *Safeguarding Future Drinking Water Supply in Odisha*" at the New Marrion, Bhubaneshwar, was rolled out with the following objectives:

- ✓ Current situational analysis of water quality in Odisha from monitoring to date.
- ✓ Increase awareness of the importance of groundwater monitoring (quality and quantity).
- ✓ Discussion and exchange of experience on Odisha's rural drinking water issues in terms of water resources.
- ✓ Improve cooperation in the water sector and exchange experiences.

Opening remarks were given by Joe Madiath (Gram Vikas) Job Zachariah and Aidan Cronin (UNICEF), Marijn Kuijper (Deltares) and Mr. N.K. Shukla (RWSS GoO). The meeting comprised 13 technical presentations and discussions, followed by group work and summarizing next steps.

Presenters

1. Jerome Perrin, Indo-French Centre for Ground Water Research (IFCGR), Hyderabad
2. D.V. Reddy, Isotope Hydrology division, National Geophysical Research Institute, Hyderabad
3. Prabir K. Naik, Central Ground Water Board
4. Dileep K. Panda, Directorate of Water Management, Water technology centre for eastern region
5. Aidan Cronin, UNICEF Odisha
6. R.P. Misra, RWSS GoO, Bhubaneswar
7. Pradeep Ku. Sahu, GoO RWSS, Koraput
8. Chiralekha Chowdhury, Gram Vikas
9. Marijn Kuijper, Deltares, The Netherlands
10. S.C. Jaiswal, Water Aid
11. Roelof Stuurman, Deltares, The Netherlands
12. Nitya Jacob, UN Solution Exchange, New Delhi

13: Vijaylakshmi, Development Alternatives Group, New Delhi

Five summarizing conclusions

1. **Ground water security:** To find sufficient groundwater in the hard rock area of Odisha is a difficult task. Most water is find at the interface between weathered zone and the fissured hard rock or in weathered fault zones. The hard rock has a relative low storage capacity for water. The quantity of groundwater reduces with depth. In other words: in reaction on overexploitation and/or drought, the groundwater level will not drop linear but exponential. Based on 10 years measurements, and contrary to earlier studies which state that only 18% of the usable groundwater volume is exploited, groundwater levels in Odisha are dropping. Therefore proper management of the groundwater body and groundwater use is essential and data on water level and its careful monitoring as a trigger for interventions is crucial!
2. **Ground water safety:** The hard rock area of Odisha is very vulnerable to pollution, because of low purifying characteristics of, for example, granite. Installation of wells too close to polluting sources (urban area, near sanitation, agriculture area) will surely create quality problems. Furthermore bad management of the well site can create these problems. For those reasons many rural water supply wells are suffering water quality problems. The most significant anthropogenic polluting elements are: nitrate, iron and microbiologicalcontaminants, including E-coli as a proxy for bacteriological and viral pathogens. Besides this anthropogenic pollution also natural fluoride and iron create water quality problems. Water safety can be guaranteed by proper site choice, proper well installation and good site management.
3. **Ground water salinization (security & safety):** In the coastal area with dunes and marine and river deposits (clays and sands) the quality and quantity stress differs from the hard rock area. Groundwater storage is larger in the coastal area and is generally constant with depth. Salinization of groundwater by upcoming salt formation water (i.e. water present since deposition of the sand) and intruding seawater is a typical risk for this area. For that reason proper knowledge about the distribution and the future behavior of salt and fresh groundwater is important. Groundwater in the coastal area is less vulnerable to microbiological pollution, but is still vulnerable for antropogenic chemical pollution and geogenic arsenic pollution.
4. **Groundwater monitoring:** Monitoring of groundwater levels, groundwater quality and, in the coastal area, monitoring of the fresh-salt interface is necessary to protect groundwater as a resource for the future. There is a need for standardization of monitoring protocols, data storage and data analyses. It is a great opportunity if state organizations, NGO's can realize one open web-based data management system. Also very important is the creation of a transparent protocol how to react on alerting situations, i.e. too high nitrate concentrations.
5. **Groundwater stakeholders interaction:** Many organizations are working in the field of groundwater (Government, NGO's, universities, etc.) and many organizations are depending on groundwater (RWSS, agriculture, nature, etc.). There is a felt need to, on a regularly basis (1 or 2 times a year) all stakeholders will meet and discuss the state of the art of Odisha's groundwater situation.

Presentation 1: Dr. J. Perrin, Indo-French Centre for Ground Water Research (IFCGR)

The Indo-French Centre for Ground Water Research is a joint collaboration between National Geophysical Research Institute (NGRI) India and BRGM, France. The Centre is involved in research work that focuses on hard rock aquifers of southern India. In his presentation Mr. Perrin focused on hard rock hydrogeology, aquifer structures and ground water flow characteristics.

Weathering profile

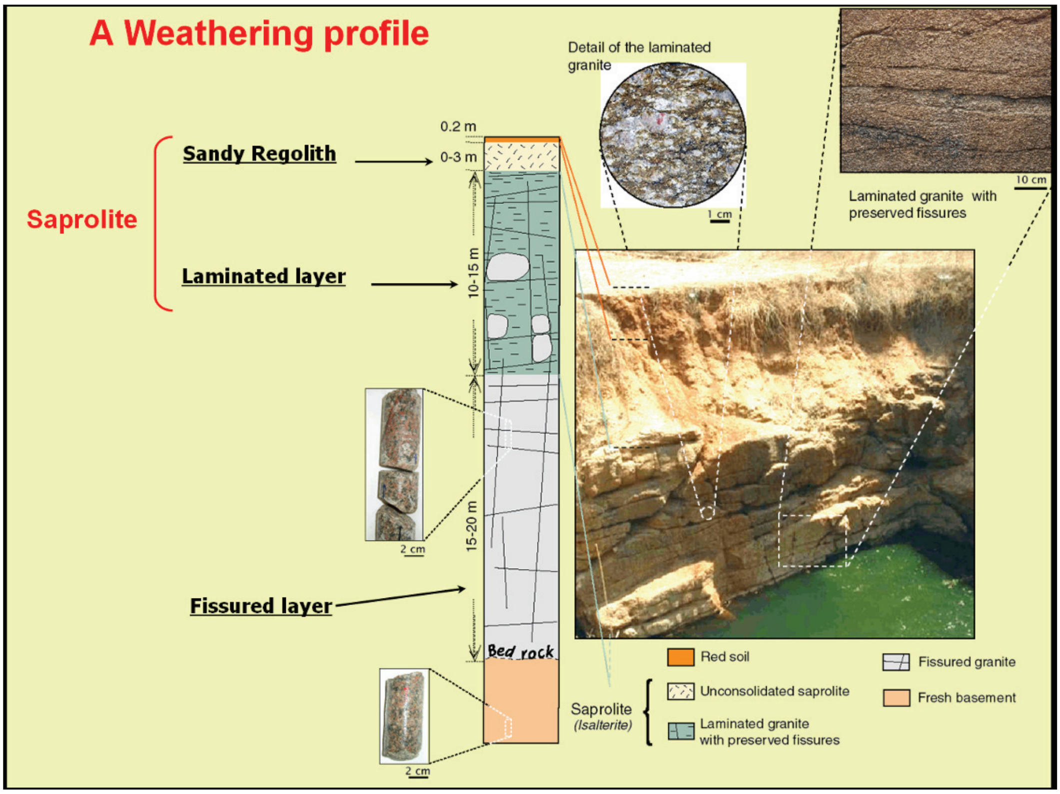
Hard rock areas (granite, gneiss, schist) constitute a large part of southern India. Mr. Perrin describes a hard rock aquifer as a layered system with a typical weathering profile. From the bottom up:

- unweathered bed rock
- moderately weathered fissured layer with high permeability and low water storing capacity.
- highly weathered saprolite layer with high water storing capacity but lower permeability.

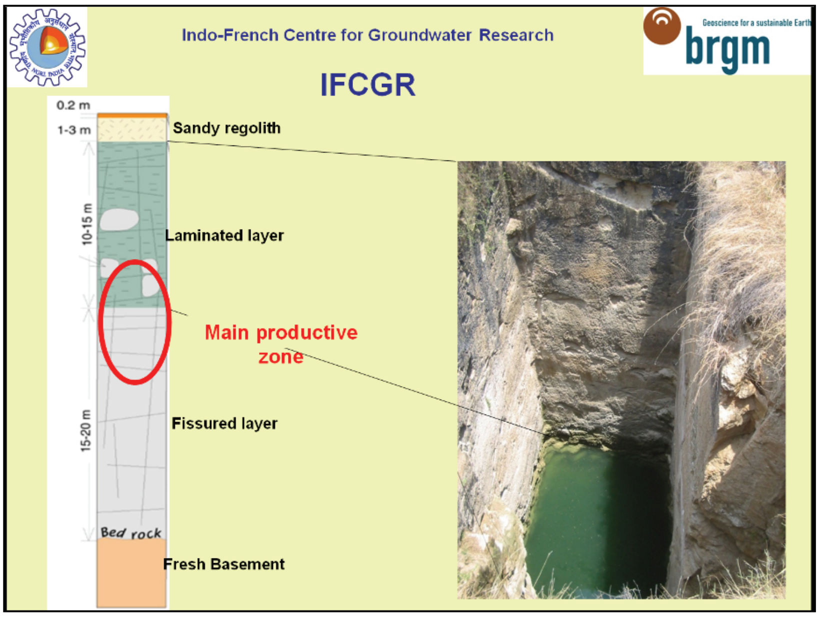
Higher transmissivity may occur along quartz reefs due to a thicker weathering profile and because flow is canalised. Dolerite dykes on the other hand may act as impermeable barriers to groundwater flow.

Most water within 50 meters

Hard rock aquifers are developed by weathering process. They are extensive but highly heterogeneous. The main productive zone can be found at the intersection of the saprolite layer and the fissured layer, where the most conductive fissures and most water can be found. This intersection is usually found within the first 50 meter below the ground surface.



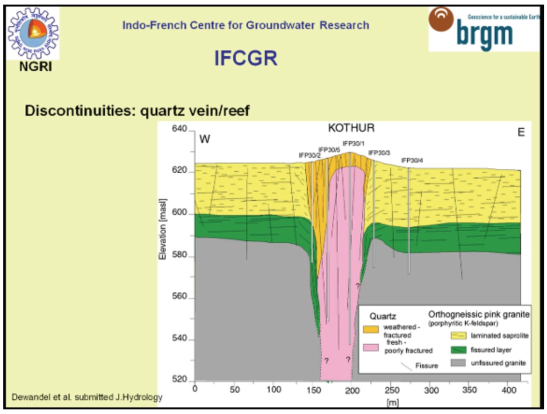
Slide: example of weathering profile in hard rock areas.

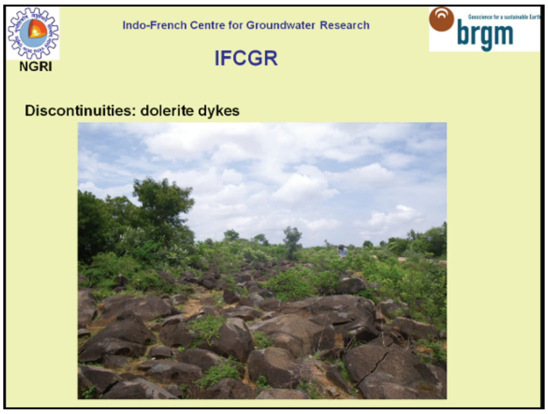


Slide: the main productive zone for groundwater abstraction is the intersection of laminated layer and fissured layer.

Recommandations for well siting in hard rock areas:

- Choose low lying areas (valleys), because the groundwater table is closer to the surface.
- Find quartz reefs, because there the weathering profile is thicker and can contain more water.
- Choose locations near water tanks, because seepage from the tanks can dilute potential contaminants (but be aware of possible additional contaminants from the tank water itself!)
- Most of the times, drilling deeper than 50 meter is not advisable, because most transmissive fractures are found within the weathering profile.





Slides: other productive zones are quartz veins, due to thicker weathering zone. Dolerite dykes may act as impermeable barriers to groundwater flow.

Risks for wells in hard rock areas:

- Development of agriculture:
  - overexploitation
  - deterioration of quality (nitrate, pesticides).
- Other contaminant sources: sewerage, poultry farms, mining activities, geogenic (e.g. fluoride).
- Decrease in well yield.

Mitigation measures

- Groundwater management policy (budgeting, decision support tools and simulation tools)
- Use of information for adequate well siting (geological and, chemical data).
- Testing of well yield at the end of the low season.
- Long term monitoring of groundwater levels, discharge and quality at least twice a year (end of dry season and end of monsoon).
- Groundwater development programmes to avoid over exploitation.
- Proper well design:
    - casing the entire weathered (saprolite) layer (and the first meters of the fissured layer).
    - cementation around the casing to prevent direct infiltration of pollutants.

Disussion

The discussion focussed on the depth of new wells. If going deeper in hard rock areas is futile, then it may be better to dig three wells of less depth than a single well of over 300ft depth, because the drilling costs will be equal. Some viewed that in Odisha desired quantity of water is not possible within 50m. So this point requires more research. The solution of digging two wells of 50mtr deep instead of digging one well of 100m deep makes sense economically but may be complicated socially. An example was mentioned where very close wells were interfering, causing fluctuations in the water table. This shows the vulnerability of shallow aquifer systems and the need for good management of the available water.

Presentation 2*: *Dr. D.V. Reddy, National Geophysical Research Institute, Hyderabad.

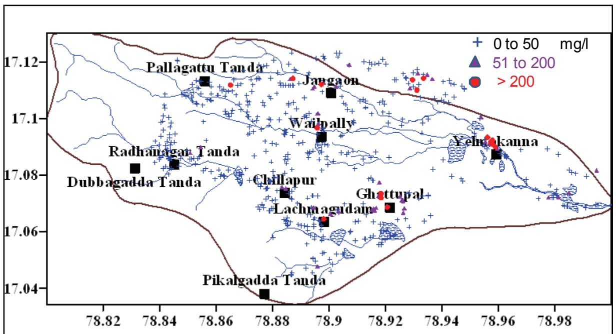
Dr. Reddy discussed the main sources of groundwater pollution, the effects on human health and the influence of human waste on water quality.

Groundwater contamination is found when micro-organisms are present or when ions are more than the specified limit. Anthropogenic contamination is induced by human activity and may include nitrate and several other organic compounds.

Fluoride

Most of the fluoride found in groundwater is due to natural weathering of rock and dissolution, e.g. Nalgonda District of AP, India, has a very high content of Fluoride and has been linked to political parties claims on safe drinking water. Higher amounts of fluoride can cause dental and skeletal fluorosis, joint pain, restriction of mobility, and bone fractures.

Dental fluorosis

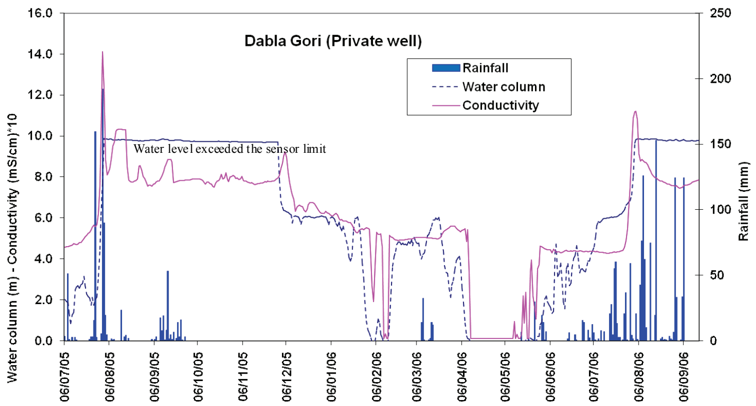


Nitrate distribution in granitic terrain (Wailapally watershed)

Nitrate

Nitrate pollution is generally from anthropogenic sources. Human encroachment is the main source of elevated nitrate levels in groundwater. Sources include septic tanks, sites used for disposal of human and animal sewage, food processing and industrial chemical fertilizers. The biggest health risk is the conversion of haemoglobin to methemoglobin which depletes oxygen in blood and enlargement of thyroid, cancer, birth defects and hypertension.

Slide: Nitrate above health limit in Wailapally watershed.



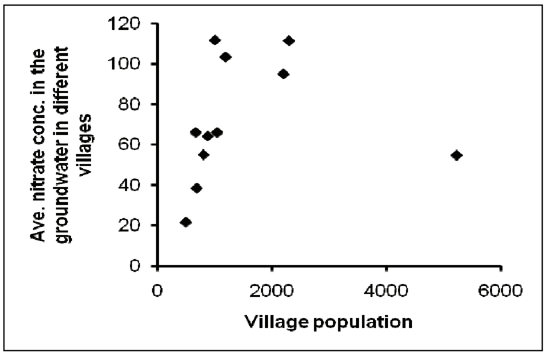
Water level and conductivity changes in time. Rapid increase in water level and conductivity can be seen in response to rainfall recharge (flat portion of the water level is due to water level increase is more than the sensor limit or level reduced to below the sensor). (conductivity values µS/cm are multiplied by 10 to fit the scale).

Slide: High electrical conductivity during rainfall events reflects pollution with nitrate from human waste.

Key question

A key question is: how can we manage the nitrate pollution in rural environment?

- Proper management of sewerage / waste water.
- Suitable solid waste dump yards for the cattle and kitchen waste.
- Community drinking water supply wells situated away from the villages.



Slide: higher village population shows increased pollution with nitrate. Therefore it is advisable to locate drinking water wells away from the villages.

Decontamination is not an easy task, however, we have to explore the new technologies to reduce / minimize the contamination.

Presentation 3*: *P. K. Naik, Scientist, Central Ground Water Board.

Mr. Naik showed the main problems in rural drinking water supply are erratic rainfall, low yields and uneven distribution of groundwater in hard rock areas and contamination with fluoride, iron and bacteria. He also described general guidelines for selection of new well locations.

The average annual rainfall in Odisha is 1502 mm. But rainfall is erratic and as we go westward, it gradually decreases. The database of the Central Groundwater Board contains 1167 exploratory wells, 54% of which have low yields of less than 3 litres per second.

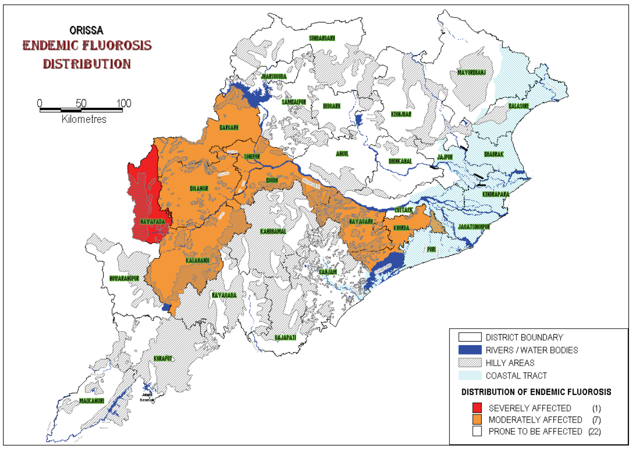
Total number of bore wells: 1167
(Exploratory Wells, CGWB)

% of bore wells	Yield (liters per second)	
54	<3	29% (1-3 lps)
46	>3	

Slide: 54% of bore wells have low yield: less than 3 litres per second.

Fluoride, iron and bacteria

Groundwater quality problems are linked to fluoride, iron and bacteria. It is estimated that about 21% of communicable diseases in India is water related. High iron concentrations do not create health hazards, but in the mining areas of Joda-Barbil-Koira and in some sedimentary rock areas it makes the water unfit for drinking purposes because of bad taste. High fluoride is a problem in 8-9% of Odisha bore wells.



Slide: distribution of endemic fluorosis in Odisha; red: severely affected, orange: moderately affected.

Bacteriological contamination, especially faecal coliform, is the most widespread groundwater pollution problem in India. Groundwater itself does not contain faecal coliform. Most of the groundwater coliform come from leaching of solid (human and animal excreta) and liquid wastes. The presence of faecal coliforms and related pathogens accounts for a number of water-borne diseases like diarrhoea, gastroeneritis, jaundice, hepatitis, cholera, typhoid, polio. Sanitary risks from locating a drinking water source (well, hand pump) close to household toilets and from accumulation of human excreta near a drinking water source are the major risks in a typical rural setting. As the remote rural villages are not accessible to regular monitoring, these rural people suffer the most.

The uneven distribution of groundwater in hard rock area is the main problem. In the mining areas of Joda-Barbil-Koira especially in summer season deeper water level in discharge areas and low base flow lead to water scarcity.

Slide: uneven distribution of groundwater in hard rock geology

Determining the best well site

Studies reflect that there is enough groundwater for drinking water purpose, but conservation is required. In a water supply scheme community participation in operation and maintenance is important. People should be aware about changes in the static water level, discharge and drawdown, which determines the depth of lowering of the pump.

Determining the best well sites in remote rural villages can be done by the collection of data:

- historical data of the area and it's vicinity (take the help of old age experience of the local people).
- study topographic sheets, remote sensing data and geology of the area.
- depending on the problem we can use electrical conductivity measurements for site specific information.

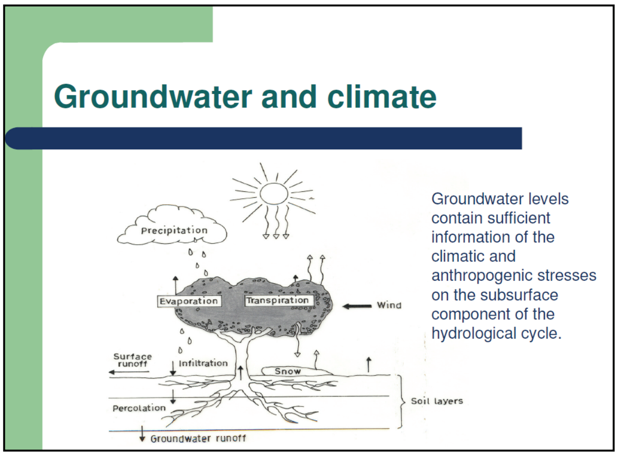
Presentation 4: Dileep K. Panda, Water technology Centre for Eastern Region, Bhubaneswar.

Mr. Panda works at the Water technology Centre for Eastern Region, Directorate of Water Management in Bhubaneswar. In his presentation Mr. Panda related the hydrological variability to climatic and anthropogenic stresses.

Stresses

Climatic and anthropogenic stresses influence the recharge to and discharge from the aquifer. Examples of these stresses are:

- Changes in mean and extremes in rainfall and temperature.
- Changes in evaporation and transpiration.
- Sea level rise.
- Anthropogenic groundwater extraction.

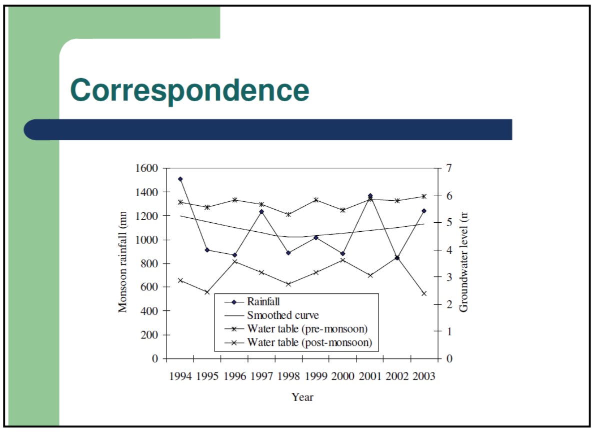


Slide: Groundwater levels reflect climatic and human stresses on the groundwater system.

Mr. Panda performed a statistical analysis on measured pre- and post-monsoon groundwater levels, from 1002 monitoring stations over the period 1994 – 2003. The aim of this study was to identify and quantify the groundwater level trend of the state Odisha to understand the forcing mechanism of droughts in conjunction with the anthropogenic pressure.

Drought 2002

His first results show that the groundwater levels of the observation wells are very sensitive to the monsoon rainfall. Changes in rainfall directly influence the measured groundwater levels. The drought in the year 2002 was one of the severest in the history of India, which affected 56% of the geographical area and the livelihoods of 300 million people in 18 states. In the pre-monsoon season 59% of the monitoring stations experienced groundwater declines, against 51% in the post-monsoon season. In Odisha, groundwater levels normally ranging from 0-3 meter below the ground surface, shifted to the range of 3 meter up 7.5 meter below the ground surface in the drought year.

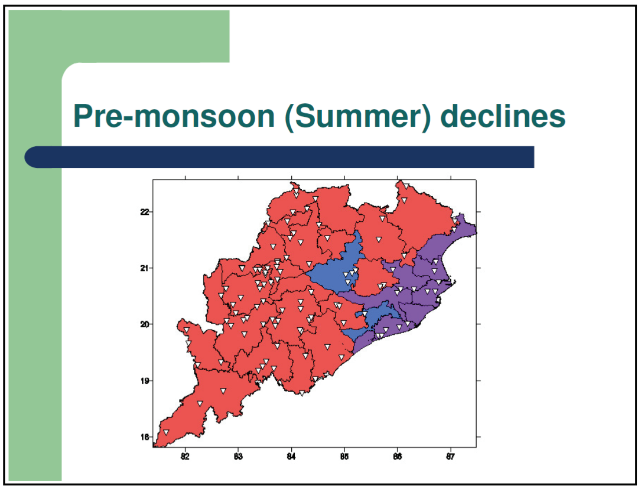


Slide: groundwater levels of the observation wells are very sensitive to the monsoon rainfall.

Significant groundwater depletion

Furthermore from the measurements a declining trend was detected in groundwater levels. The measurements show that the drop in groundwater levels from the dry year 2002 has not been recovered through the recharge in the following wet years. In the pre-monsoon period a significant depletion was measured of 0.23 m in 10 years. The groundwater level drop is the result of a systematic forcing mechanism of drought, combined with human stress and high temperatures

A statistical test of the groundwater level trends indicated that the consolidated rock formation (that covers 80% of the area of Odisha) experienced an overall significant decline of groundwater level during the study period, irrespective of the seasons. The semi-consolidated and unconsolidated formations, however, experienced significant water table decline in the pre-monsoon summer season only.



Slide: observed significant decline in groundwater levels

Discussion

There was a remark about the paradox that state reports indicate that only 18% of the renewable groundwater source is used and on the other hand Mr. Panda's conclusions of significant drop of groundwater levels during the last decade. Perhaps the groundwater volume is overestimated?

Presentation 5: Dr. Aidan Cronin, UNICEF, Bhubaneswar.

Mr. Cronin works for UNICEF in Bhubaneswar. In his presentation Mr. Cronin reflected UNICEF's involvement supporting The government of Odisha (GoO) at State level and in Koraput District, in the context of infrastructure organisation and management and water quality monitoring.

UNICEF's mandate is the survival and development of all children and Dr. Cronin shows in his presentation that Odisha's diarrhoea burden is 20% higher than the Indian average. The significance of water and sanitation is appreciated when one realizes that according to WHO research 88% of diarrhoea is due to incomplete water and sanitation service provision.

Diarrhoea: India v. Orissa (2002)

	India	Orissa
Population	1,049,550,000	36,804,660
Total Diarrhoea cases	-	156,872
Diarrhoea cases per 1,000 persons per year	-	4.3
Total Diarrhoea Deaths per year	456,400	453
Diarrhoea Deaths per 1,000 persons per year	0.435	0.0123
Total Diarrhoea DALYs per year	15,254,000	637,000
Diarrhoea DALYs per 1,000 persons per year	14.53	17.31

Orissa's Diarrhoea DALYs 20% higher than the Indian average

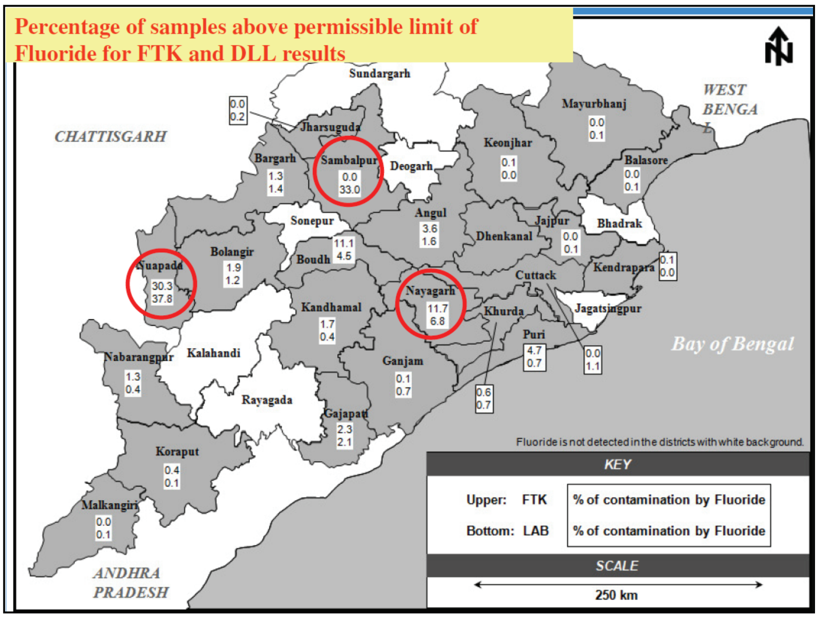
Slide: Odisha's diarrhoea burden is 20% higher than the Indian average.

Water quality monitoring

Water quality monitoring was performed by the government of Odisha (GoO) Rural Water Supply & Sanitation (RWSS): in 2009 RWSS covered 1,570 GPs of the state via 5 focus GPs in each block. Measurements are performed by Self Employed Mechanics (SEM), using Field Test Kits (FTK) and part of the samples was also tested in the District Level Laboratory (DLL). In 2010 the remaining 4664 GPs of the State are to be covered, after incorporating of lessons learnt.

Iron, fluoride and microbial contamination

- The percentage of samples above permissible limit tested by DLL is 43%, compared to 18% above permissible limit in the measurements from the FTK.
- Iron is detected as the most common contaminant, and fluoride follows as the next in both DLL and FTK.
- In the DLL turbidity was also detected as a common contaminant.
- Widespread microbiological contamination of groundwater was detected by additional testing supported by UNICEF: 20% positive detects with faecal coliforms.



Slide: Percentage of water samples above permissible limit for Fluoride.

Sanitary Surveillance

Looking at ages of installation, it can be deduced that approximately:

- 40% of tube wells are over 10 years of age,
- 25% are 5 to 10 years old
- 35% are less than 5 years old.

Furthermore, the ratio of point source to SEM has increased from 29 to 36 in the period 2002-2009.

Sanitary Surveillance describing the environment/surroundings of the water source in the operational villages can make a huge impact on identifying and addressing risks of point source pollution. Ten questions are asked about the environment/surrounds of the water source:

1. Is there a latrine within 10 meters of the bore-hole
2. Is there a latrine uphill of the bore-hole
3. Is there any other sources of pollution within 10 meters
4. Is the drainage facility allowing ponding with 2 meters of the bore-hole
5. Is the drainage channel cracked, broken or need cleaning
6. Can animals come within 10 meters of the borehole
7. Is the apron less than 2 meters of diameter
8. Does the spilt water collect in the apron area
9. Is the apron or pump cover cracked or damaged
10. Is the hand-pump loose or pump cover missing

Issues for addressing:

At *Village/GP level* there is a need for systematic information sharing (with the local village water, sanitation and health committee / GKS) by the SEM and verified by the District Level Laboratory (DLL). At *block level* there must be handholding and monitoring overview of SEMs to support their work. At the *district level* a minimum 10% of the sources tested by FTK are required to be analyzed in the DLL. Sources showing positive results of faecal coliforms or fluoride contamination should also be analyzed in DLL. A systematic procedure for follow-up on risks identified by the sanitary risk survey should be initiated via remedial works. Stronger organization and management (O&M) is required for positive impact on water quality. Bacteriological contamination is seen consistently and needs addressing urgently.

Bacteriological contamination is a serious issue in Odisha. We need to:

1. Strengthen monitoring of water quality program.
2. Reinforce human resources (SEMs and monitors).
3. Develop capacity on water quality – especially on sanitary risks at water sources.
4. Set up a cross-departmental State Task Force on water quality.
5. Follow up on response measures.

Discussion

The discussion focussed on the steps to be taken when a polluted well was discovered using the sanitary risk survey form – there needs to be a clear follow-up action plan involving the Village Water & Sanitation Committee, the GP and RWSS.

Presentation 6: Dr R.P. Mishra, Government of Odisha RWSS, Bhubaneswar.

Mr. Mishra works as technical Advisor on water quality at GoO Rural Water Supply & Sanitation (RWSS). He emphasized on strengthening the implementation of government policies and guidelines. Dr. Mishra reflected the national level guidelines in relation to the state level.

National Goal:

- Paradigm shift from "*just providing Water Supply System in the village to ensuring Water Supply Security at the House Hold Level*".
- Establishment of Water Security Plan "*Adequate quantity of highest quality water for drinking and domestic purposes on a sustainable basis at all times*".
- Water quality testing and sanitary inspection as Water safety Plan.

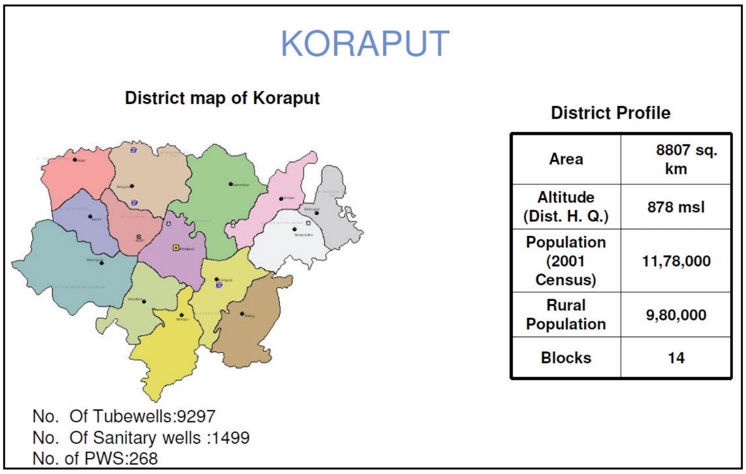
State plans:

- Establishment of 26 Sub Divisional laboratories during this financial year. Balance laboratories in the next year.
- Provision of field test kits (FTK) to all Gram Panchayats of the state and provision of refill chemicals for the existing FTKs.
- 100 % water quality monitoring by using FTK (engaging VWSC/GKS member or outsourcing).
- Preliminary bacteriological analysis using H_2S Strip Test Vials.
- Subsequently 100 % testing at Sub Division and 10% of samples to be tested by District Level laboratory which include positively tested samples.
- Data consolidation at District level and entered on-line on National MIS.
- Random testing of water samples by SRI.
- Identification/ registration of all water supply sources.
- Sanitary Survey by ASHA/VWSC/NGO.
- GPS survey of all water sources by NGO.
- Sanitary inspection by sample testing is in progress.
- Well maintenance, cleaning and rehabilitation is essential.

Slide: National level guidelines presented by Dr. Mishra.

Presentation 7: Pradeep K. Sahu, Rural Water Supply & Sanitation, Koraput.

Mr. Sahu works for RWSS in Koraput. In his presentation he describes the procedure of water quality monitoring, sanitary surveillances and lessons learned from the experiences in 2009.

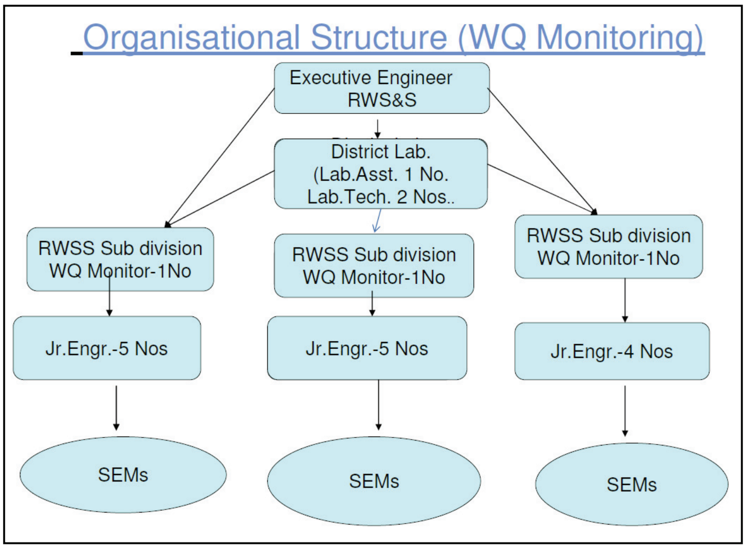


Slide: districts in Koraput

Koraput Laboratory under the intervention of RWSS, with some support from UNICEF, is well equipped with instruments and reagents for testing of:

- Physical analysis: Conductivity, pH, TDS, Colour, Odour.
- Chemical analysis: Iron, Calcium, Magnesium, Nitrate, Fluoride, Chloride, Sulphate, Hardness, Alkalinity.
- Microbiological analysis: TTC (Thermo Tolerant Coli form) and FS (Faecal Streptococci).

The study procedure is a bottom- up approach based on a water safety plan identified by sanitary surveillance supported by microbiological testing and different levels within RWSS, from Self Employed Mechanics' to the executive engineer are part of the organisational structure of monitoring procedure.

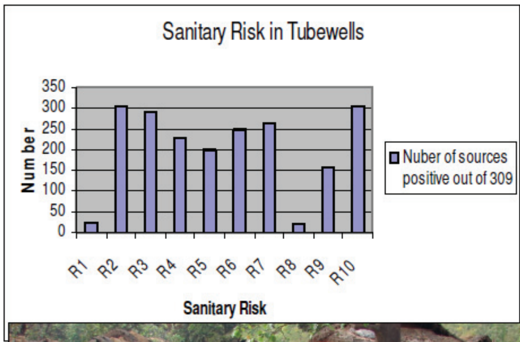


Slide: Organisational structure water quality monitoring

Challenges to address include reaching 100% coverage of all sources in sanitary surveillance, chemical and microbiological testing and mitigation of water quality related problems with the consumer.

SANITARY RISK IN TUBE WELLS

Sl	Factors
R1	Latrine <10m ?
R2	Can animal approach near the source?
R3	Other sources of pollution <10 m ?
R4	Apron missing/damaged <1.85 m dia?
R5	Waste water collect on the apron
R6	Drain channel cracked/need cleaning?
R7	Waste water ponding within 3 meters?
R8	Pump cover missing/damaged?
R9	Is there a visible gap between riser pipe and platform / borehole allowing water to enter?
R10	Bathing/cloth washing/utensil cleaning near hand pump?



Slide: Example of sanitary risk assessment.

Discussion

It was discussed by several prominent contributors in the audience that faulty design of the borewells and a lack of cement packing combined with limited/no operation and maintenance of wellheads are the main reasons for the contamination from surface pollutants. Questions were raised as to how the government would scale up the activities as demonstrated by the Koraput laboratory. Dr. Misra responded saying that water quality surveillance is to be done and in the second phase response plans addressing the sanitary risks is needed. The feedback from the first phase will be used to strengthen the laboratory infrastructure and personnel for water quality surveillance. It was also discussed that environmental management of the area around the well by the village people is of great importance. RWSS stated that they always choose an unpolluted site for new wells. In their case pollution is always caused by improper management after installation of a well. All agreed proper well siting and construction, which includes a seal of the well, combined with good operation and maintenance are essential for prevention of groundwater contamination.

Presentation 8: Chitralekha Chowdhury, Gram Vikas, Monuda.

Ms. Chowdhury works as manager for Gram Vikas. In her presentation she shared Gram Vikas' experience in the field of water & sanitation and the challenges faced in providing safe water supply in Rural Odisha. These touch the core values of the organization as Inclusion, Gender Equity, Social Equity, Cost Sharing, Sustainability.

Indian context and Gram Vikas

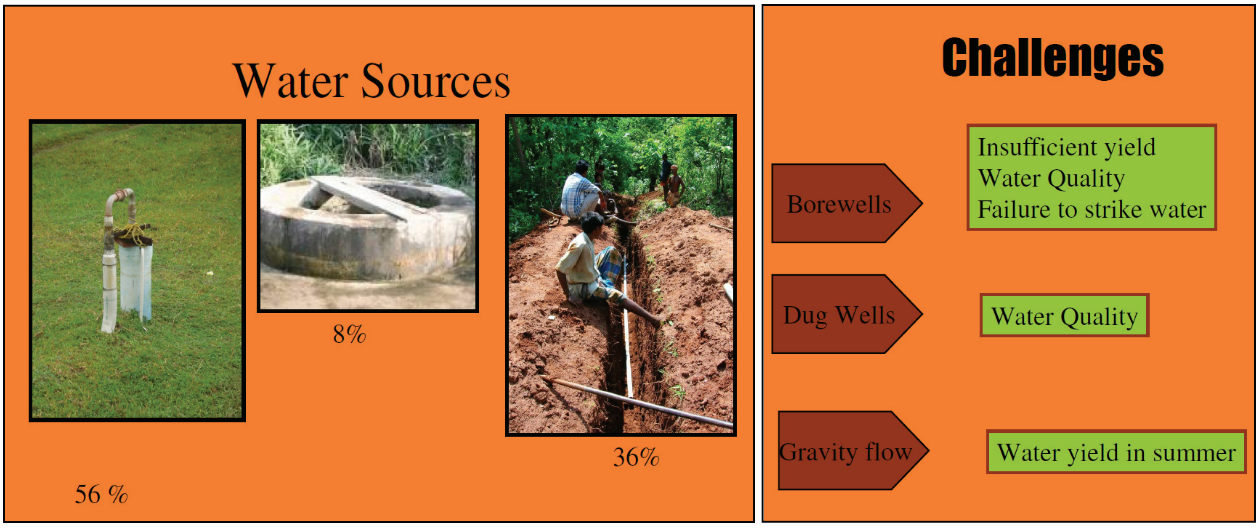
The Indian context means that 80% of morbidity in rural India is due to lack of protected and safe drinking water and sanitation. Of the population in rural Odisha 94% has no access to protected water and less than 1% has access to sanitation facilities. The daily drudgery of water collection and poor sanitation does not even spare children. A key vehicle for social inclusion can be water and sanitation.

Gram Vikas' approach is that the aim must be 100% coverage of all households in a village with institutional mechanisms developed for organization and management (O&M). On this there must be equal representation of men and women and each household must contributes an average of Rs. 1000 ($22) towards corpus fund as people can and will pay for quality but there are social costs. To ensure sustainability the institutional mechanisms to enforce and maintain hygienic practices can be achieved by group monitoring by children and women. There must also be clear identification of maintenance mechanisms, e.g. contribution from harvests; community pisciculture; monthly payments. Physical capital Gram Vikas has supported includes toilets and bathing rooms, piped water supply with three taps and development of community assets.

Slides: Examples of Gram Vikas'work.

Key challenges
Three types of water sources are used: borewells (56%), open wells (8%) and gravity flow wells (36%). Key challenges faced in providing safe water supply in rural Odisha are:

- Scarcity of groundwater: insufficient yields.
- Water quality: pollution of the water sources.
- Water source identification: failure to strike water.



Slide: Water sources Gram Vikas programme: 56% borewells, 8% open wells and 36% gravity flow wells (left) and main challenges regarding rural water supply (right).

There is a strong need for collaboration when it comes to understanding ground water movement and interaction in the hydrogelogical context. With Deltares and ICCO, Gram Vikas has worked on training of staff in water quality monitoring and on expanding knowledge to understand pollution and well vulnerability.

Key future challenges include: How to continue to balance up-scaling MANTRA and at the same time tackle issues of water quantity and quality? And how to ensure sustainability in water quality monitoring?

Gram Vikas' way of involving community from planning to implementation level is an example for all the participants; the challenges reflected in the presentation put forth the issue of the need for various stakeholders to play a proactive and complimentary role.

Presentation 9: Drs. Marijn Kuijper, Deltares, The Netherlands.

Ms. Kuijper works at the Dutch research institute Deltares and has been working with Gram Vikas since 2007. She emphasized on the issues of groundwater recharge and the importance of a clean well location. The focus point was to demystify monitoring and facilitate non experts to play a significant role at the grass root level with respect to water quantity and quality monitoring.

Bare foot hydrologist

The Bare foot hydrologist is a member of a rural community who has sufficient knowledge (after training) to make appropriate decisions about siting for new well locations and to monitor for contaminants. The barefoot hydrologists are to ensure sustainable safe drinking water by improving the knowledge of ground water management in an approachable manner to the community.

Objective

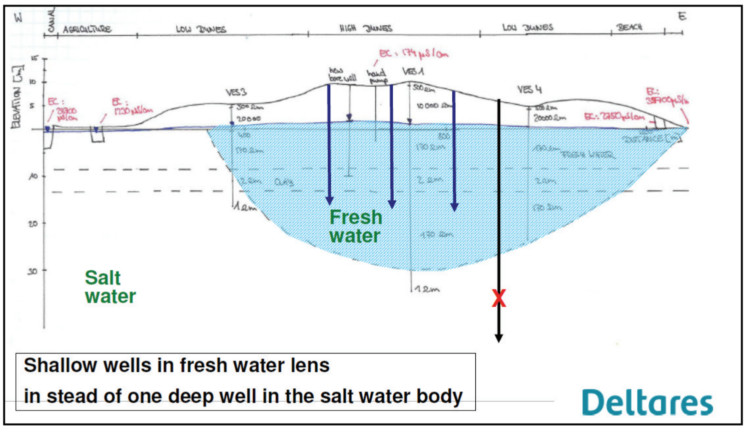
Deltares and Gram Vikas trained 40 barefoot hydrologist trainers on monitoring water quality and protecting wells development. To this end an easy-to-use toolkit was developed. Another key objective was to find sustainable well locations (clean and sufficient in yield).

Slide: Objectives of the barefoot hydrologist project.

Findings

Findings from the bare foot project included that about two thirds of the sampled wells were of good quality though microbiological contamination was found in 8% of wells and nitrate and bacteria found in another 8% of wells.

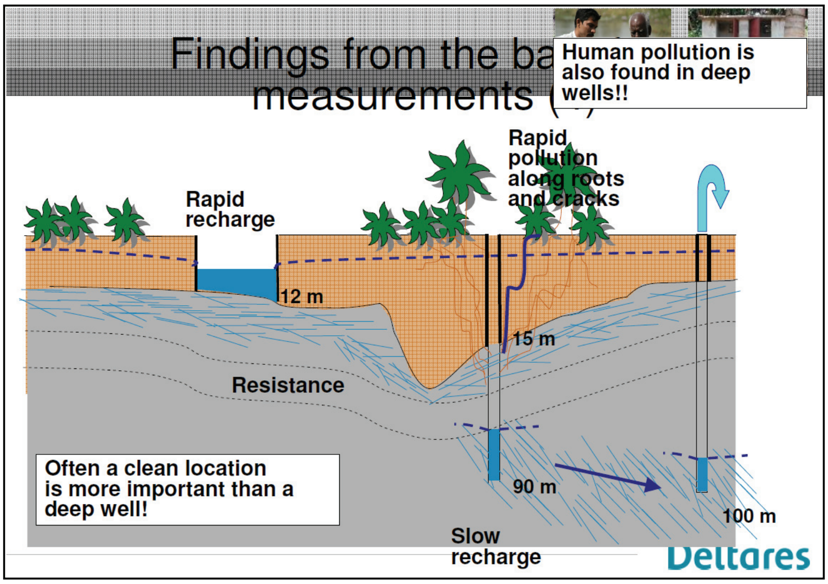
In the dune area several shallow wells in the fresh water lens are preferable to one deep well in the salt water body. Preferably, minimizing the risk for salinization, the shallow wells should be placed in the centre of the dunes and made as shallow as possible.



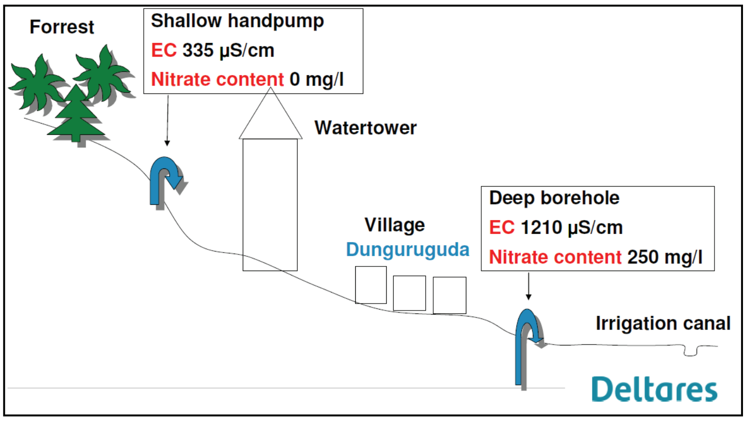
Slide: Dune area: hallow wells in the fresh water lens versus a deep well in the salt groundwater.

A cover on an open well is preferable in order to prevent dirt falling into the well. A cover makes no difference in recharge. Practical difficulties however have been encountered in covering bigger diameter wells.

In hard rock areas more knowledge is needed about groundwater recharge and the interaction between shallow and deep wells. From measurements it can be concluded that in all areas a clean location is more important than a deep well! For example gravity flow wells, although shallow wells, provide the cleanest water because they are located in a clean, natural environment.



Slide: Leakage through cracks and fissures can cause pollution to rapidly reach a deep well.



Slide: example of clean well up stream of the village and polluted well down stream.

Key challenges

Key challenges for the future include:

- How to make a choice between abstracting shallow groundwater or deep groundwater?
- How far can bacteria travel in granite areas?
- How can groundwater exploration become more common practice?
- How can barefoot hydrologist assist in selection of clean wells locations?
- What affordable filtering and purification solutions can work on village level?

Discussion

The term "barefoot hydrologist" led to some debate as there was apprehension that if specialized work is to be done by the "barefoot " approach, then we are at risk of loosing technical integrity. This view was opposed by others present saying that the "barefoot approach" has proved to be successful in other sectors, especially health care. Many participants were also of the opinion that with certain literacy levels local people can be trained to carry out simple monitoring protocols and fill the gap where the government is not able to reach out to and government may play a facilitative role in this process. The challenge however remains regarding sustainability of the monitoring systems.

Presentation 10**: **Mr. S.C. Jaiswal, Water Aid.
The presentation of Mr. Jaiswal dealt with the water quality problems encountered in coastal areas and Water Aid's experience of sustainable technical solutions in Puri.

In Puri severe water quality problems were encountered, mostly dealing with iron and salinity. Microbiological contamination was also found – even in deep wells – mirroring the experiencing of all of the other sampling results. Adverse impacts on health are not known to the community and use of non potable sources are quite common. No community participation was present in mitigation activities.

Water Aid implemented a baseline study, hardware activities, water quality analysis from different sources and defined area specific solutions.

Project outcome

- to create models of safe drinking water facilities in quality affected areas through proper water quality mitigation and management strategies.
- to identify alternate water sources in iron or salinity and other quality affected areas.
- to liaise with government to replicate the low cost and community managed mitigation measures in other areas.

One of the solutions introduced was the terra-filter, developed by IMMT Bhubaneswar. It reduce iron, suspended materials and is appropriate for installation in areas where people are poor and have no regular electricity and the public tube well is the only source of drinking water.

Discussion
There were some questions regarding the intervention, mostly on the iron removal filters promoted by Water Aid in Puri district and its efficacy in removing iron contents from water. There was agreement that there need to be more research as to how much iron is being removed as a result of the use of the terra filters, the life of the filter and how often it needs to be replaced.

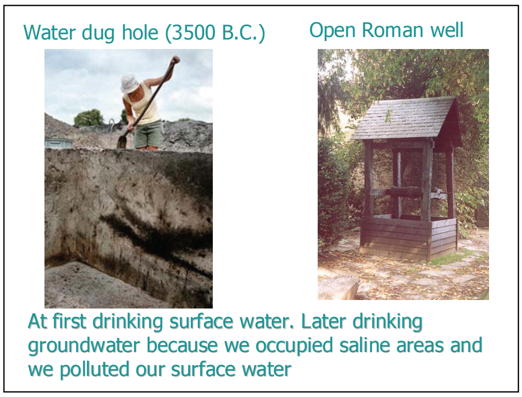
- In deeper tube wells the concentration of Iron is more than permissible limit
- In open wells and ponds pH concentration is with in permissible limit where as in deeper wells it is on the higher side
- Higher turbidity in deeper wells indicate that well development , sanitary protection and lowering of casing is not done properly
- Presence of fecal coliform indicates unsanitary conditions around sources
- Hardness and Iron concentration in Open wells and ponds are with in permissible limit
- In most of the deeper tube wells hardness is more than permissible limit

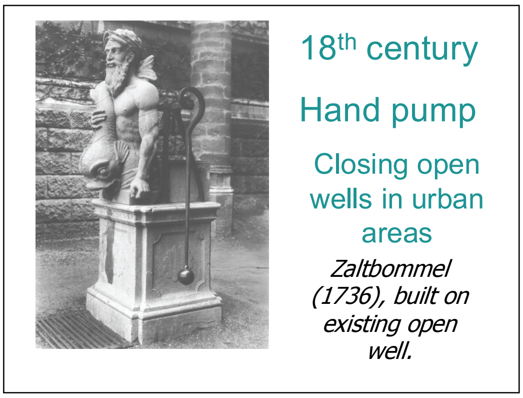
Slides: Problems encountered and some solutions.

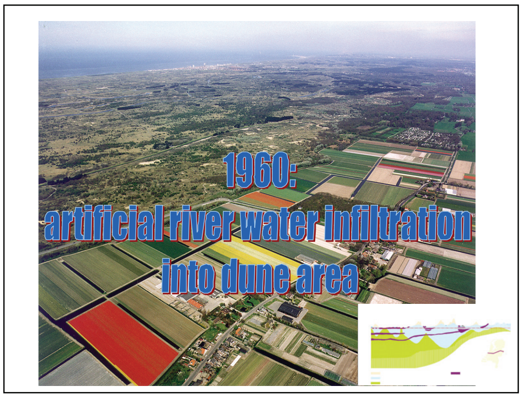
Presentation 11*: *Drs. Roelof Stuurman, Deltares, The Netherlands.

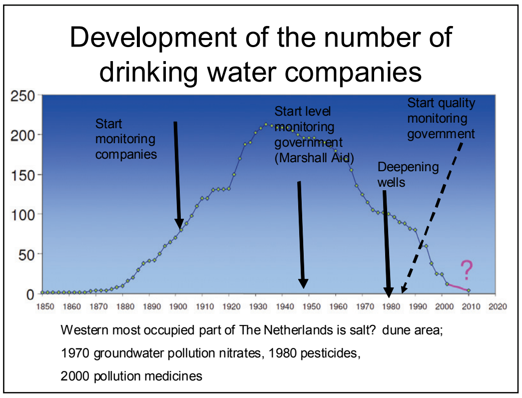
Drs. Roelof Stuurman presented an overview of the evolution of water supply system in the Netherlands and in the European context. He highlighted the various developments in the sector that have led to improved access, research and monitoring of drinking water in the Netherlands and he compared these to the challenges for Odisha.

Evolution of the Dutch water supply system



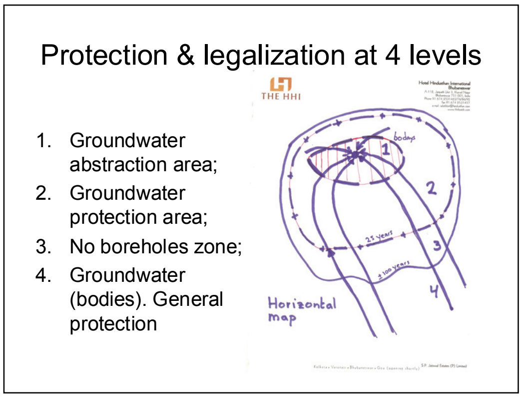


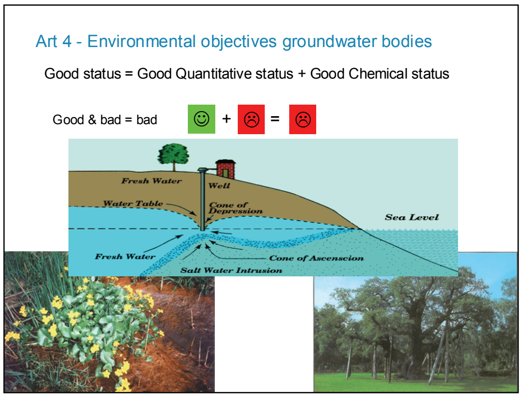




Slides: history of drinking water protection in The Netherlands.

Groundwater protection in The Netherlands is done at four levels, identified in years of travel time towards the well (60 days, 25 years, 100 years and general protection of water body), with strict control on activities allowed at the different levels. The 60 days protection boundary is based on the assumption that the risk of microbiological pollution will be minimal after 60 days. Europe has special regulations for protection of water quantity and quality defined in the European water framework directive, aiming at environmental healthy water systems. These regulations state that a water body is in good status only if both quality and quantity are in good status.



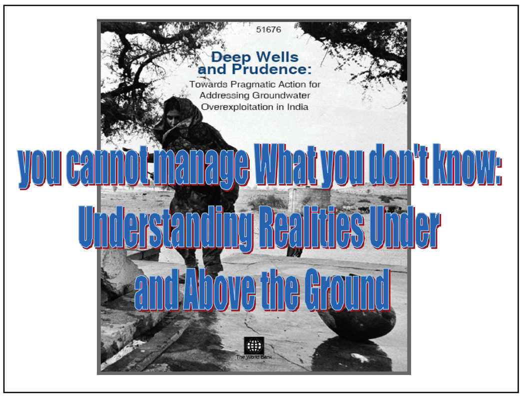


Slides: Protection zones at four levels (left) and environmental objectives European water framework directive (right).

Odisha challenges

In Odisha groundwater storage is low. Rainfall in Odisha is high, around of 1500 mm/yr, but with also high evaporation. This results in only 100 mm groundwater recharge. Odisha also has low natural groundwater protection given the hard rock aquifers. Hence, future challenges in Odisha include planning for groundwater protection as well as robust monitoring and groundwater management.

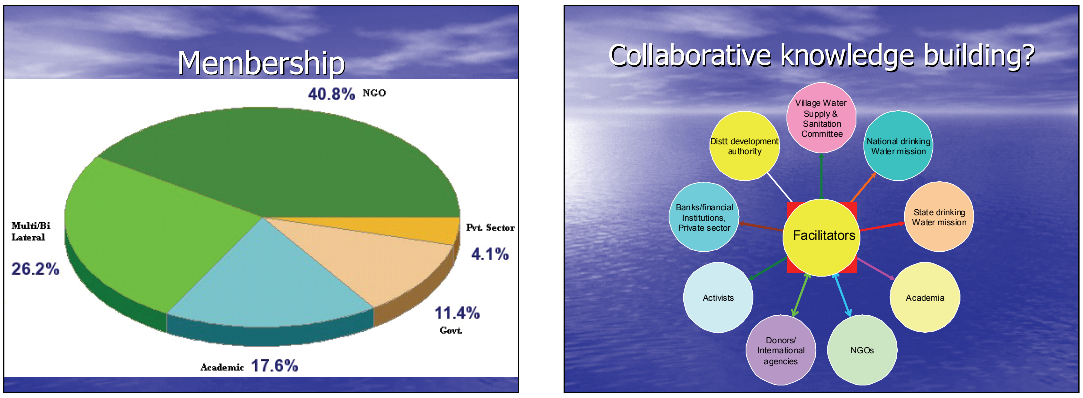
As one cannot manage what is unknown, much better understanding is needed on travel times, pesticide threats, purification capacity of the soil, effect of fertilizers, acid soil and safe groundwater use. Future challenges will be to regularly check the drinking water quality, to organise and unify monitoring practices, to handle all information that is generated by monitoring and to follow-up with appropriate measures.



Slides: Future challenges.

Presentation 12: Nitya Jacob, Water Community, UN Solution Exchange.
Mr. Nitya Jacob presented his work for UN Solution Exchange, focussing on collaborative knowledge building for water management.

About Solution Exchange
UN Solution Exchange is a water community facilitated by Unicef, UNDP and FAO. It is an impartial, national level platform for sharing views, experiences and research. It can be used as a 'help' function and generates inputs for policy programmes, research, raising awareness and networking.



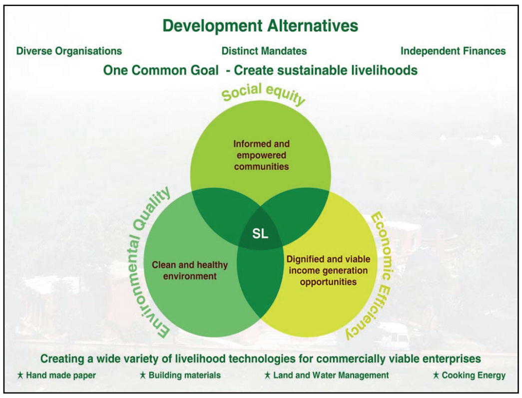
Slides: Membership and stakeholders of UN solution exchange.

Discussion themes
- Main Focus:
    - Human interface with water.
    - Access, quality, service delivery, management.
- Issues:
    - Drinking water
    - Sanitation
    - Governance
    - Water and agriculture
    - Socio-economic & cultural barriers to access
    - Water resources management
    - Conflicts over water
    - Water and climate change

Advantages
Sharing knowledge, organizing information, helps in making informed decisions, wider consultations in real time, brings out innovations, eliminates duplication of efforts; saves time and money, helps to build on what is already there. Solution Exchange brings together experts from academia, NGOs, the government, international agencies and donors to pool resources and tackle the menace of contamination.

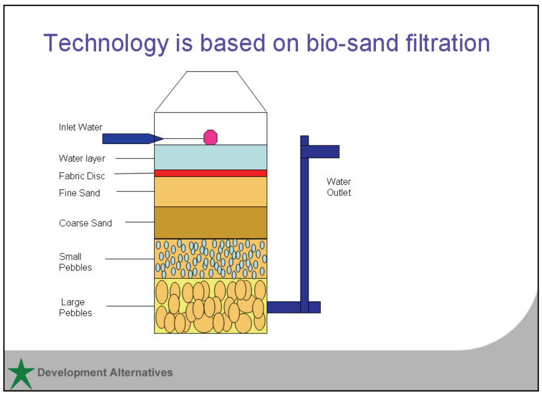
Presentation 13: Dr. K. Vijaylakshmi, Development Alternatives Group, New Delhi.

Dr. Vijayalaksmi briefed the audience on the work of Development alternatives and its involvement in technology promotion with respect to water quality monitoring and purification technology.



Sustainable livelihoods

The goal of the Development Alternatives Group is linked primarily to sustainable livelihoods (Social equity, Environmental quality, Economic efficiency) and sustainable enterprises, based on appropriate technology. The organisation has worked on water quality monitoring (using Jal-TARA testing kit which can test 14 physical, chemical and biological Parameters). They also work on bio-sand filtration techniques that provide continuous gravity feed with output of 2500 -3000 litres per day and removes Bacteria (99.9%) and Turbidity.



Slides: Water purificatons systems

Holistic water management approach

Ms. Vijaylakshmi also demonstrated the IWRM initiative Bundelkhand, in cooperation with Arghyam Trust, demonstrating a holistic water management approach, including demand management, supply management, sanitation management, institution development via capacity building modules and community mobilisation for water management.

Lessons learned

They have found that the strategies for a successful approach must have the following key elements:

- Periodic water resources/quality *data collection* and maintenance.
- Design and implementation of *problem based* treatment and management systems.
- *Training* of local NGOs, CBOs on monitoring and management.
- *Institutionalizing* all the activities.

Group Work

The Group work aimed at addressing the two key questions:

- *What do you see as the biggest challenges in safeguarding rural water and sanitation?*
- *What are the first steps we can commit to together to improve cooperation in addressing these challenges?*

The outcome discussions are summarized below.

1. Biggest challenges:

Management

- Water resource management poor - from source siting to development and management.
- Need for a strong push for sanitation and hygiene and SLWM to complement advances in water supply – only then will have an integrated sectoral approach.
- Poor infrastructure development and maintenance – there is a lack of a sense of ownership of the community of natural resources and their management.
- Too little priority on water quality issues.
- Too little inter-departmental convergence / little integration of all good initiatives.
- Difficulty in implementing laws, policies and guidelines – need good monitoring for this.
- Transparency in program implementation and pricing.

Knowledge

- Poor understanding of the resources and need for more research on hard rock aquifers.
- Water security and sustainability issues need strengthening.
- Need to see how traditional methods of water management can be used in conjunction with modern challenges and also improved technical solutions.
- Need to understand how over extraction and pollution of groundwater are impacting on the future.

2. To address these challenges we have to take the following steps:

- Prepare a clear plan of action on water and sanitation with all key stakeholders involved on the protection and maintenance of the water source system.
- Information from all stakeholders to be registered and with access through public domain.
- Proper training to community on water, sanitation and hygiene practices, through Media TV, Radio, campaigns, advertising, wall painting display on water quality information.
- Supporting panchayat and CHWS/GKS to be given training and provide with financial, technical and administrative support.
- Demonstrations need to be done on a large scale in collaboration between research institutions, community and government. All stakeholders are to pick this model up.
- Strong convergence of line departments like Health, PRI, Water resources, Sanitation, Education, NGOs and CBOs.
- Regular monitoring of programs by and with Govt, and developing an alliance on improved water and sanitation provision - Further such meetings will help this.

Wrap-up

The concluding session had the presence of Ms. Shairose Mawji, Chief of Odisha UNICEF. She appreciated the gathering and the energy of the participants to involve on the subject of the workshop. She said that the presentations rightly reflected the issue and the next steps would be crucial considering the risks involved with respect to availability of groundwater. Water quality is an important factor for ecology as well as economy. Addressing water and sanitation can combat diarrhoea incidences among children and increase school days up to 1.9 billion.

Dr. Shukla appreciated the enthusiasm of participants. Safe water supply has been always a subject of concern. Sustainability with respect to water entails quality, durability and safety. To make it available to the community is an onerous task hence joint action is needed to find solutions. Acceptance of "water diviner" or "barefoot hydrologists" may be a long debate but the moot point is that people want water. Therefore setting up knowledge schools can be instrumental.

Ms. Chitra thanked all the members or their enthusiastic participation and hoped that the take home would be to be more open to joining hands with one another in the light of the complexity of the subject and appealed that the energy generated should not end up as workshop but come out as collaboration.

Key learning & recommendations from:

"Exchange Meeting on Safeguarding Future Rural Drinking Water Supply in Odisha"

Bhubaneswar April 29th and 30th 2010

Odisha as a state with abundance of natural resources is blessed with significant water resources. However, the availability of fresh water varies from place to place, based on its hydrogeology and natural resources. At present, clear trends of groundwater depletion are evident. Clear threats to groundwater quality are also evident from water quality sampling undertaken by several different agencies. Hence, sustainability is a key worry for all participants but it was agreed that there is not even adequate understanding yet of groundwater in hard rock aquifers such as those found in Odisha.

Recommendation 1: More research and data collection and sharing are needed for Odisha aquifers focusing on water levels, recharge mechanisms and water quality.

There is a need for documenting best practices in the State and for up-scaling these – these will require key collaboration between Govt and NGO and other organizations. One potential starting point for collaboration can be a 'State of Water in Odisha' report, a regular stakeholders meeting forum for all parties interesting only in better synergy in the sector. The participants indeed saw this meeting as a starting point for increased technical knowledge sharing and data sharing. Each organization at the meeting brought unique abilities to the table e.g. technical ability, grass roots understanding and mobilization, implementation capacity and/or communication skills.

Recommendation 2: Strengthen the alliance of all water and sanitation actors via a regular forum of the meeting participants which can lead to increased technical knowledge sharing and data exchange platform, and help galvanize cooperation and collaboration to address the serious threats facing us.

Groundwater is key to the development (social and economic) of Odish state and it needs active interventions to be protected. Strong political commitment and inter-departmental convergence is required to achieve this. There is a felt need that more momentum needs to be generated to bring about change through committed involvement of all stakeholders. Increased community involvement is essential for improving operation and maintenance but will require substantial hand-holding. One group comprising of Government officials recommended more regular meeting s for convergence and listed a strategy of State level bi-annual meetings for policy decision, with quarterly District/ Block level planning and implementation meetings complemented by monthly meeting at GP/village level for problem discussion and solution action plans.

Recommendation 3 (linked to Recommendation 2): Convergence and capacity building at District/GP/Village levels can cascade downwards from a State level knowledge sharing and dissemination alliance.