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SUSTAINABLE ENVIRONMENTAL SANITATION AND WATER SERVICES

Well monitoring: World Vision's experience in Ghana

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ACCESS TO ADEQUATE and sustainable safe water supply is far from assured in many Ghanaian communities, resulting in high incidence of infections from water borne diseases, especially in rural areas that constitute about 70% of the total population. Only 39% of the population in rural areas have access to safe water (Ghana Vision 2020 Document). Eighty four percent (84%) of the rural population has no pipe-borne water (Ghana Living Standard Survey- GLSS 1992/92). Though the rural population contributes over 80% of the country's food crop production and 60% of its export earnings they still live in extreme poverty. The worst affected being in the Northern Savannah Regions (Ghana Living Standard Survey- GLSS, 2000).

To supplement the Ghana Government's drive to provide potable drinking water to the deprived rural people, World Vision Ghana- Ghana Rural Water Project (WVG-GRWP) has since 1985 provided over 1,600 drilled wells fitted with hand pumps in rural communities as well as in some health and educational institutions. The bulk of drilling has been in the Greater Afram Plains. Since 1999 WVG has focussed attention on the Northern Region which has recorded the highest incidence of guinea worm infections. Savelugu-Nanton, West Mamprusi "Overseas" and Gushiegu-Karaga Districts are the current areas of operations.

The people of the area mostly depend on hand-dug wells, surface dugouts and streams for their domestic water supply. These sources dry out midway through the dry season, which lasts for about 7 months (November-May). This compels the rural folks to travel several kilometres (averagely 7km) to look for water in whatever form it may be.

This paper discusses some observations of a pilot-monitoring programme initiated by GRWP in the 'Overseas' area of West Mamprusi (WMO) District and some communities in the Gushiegu-Karaga (G/K) Districts from May 1999 to May 2002.

Climate and hydrogeology

During the period under study weather conditions have been very dry, especially from December to February, with annual temperatures ranging between 20.4-40.2°C. Annual rainfall within the same period has been 5.6-376mm in G/K and 11.2-203.5mm in WMO. It is estimated that 10% of annual precipitation goes into streams and rivers as run-off and 2-4% infiltrates to recharge the groundwater system. Evaporation and transpiration account for the rest (Van-Ess, 1982).

The areas are underlain by the middle Voltaian unit of the Voltaian Sedimentary Basin rocks. These rocks are predominantly green to grey silty feldspathic sandstones and shales.

The groundwater occurs in slight to moderately fractured semi-confined aquifers that occur discretely. The rocks have lost their primary porosity and permeability due to an appreciable level of metamorphism that the rocks have suffered. As such they produce water of between 9-200L/min and 12-100L/min in the Gushiegu-Karaga and West Mamprusi Districts respectively (Kwei, 1997). Static water levels range between 1.6-17m in the Gushiegu-Karaga area whilst in the West Mamprusi area it is between 0-19m. The aquifers are recharged mainly by infiltration from rainfall (Van-Ess, 1982).

Well monitoring

Most rural water supply agencies in Ghana do not effect periodic well monitoring to ascertain the performance of the wells and the water quality except for the initial water quality investigations they conduct. This is due to the high cost involved ($100 per water sample). This cost is undoubtedly unbearable for both the communities and the water agencies. One other reason is that some of the agencies are only contracted to drill for the communities. Continuous use of the boreholes leads to a drop in the water levels and a change in the water quality due to infiltration, leaching of compounds derived from putrefying materials in the soil, water drawn-in from different aquifers and contamination from anthropogenic sources near the point sources.

To ensure user-satisfaction, acceptance and sustainability of the boreholes provided, a partnership programme on well monitoring has been initiated between the beneficiary communities and World Vision Area Development Program offices (ADPs).

The objectives of the well monitoring program is to generate data that will be used to:

i) delineate areas with peculiar aesthetic water quality characteristics which may not be injurious to health but yet could cause a rejection of the water provided.
ii) delineate areas with water quality challenges that may have developed over time. This will enable World Vision Ghana Rural Water Project (WV-GRWP) to provide the appropriate treatment facility where possible.
iii) Identify boreholes with flow rate challenges.

iv) Mobilise rural communities (borehole water users) to get involved in groundwater resource management to achieve sustainable rural water supply.
v) To enable the organisation have a fair knowledge of the borehole water supply situation at any point in time.

Monitoring methodology

The well monitoring programme covered water quality, wellhead changes, rate of pump breakdown, time between breakdowns and repairs and general well site sanitation. The water quality parameters that were monitored are those that pose aesthetic challenges e.g. taste, odour colour, turbidity. These are felt or observable parameters that can influence the acceptance or rejection of the water provided for the people in the communities. A template (Table (i)) capturing these parameters has been designed to gather data on each well for every quarter beginning the month of May every year. Data gathered was interpreted against an initial detailed water quality analysis and hydrogeological information.

Static water levels were measured using well sounders. This was done early in the morning before the people began drawing water from the wells. Data on aesthetic water quality parameters was gathered by interviewing the people at each well site. The people who were interviewed are those based in the communities. They were asked of any observable changes (e.g. colour, taste, odour and hardness) that they might have noticed of the water and how that affects their use of the water. The interviewers verify these perceptions by tasting, smelling, and testing the water with a hardness strip. The aprons, laundry pads and soaks-away were also inspected. At sites with poor sanitation the community opinion leaders and the WATSANs were contacted to identify the possible causes. The community bank account books were also inspected to ensure that they had enough money to meet the cost of repairs in the event of pump breakdown.

Observations by the monitoring team were discussed with opinion leaders and WATSANs.

Discussion

A total of nineteen wells (9 wells in WMO and 10wells in Gushiegu) were monitored. These are wells drilled by GRWP. The wells in Gushiegu were drilled in 1999 whilst those in WMO were drilled in 2000.

Tables 1a & 1b show the average annual drop in static water levels per well over the period. The results reveal that even notwithstanding the contribution of rainfall to recharging the aquifers and as such raising the water levels there is rather a general drop in water levels in both areas (Table 1a &1b). The drops are generally greater for the first year after pump installation than subsequent years. This is mainly due to intensive usage of the wells by people from far and near communities. Except for a few wells which show further significant drops in water levels after the first year, the rest have recorded minimal drops. Even in areas where wells have some aesthetic quality challenges significant drops in water levels have been recorded.

High temperatures and extended dry seasons also caused the early drying up of surface water sources, which could serve to recharge the groundwater system. Extensive bush burning further enhanced surface run-off. The lesser drop in subsequent years can be attributed to the provision of more wells (20 in WMO and 60 in Gushiegu). These wells have eased the pressure on the earlier ones. However wells (WVI 1505 and 1518) which are located in commercial centres show further significant drops in water levels. These wells are continuously under use by more people visiting these centres for business purposes.

Odour and salinity are the main aesthetic characteristics of the well waters. As was gathered from the interviews, these characteristics were not observed to have decreased any much over the years. Turbidity and colour have not been of any challenge. The saline and odour features have not influenced the rejection of the water in anyway, especially when the odour, which is due to hydrogen sulphide, is transient. The study areas have been delineated into zones A & B according water quality and changes in water levels. All wells in zone A of WMO flow all year round except the WVI 1505 and 1518 which are located in commercial centres. Only WVI 1512 in zoneB flows year round. The others yield very little water (70L/Day) in the dry seasons. The people from this community thus depend on WVI 1512 for water and as such the further significant drop in water level; notwithstanding the odour problem. Aesthetic quality is not a problem in the Gushiegu area. All wells in zoneA produce very little water (140L/day) in the dry seasons whilst wells in zoneB flow all year round.

No hand pumps were recorded to have broken-down since their installation. The pumps were greased at least monthly. Most of the communities do not consciously and consistently keep records of the performance of the wells. This is because they have not been educated enough on the importance of monitoring and good record keeping of the water facilities.

Conclusions

The well monitoring programme has shown that though some communities have been provided with potable water their water needs are still not satisfactorily met since some of the wells yield very little water during the dry season. Monitoring and record keeping on water facilities in the communities is almost non-existent. Also the areas under study have been delineated according to year- round productivity of the wells and the aesthetic characteristics of the water produced from the wells.

Way forward

To ensure that monitoring is done effectively

i. ADP staffs have been trained on well monitoring skills and will be equipped to monitor the wells .

Table 1a. Monitored annual static water levels and some aesthetic characteristics Ghana rural water project

WELL MONITORING											
ADP:WEST MAMPRUSI OVERSEAS											
DISTRICT:WEST MAMPRUSI											
COMMUNITY/ WELL #	May-2000 *SWL (m)	May-2001 SWL (m)	May-2002 SWL (m)	Well depth (m)	Yield (l/min)	Taste	Colour	Odour	Hardness mg/l	Fe (total) mg/l	Mn (total) mg/l
ZONE 1											
Loagri #(1505)	6.68	8.04	9.76	31.0	20	Tasteless	clear	nil	50	0.02	0.05
Loagri #(1518)	6.5	7.18	9.73	27.0	55	Tasteless	clear	nil	50	0.01	0.034
♦Yagaba(WVI)	7.72	9.37	9.97	33.0	??	Salty	Trace	rotten egg	425	NIL	0.770
♦Yagaba(1517)	7.63	9.99	11.02	34.0	184	Salty	Trace	pungent	150	0.04	0.276
♦Yagaba(1520)	7.68	10.09	11.53	30.0	17	Salty	Trace	pungent	120	0.05	0.446
♦Yagaba(1511)	7.75	10.12	11.88	34.0	84	Salty	trace	pungent	120	0.61	0.001
ZONE 2											
♠Zanwara(1519)	2.46	13.78	15.75	34.0	15	Tasteless	cloudy	nil	50	0.08	0.009
♠Zanwara(1510)	2.84	6.64	8.12	31.0	38	Tasteless	cloudy	nil	50	NIL	NIL
♦Kubori(1512)	9.04	10.13	13.07	43.0	10	Salty	clear	rotten egg	150	0.02	0.02

* SWL before hand pumps were installed.
'& Wells that yield very little in the dry season.
f& Wells with aesthetic water quality challenge.

Table 1b. Monitored mean static water levels wnd some aesthetic characteristics

ADP: GUSHIEGU												
DISTRICT: GUSHIEGU-KARAGA												
COMMUNITY/ WELL #	1999 *SWL (m)	May 2000 (m)	May 2001 (m)	May 2002 (m)	Well depth (m)	Yield (l/min)	Taste	Colour	Odour	Hardness mg/l	Fe (total) mg/l	Mn (total) mg/l
ZONE1												
Nakunga-(1369)	4.54	27.56	30.93	34.26	48.0	48	Tasteless	Clear	Nil	50	0.04	0.04
Nakunga-(1378)	4.54	22.79	23.54	26.31	28.0	15	Tasteless	Clear	Nil	50	0.02	0.003
Kpahikpaba-(1381)	5.97	20.19	31.40	40.12	43.0	10	Tasteless	Clear	Nil	50	Nil	0.01
Gumonayili (1368)	5.29	14.39	19.25	22.08	27.0	16	Tasteless	Clear	Nil	50	Nil	0.025
ZONE 2												
Nyensong (1362)	2.36	5.52	6.55	7.22	28.0	10	Tasteless	Clear	Nil	120	0.01	0.012
Nyensong (1371)	2.13	5.92	6.30	6.93	42.0	16	Tasteless	Clear	Nil	75	0.02	0.146
Zantele(1374)	3.90	7.28	8.77	9.31	46.0	78	Salty	Clear	Nil	120	0.01	0.108
Zantele(1379)	3.16	6.87	7.96	9.92	55.0	75	Tasteless	Clear	Pungent	25	0.08	0.012
Zeei(1384)	10.82	14.21	16.94	17.89	67.0	15	Salty	Clear	Pungent	50	0.08	0.011
Pumo(1376)	7.50	11.83	15.30	16.35	73.0	24	Tasteless	Clear	Pungent	25	0.1	0.038

'& Wells that yield very little water in the dry season. f& Wells with aesthetic water quality challenge.
* SWL before hand pumps were installed.

Table I. Sample well monitoring data collection sheet

WELL MONITORING DATA COLLECTION FORM										
DISTRICT: West Mamprusi Overseas										
CLUSTER/ZONE:										
DATE/ TIME	WELL # WVI	COMMUNITY	WATER LEVEL (M)	TASTE	COLOUR	ODOUR	FUNCTIONAL STATUS		YIELD (L/min)	REMARKS
							YES	NO		
18/05/2000 0645GMT	1369	Nakunga	34.26	none	Milky and cloudy	nil	YES	-	140L/day	Clean site. Flow rate very low. Pump head in good shape and greased a week ago.

ii. Community pump maintenance Volunteers and WATSAN committee members are to be trained on well monitoring, record keeping, their importance.
iii. A study to identify recharge groundwater source is being undertaken.
iv. Wells that have yield challenges will be replaced after further more intensive exploration
v. The lessons learnt from the pilot monitoring will be shared with the District Assemblies and other water agencies.

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