Briefing note

WaterAid

Strengthening WASH services and community resilience through community-based water resource management

This briefing note describes the early experiences of a community-based water resource management (CBWRM) initiative carried out by WaterAid's Regional Learning Centre for Water Resources in Burkina Faso. The approach aims to draw water, sanitation and hygiene (WASH) and water resource management (WRM) practices closer together, positioning WASH as a mechanism for delivery of WRM. WASH approaches have traditionally focused on provision of water supply assets with limited consideration of threats to water resources. There is a need to strengthen WASH approaches to better take account of ongoing threats. Stronger integration of WASH and WRM is required to achieve this.

Figure 1 Following a discussion on the implications of changing water levels in their community wells, women plot the information collected by villagers. Photo: WaterAid/Richard Carter

Why implement CBWRM as part of WASH programming?

Water availability varies over space and time

The ability to supply water directly from rainfall using rainwater harvesting, from springs and surface water (with or without piped distribution), or from groundwater using hand-dug wells and boreholes, depends fundamentally on the availability of rainfall, surface water or groundwater – in other words on water resources. Both the quantity and quality of water resources vary between areas and over time.

Water resources are under pressure

Numerous changes, trends and threats are affecting water resources around the world. These include population growth and urbanisation, increasing water demands, increased degradation of the environment, high levels of natural climate variability, and the effects of man-made climate change.

In arid and semi-arid areas like Burkina Faso, Mali and Niger, communities may only have a limited number of wells and boreholes where they can access groundwater needed for multiple purposes, not just drinking water provision. Water availability at these points can be limited. In dry periods, there can be long queues and competition for access between different water users. Conflicts between women, livestock keepers and farmers can arise in the absence of operating principles assuring fair access for different users. Livestock can cause pollution of water sources and damage to infrastructure.

Monitoring these pressures locally helps communities make decisions about managing their water

Because the impacts of many of these threats are difficult to predict accurately, it is essential that water resources and the factors that affect water availability are carefully monitored. It is only through such monitoring that well-informed management decisions and operating principles can be used to improve water security[1] and ensure fair allocation of water for different purposes.

Some monitoring of water resources can be carried out by communities, who can use the information generated to improve the management of their own water. Other aspects need support from local governments and technical agencies, but CBWRM, as the name suggests, begins with the community of water users. WASH programmes provide a good starting point for the initiation of monitoring and the establishment of operating principles.

[1] Water security is defined by WaterAid as 'reliable access to water of sufficient quantity and quality for basic human needs, small-scale livelihoods and local ecosystem services, coupled with a well-managed risk of water-related disasters'.

What is CBWRM?

CBWRM is a set of activities and relationships designed to improve local management of water resources, and so enhance water security. These are practical activities that can be carried out locally as part of WASH programming, so that local water security can be improved with fair allocations between different users – even if higher-level institutional capacity is weak. It strengthens WASH programming by factoring multiple uses of water into the design of further improvements to WASH.

CBWRM has the following objectives:

1. Reducing conflict between different water users at water points.
2. Strengthening community operating principles for water use, achieving better coordination and prioritisation of water use between water users.
3. Acting as an early warning system, alerting communities to emerging threats.
4. Informing the design of WASH services to meet multiple water needs (MUS).
5. Strengthening the voice of communities to call for assistance when access to water is threatened.

CBWRM activities consist of:

- Understanding where the approach can best add value.
- Bringing communities together to understand collectively the needs of different water users.
- Collectively understanding possible threats to water resources and water supply infrastructure.
- Monitoring water resources and related factors, by communities and specialist institutions.
- Planning and management decisions taken by communities to mitigate threats to water supplies, with support from local governments, non-governmental organisations (NGOs) and regional specialist agencies.
- Strengthening the voice of communities to call for assistance from higher authorities.
- Complementary improvements to water supply and sanitation services, and hygiene practices (jointly referred to as WASH).

Monitoring may include observations of:

- Rainfall, usually on a daily basis, by community volunteers.
- Groundwater levels in open wells, usually carried out weekly, by community volunteers.
- Groundwater levels in boreholes, often monitored hourly using data loggers managed by specialist government agencies.
- Spring or stream-flows, carried out at least monthly by community members with or without assistance from technicians.
- Water abstractions, carried out through a periodic water use survey, by local governments, NGOs or other technical personnel.
- Watershed (especially upstream) land use changes, monitored by technical agencies over the long-term (decades) using remote sensing.

Management decisions at local level can include any or all of the following:

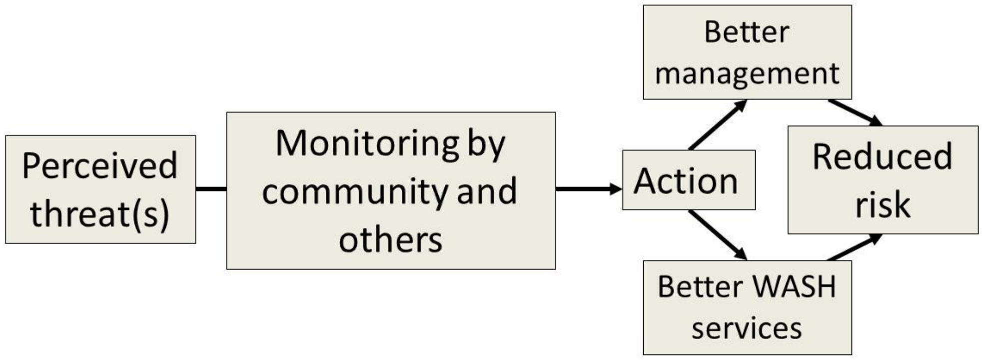
- Enforcing protection of water source catchments to protect water quality and quantity.
- Agreeing allocations for different water uses and different users.
- Rationing of water when it is known to be in short supply.
- Temporarily restricting certain water uses, eg brick-making, when water is scarce.

These types of management decisions can only go so far, so it is also important to consider physical and behavioural improvements to WASH, including:

- Investing in domestic rainwater harvesting.
- Deepening or constructing hand-dug wells.
- Borehole construction.
- Constructing water conservation structures to enhance natural recharge.
- Bringing about total sanitation, to eliminate faecal contamination of the local environment.
- Improving hygiene practices, especially around domestic water management, handwashing and food hygiene.

Figure 2 shows the logic of CBWRM – how monitoring of perceived threats facilitates rational water management decisions and complementary WASH interventions, which ultimately enhance water security by reducing the threats perceived at the outset.

Figure 2 The logic of CBWRM



The policy/practice linkage

The key relationships are those formed between communities and their representatives; local governments; local and international NGOs; and national government ministries and technical departments. Each of these has a part to play in monitoring, taking joint management decisions, carrying out improvements to WASH services, advocating wider implementation of the approaches set out in this briefing note, and advocating corresponding changes to national water sector policies and guidelines.

Figure 3 Roles of institutions at different levels

Institutional level	Role
National government ministries and technical departments	• National-level collation of monitoring data from community and government sources • National-level planning and resource allocation for threat mitigation • Regulation and catchment-level management
Local governments and local/regional technical bodies	• Technical support to communities for monitoring • Monitoring of boreholes using level loggers • Supporting communities with enforcement of operating principles • Mitigation of threats to water supply • Expansion of WASH coverage
NGOs	• Facilitating initiation of CBWRM together with local and national government • Providing initial training in monitoring and needs assessment • Supporting communities to identify threats to water supplies and possible mitigation strategies
Communities	• Identification of threats to water resources • Development and implementation of equitable operating principles that effectively coordinate water use between different users • Monitoring of rainfall, wells and surface water • Risk-based planning • Voicing need for improvements to WASH infrastructure to higher authorities

WaterAid's West Africa CBWRM project

WaterAid and Oxfam GB developed a multi-country CBWRM project in six countries: Burkina Faso (WA), Chad (OGB), Ghana (WA), Mali (WA), Niger (OGB) and Nigeria (WA). Medicor Foundation provided $350,000 of funding over 18 months, commencing in January 2011. This project focused on managing community water supply services within highly variable climates – with the central aim of improving water resource management through better groundwater monitoring, management and retention, and re-use of rainfall. Lessons from these projects would be shared and replicated across other drought-prone countries in different regions (where appropriate), to help ensure WASH services, once delivered, continue to function indefinitely.

The Burkina Faso component

In Burkina Faso, the project was carried out in Tenkodogo and Lalgaye communes. WaterAid has been working with three communities in the communes – Sablogo, Basbedo and Kampoaga – since 2006. To date, WaterAid has provided basic water supply and sanitation facilities to a significant proportion of the communities' 7,549 people (1,166 households).

The CBWRM project built on these earlier project activities, which were more focused on the provision of infrastructure (wells and sand dams). The project worked directly with:

- Community volunteers and water user associations in the three target villages.
- Representatives from Tenkodogo, Lalgaye and Comin Yanga communes[2].
- Local partner NGO, DAKUPA.

Activities undertaken included:

- A survey of 150 households across the three villages to assess collective water use, conducted by the project team.
- The establishment of a committee to document and monitor implementation of the project.
- Water resource monitoring training for six community volunteer water resource observers, six members of water user committees and five animators from DAKUPA, between December 2011 and March 2012.
- Support from the National Meteorological Authority, which installed nationally approved rain gauges in each village and provided forms to record rainfall data in line with national standards.

In Tenkodogo and Lalgaye, communities were highly motivated and there was a real demand for improved water resource management. This helped drive the project forward in these areas.

WaterAid wished to assess the success or otherwise of the intervention after one year and to share and disseminate findings with local authorities and a broader audience at national and international levels.

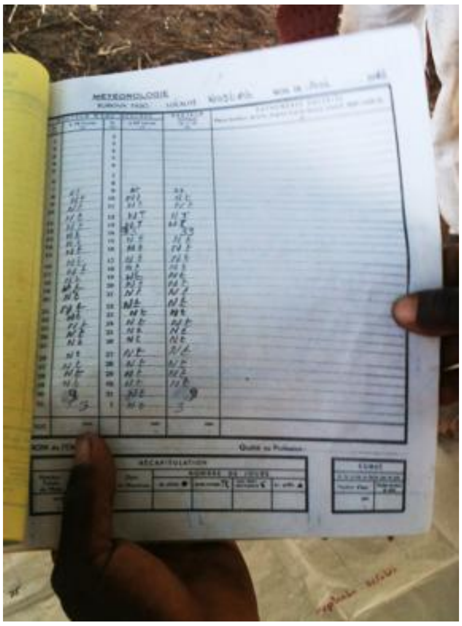


Figure 5 (left) A Dakupa field officer positions a rain gauge in Kampoaga village. Photo: WaterAid/Vincent Casey

Figure 6 (right) Daily rainfall records maintained by community volunteers in Sablogo. Photo: WaterAid/Richard Carter

[2] Comin Yanga commune was involved as an observer and a potential area for extension of the project.

Figure 7 (left) An India Mark II handpump modified for installation of water level loggers. Photo: WaterAid/Richard Carter

Figure 8 (right) A technical officer from DRAH downloads water level logger data for analysis of groundwater level fluctuations. Photo: WaterAid/Vincent Casey

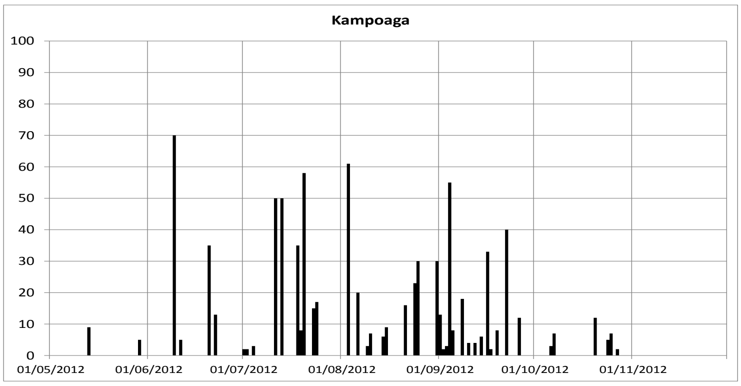
Monitoring results – examples

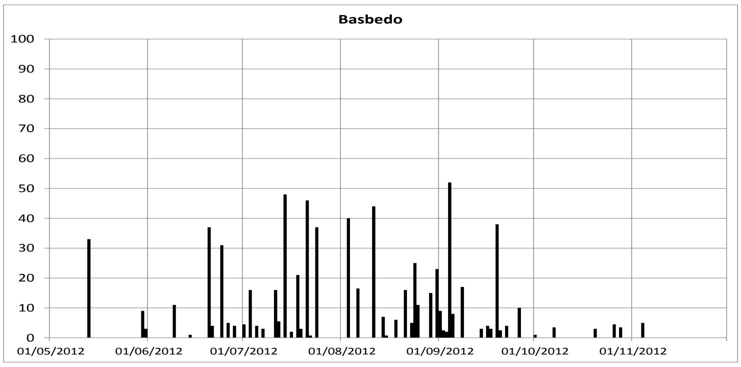
The villages of Kampoaga, Basbedo and Sablogo lie along a west-east line extending over a distance of about 16 kilometres. Observations of rainfall, hand-dug well water levels and borehole water levels are ongoing. The following data has been captured over the period December 2011 to December 2012, incorporating the rainy season, which extended from mid-May to early November 2012. Rainfall data is summarised in Figures 8 and 9.

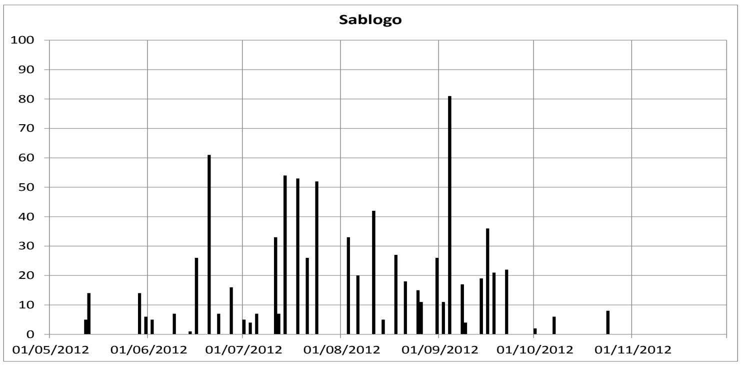
Figure 8 Selected rainfall statistics for Kampoaga, Basbedo and Sablogo, 2012

Variable	Kampoaga	Basbedo	Sablogo
Total rainfall May-October	826mm	730mm	827mm
August rainfall as a percentage of total	25%	29%	24%
Number of rain days (non-zero)	46	54	40
Number of days with at least 5mm rainfall	32	28	32
Number of days on which all three stations received some rain			20

Figure 9 Rainfall data for Kampoaga, Basbedo and Sablogo, 2012
[Approximate distance Kampoaga-Basbedo 9.7km, Basbedo-Sablogo 7.1km]







Figures 10-12 show the well water level data (monitored weekly) together with the preceding seven day rainfall totals for Kampoaga, Basbedo and Sablogo respectively.

Figure 10 Kampoaga seven day rainfall and well water levels (well dried up mid-April)

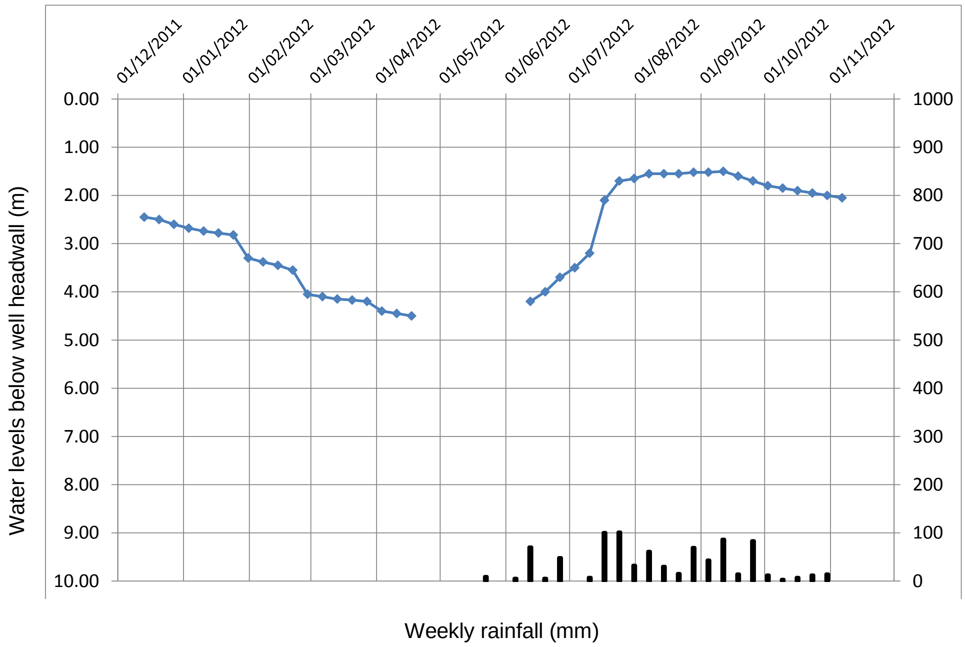


Figure 11 Basbedo seven day rainfall and well water levels (well 3 dried up mid-Feb and was deepened)

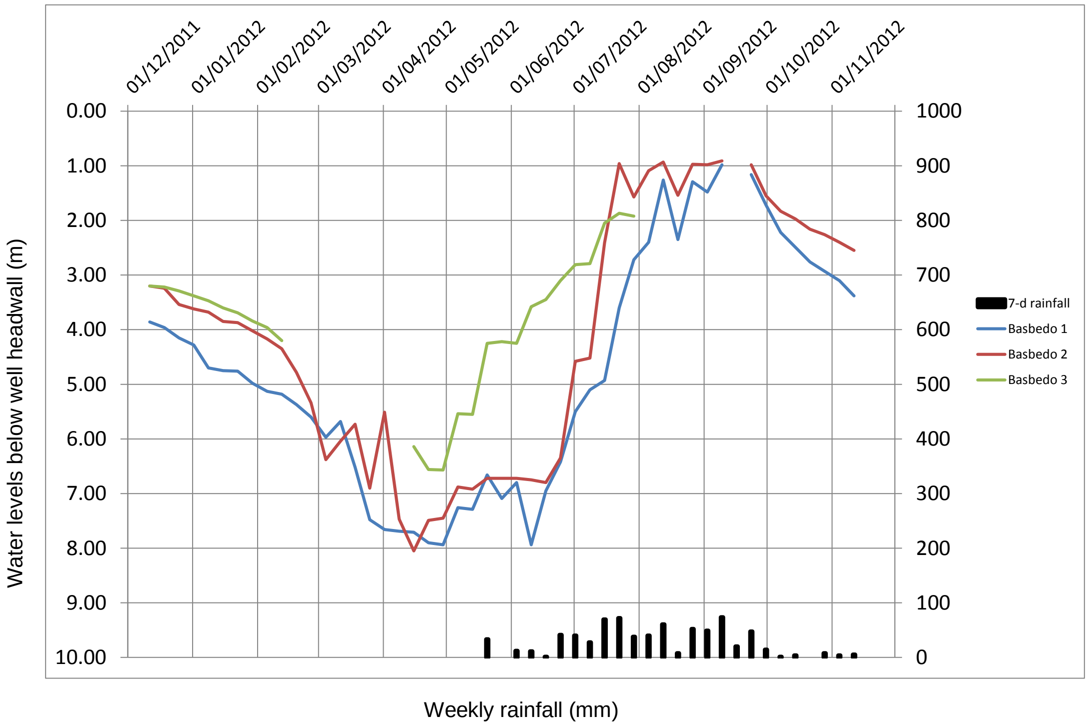
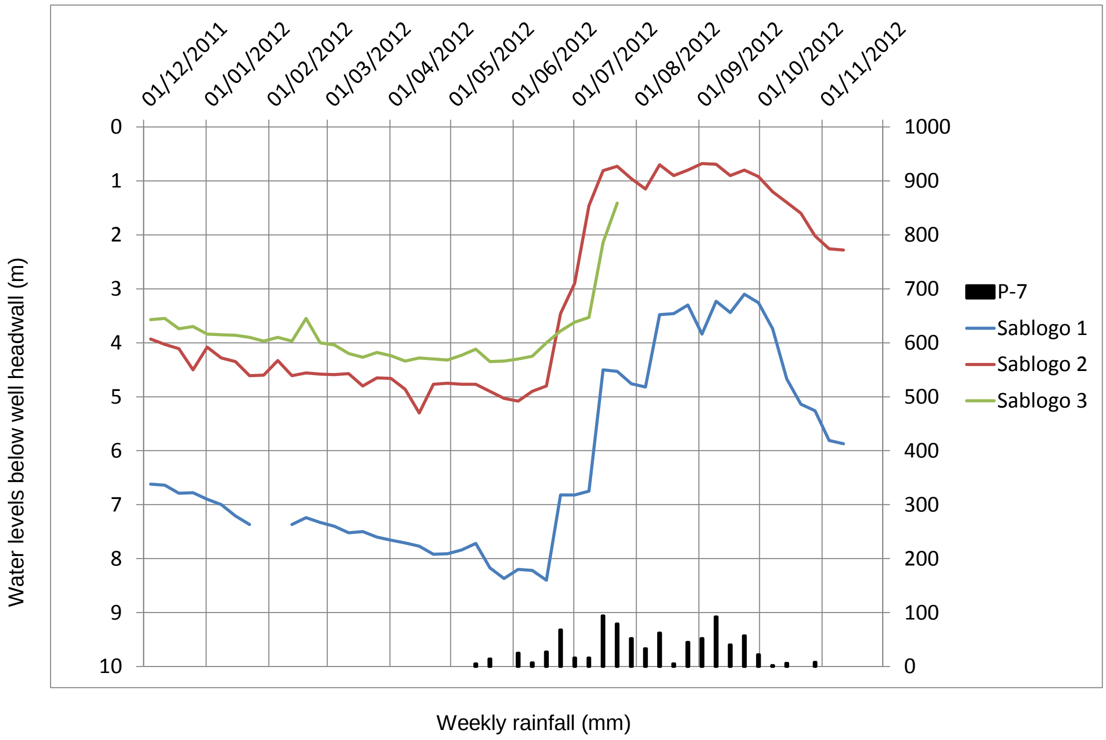


Figure 12 Sablogo seven day rainfall and well water levels (gap in record for well 1 due to lecteur's absence)



Water levels in all seven wells show a steady decline in the dry season, followed by a rapid response to rainfall (and perhaps local runoff) in the wet season. At Kampoaga and Sablogo, water levels begin to rise in early June (after only 14 and 39mm of rainfall have been measured locally) while at Basbedo the response is even earlier (early May), after no rainfall has been recorded in that village. This suggests that indirect, as well as direct, recharge may be contributing to the rise in water levels.

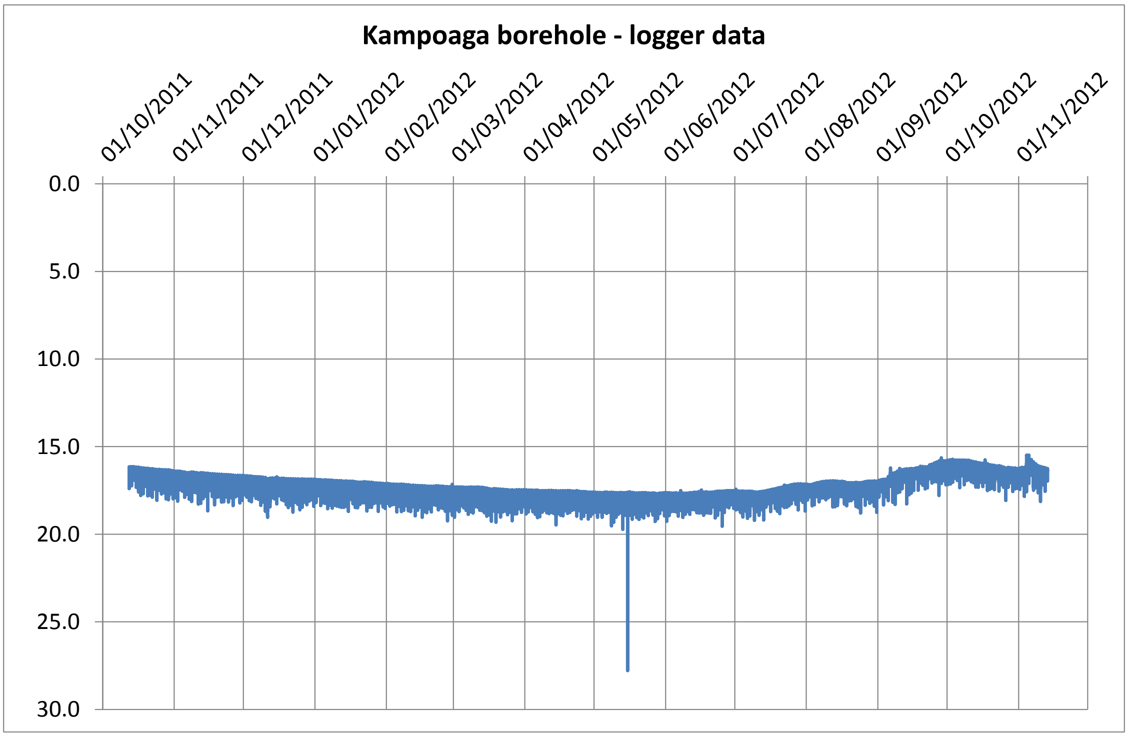
After peak water levels are reached, the initial fall is steep from early October at Basbedo and Sablogo, but less so at Kampoaga. The difference may be attributable to different aquifer permeabilities between the sites, with slower natural discharge at Kampoaga due to lower permeability.

Figures 13 and 14 show the borehole logger results for Kampoaga and Basbedo (the Sablogo data is suspect, and attempts are being made to understand the cause of the problem). The upper graphs in each case show the full season's record (October 2011 – November 2012), while the lower graphs show the water levels for one week (17-23 April 2012) at the height of the dry season.

Over the dry season, water levels in both boreholes follow shallow downward gradients, with water levels stabilising in June and starting to rise by the beginning of July. Water levels reach their highest in October or November, before (presumably) starting to fall again during the dry season. The short period records for both boreholes show drawdowns due to daily abstraction of 1.5-2 metres, implying transmissivity values in the order of $3m^2/d$ [3].

[3] Using a pumping rate of $5m^3/d$ in the steady-state Logan equation.

Figure 13 Kampoaga borehole logger data



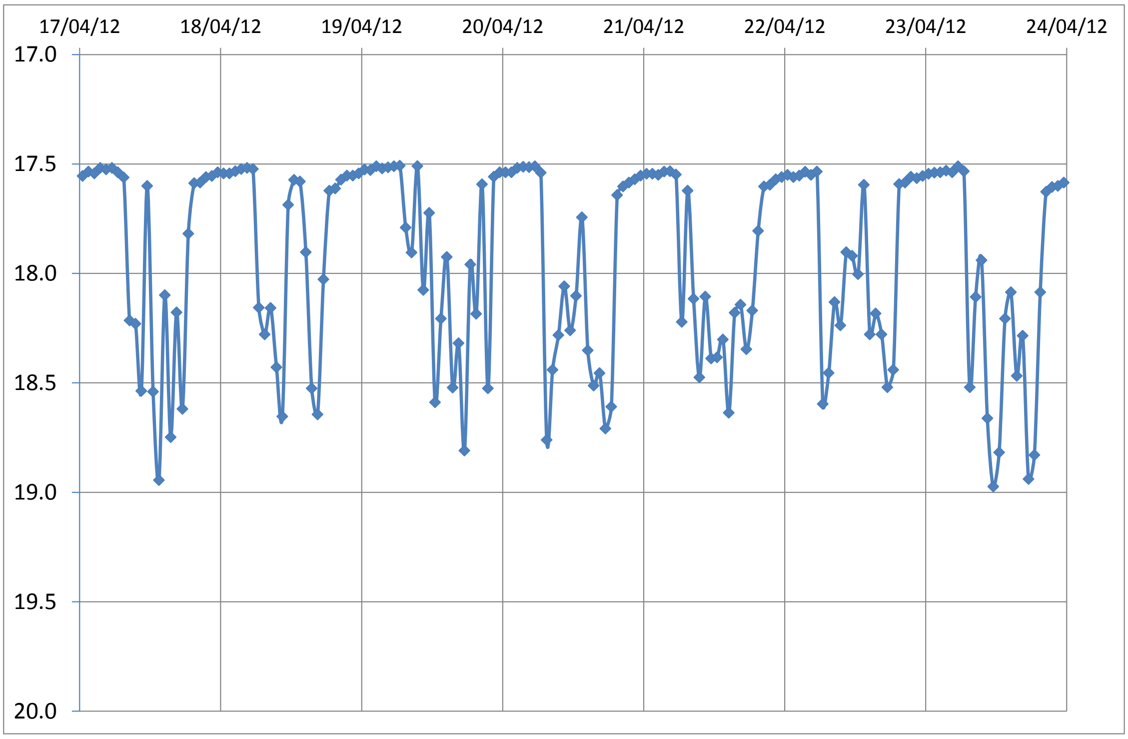
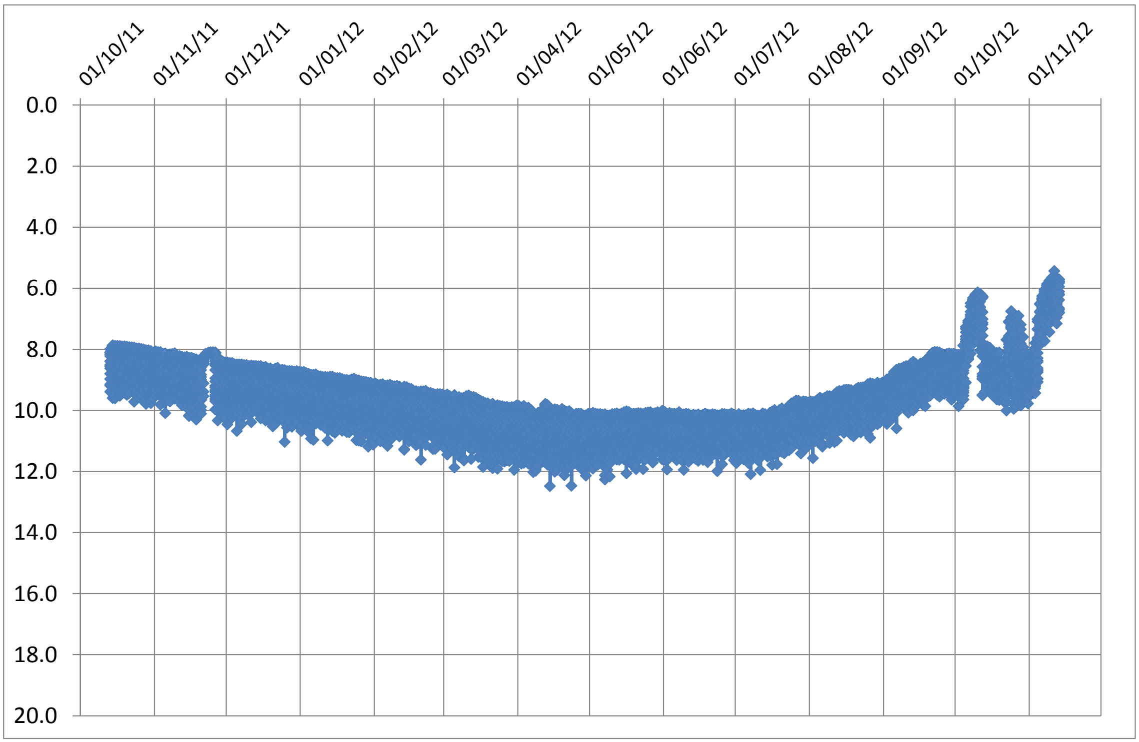


Figure 14 Basbedo borehole logger data



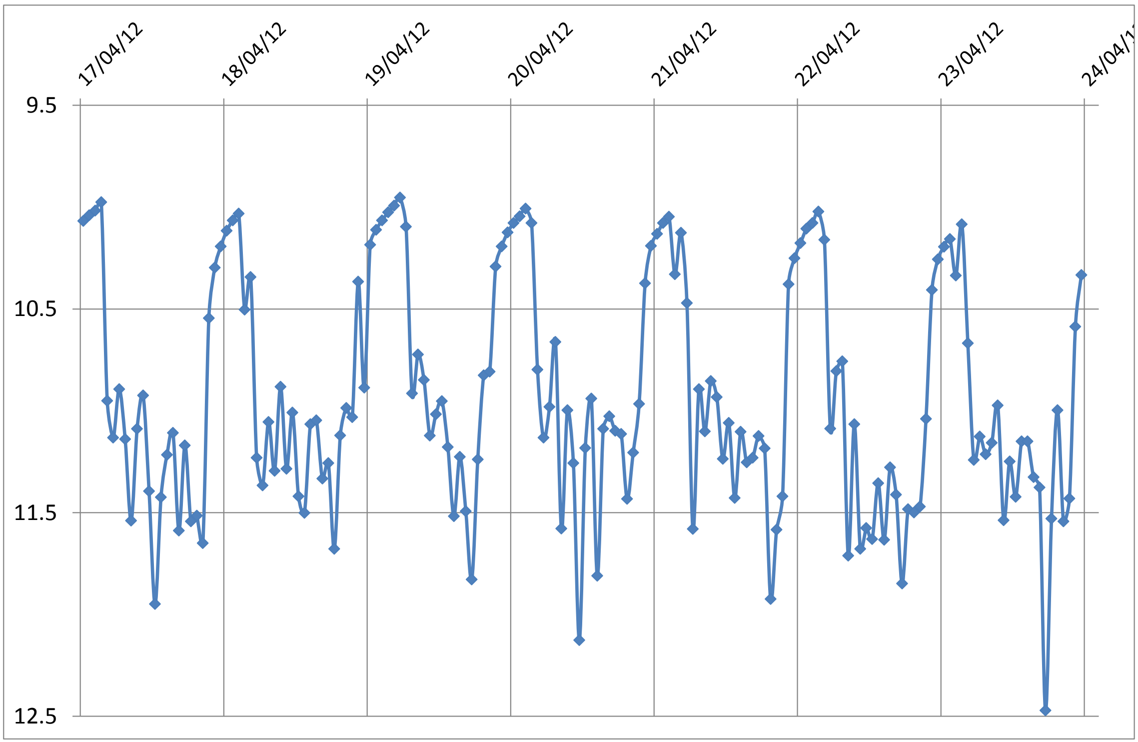
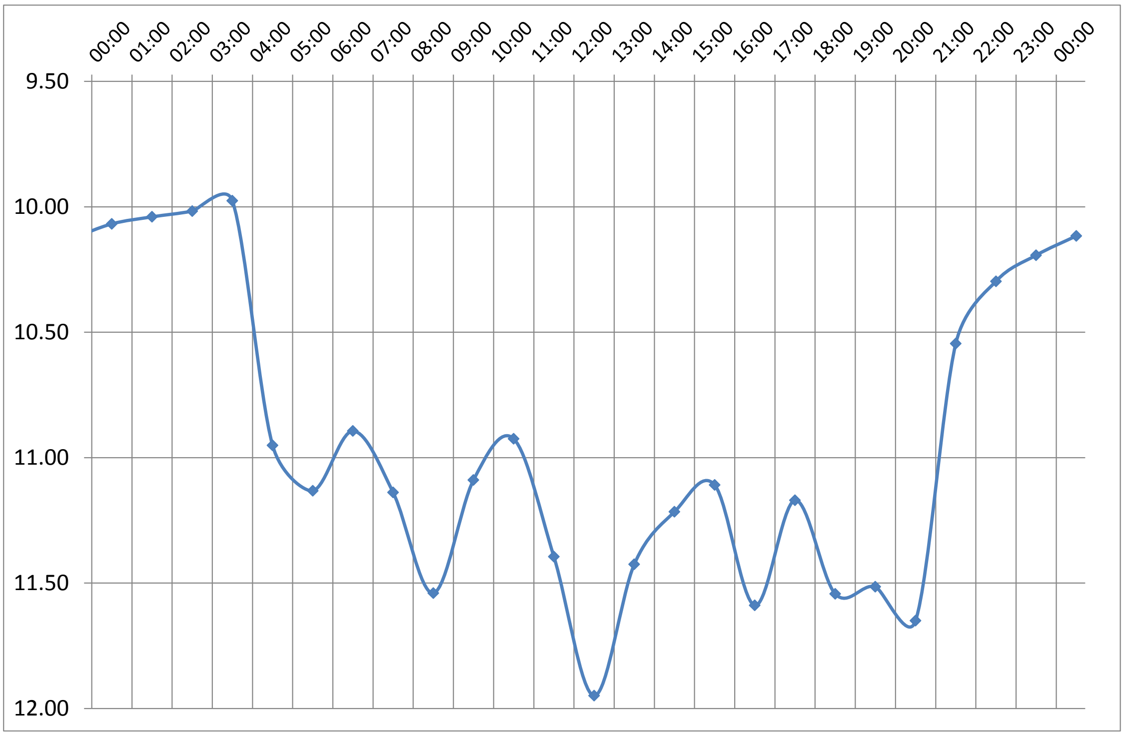


Figure 15 shows an hourly record for Basbedo for one day in April 2012, clearly showing the periods of heavy pumping (from 0330 to 0800 and again from 1030 to 1230), and the recovery of water levels after about 2030.

Figure 15 Hourly water levels on 17 April 2012 at Basbedo



Interpretation of data

Taken together, the data shows the following general findings:

1. Rainfall is spatially variable over quite short distances, as is well known in the tropics and elsewhere.
2. Well water levels respond quickly to local rainfall-recharge, and, probably, to indirect recharge from river flows and flooding of the valleys (bas-fonds).
3. After the rainy season high water levels, groundwater level recession in some of the wells is steep, leading to potential difficulties of water access in mid- to late-dry season.
4. Borehole water levels decline relatively slowly in the dry season, and they respond quickly to rainfall in June-July.
5. Diurnal variation in water level in the boreholes is caused by morning peak pumping (from about 0330h) and steady usage through the day, with cessation of pumping and recovery taking place after about 2030.

Using local monitoring data to inform management decisions

The three communities all claim to understand the seasonal variation of rainfall and groundwater levels much better since they have started monitoring and plotting data. In Basbedo, for example, which has three boreholes and a number of hand-dug wells, the main concern is that the latter may dry up prematurely if abstractions are not controlled during the dry season. To date, the boreholes have not failed (other than occasional mechanical problems, which have been addressed). Community-level monitoring focuses on two hand-dug wells on the eastern edge of the lowland (bas-fond) and one more within the bas-fond near to a small sand dam. Monitoring of water levels has led the village to prioritise drinking water abstractions and access for women in the latter part of the dry season, and take steps to reduce competition and conflict (by restricting users to one water container at a time so that all receive some water, rather than the first taking it all) when water is scarce. Sanctions have been introduced for water users who do not abide by these operating principles and these are implemented by the water user committee. As well as informing decision-making about water use, communities report that monitoring has helped them to make decisions about when to plant certain crops, which is another motivating factor for keeping data collection going.

Complementary water supply and sanitation infrastructure

Regarding previous WASH interventions in the communities, it is very unlikely that the sand dam has any significant impact on water resources, as the size of the sand body it has created is very small. It may be that the hand-dug wells built for Basbedo could have been beneficially sited on the east side of the bas-fond, closer to the village, rather than on the west, near the sand dam, but a longer walk from the village. Although a geophysical survey was undertaken to site the wells, a better conceptual understanding of the hydrogeological setting could have guided this process more effectively.

The wider watershed

In the Burkina Faso project, no work has yet been carried out to map and understand the watershed that feeds the valleys running south through the project area. It will be important to carry out such investigatory work, and perhaps collaborate with local authorities or other NGOs on watershed management and protection to conserve downstream water resources.

Enhanced water security

So far, the outcomes of the project for the three communities in Tenkodogo and Lalgaye communes are as follows:

- Each community has trained water monitors/observers making regular measurements of rainfall and groundwater levels.
- The regional office of the Ministry of Agriculture and Water is undertaking monitoring of borehole water levels using automatic data loggers.
- Community representatives, local government (commune) authorities, WaterAid and implementing partner, DAKUPA, sit together in a ‘documentation and monitoring’ committee, chaired by the Mayor of Tenkodogo. This committee monitors project progress and gives force to the decisions taken for the benefit of communities.
- Water management decisions are starting to be taken, and acted on.
- There is better integration between WASH service implementation and water resource management.

More needs to be done, and it is too early to conclude that the project is an outright success. However the first year’s results are very promising, giving confidence to scale up in Burkina Faso to a larger number of communities. The approach will also be applied with appropriate modifications for context in some or all of WaterAid’s East African countries from 2013.

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