Rural Water Supply Network

Water Point Mapping: Indicators, pump functionality, accuracy of GPS, using and sharing data

Synthesis of discussion and activities: May & June 2014

Introduction to the rwsn mapping topic

The mapping topic was created in August 2012 and has rapidly established as a strong visible element of the rural water supply network. The main component of the mapping topic is the Dgroups platform, which enables members to discuss technical, policy and management issues around water point mapping, monitoring and reporting. Members share data, analysis, insight and knowledge from mapping activities including the indicators, approaches, methodologies, technologies, and mechanisms for sustaining inventories. The group works towards making data available and accessible to all stakeholders, developing the environment where data can be used to inform resource allocation and planning decisions, and monitoring the improvements in equitable and sustained access to rural water supply.

In May and June 2014 the mapping group discussed a range of issues and shared various country specific knowledge, data and research. Key discussions on measurable indicators, GPS accuracy, water point monitoring, pump functionality, and effectively using data are summarised below. Group members discussed the potentials and pitfalls of technologies to collect, update, and share data, and highlighted the importance of resilient processes in all areas of water point mapping and updating data. Members raised the necessity of standardising indicators and better using and sharing data across the sector.

This synthesis aims to present points made in the group discussions and consolidate them within thematic areas, but does not seek to draw conclusions from the content.

Indicators for monitoring rural water supplies

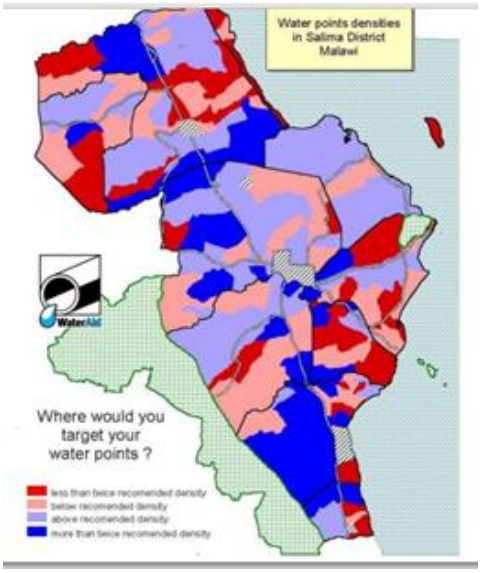
What is much more important than GPS accuracy, is how we can simplify the process of data collection - the whole discussion about rationalising indicators

-Shiriin Barakzai

Types of indicators to monitor

Consensus was established for monitoring the location, water point type, pump type and technical indicators on yield, quality and pump condition. Other indicators suggested by Bill Turner included aquifer diffusivity, the well identifier, surface elevation, geology, daily use from well, pumping rate (by electric meter data and by diesel fuel consumption), owner and depth to water. Rupert Coler emphasised that information about underlying geology is important, writing "As a rig supplier this is very helpful for me to make sure I recommend my clients the correct equipment and tooling when they purchase our rigs", and suggesting this is also helpful for drilling any well. Supporting this, Jim Anscombe wrote that in Zambia "even the better projects don't log the geology properly - so it's often difficult to work out just what underlies your area of interest".

Water Point density in Malawi, shared by Steven Sugden, WaterAid 2003



Indicators suggested

Jim Anscombe has fine-tuned a set of indicators during the process of four UNICEF infrastructure assessments divided into 4 platforms: technical, social, institutional and financial. Mark Westra added that some people also monitor environmental factors, usually to assess how wastewater is handled, if aquifers can be polluted by the waste water, and if aquifers are depleted.

Measuring water point density

Steven Sugden posted that a 2003 water point mapping programme in Malawi indicated uneven water point density was an indicator of equity. Steven uploaded the findings and asked if others had found similar evidence. Bill Turner responded that distribution can be caused by geological factors. He cited technical papers from Nigeria, and gave an example of using unevenly distributed termite mounds in Mali to indicate water sources.

Standardising indicators across the sector

Sean Furey wrote that in Liberia a common standard would help enormously because a number of different mapping systems are being used. Robert Coler pointed out that the challenge will be in creating a dataset that isn't too complex to accurately collect as the knowledge and experience of the person gathering the information on the ground will vary wildly. The potential for a standardized set of indicators was raised by Brian Banks and widely

supported by the mapping group members. More information on the WASH DataPoint initiative can be found here http://www.sustainablewash.org/initiatives/wash-datapoint-pilot.

Mobile phones

Many discussants agreed that mobile phones can facilitate the improved collection of agreed indicators, simplify the data collection process and help ensure higher quality of data collected, and help to harmonise indicators across the sector. Data collected on a mobile phone and uploaded to a web-based database can facilitate improved sharing of data.

Factors affecting pump functionality

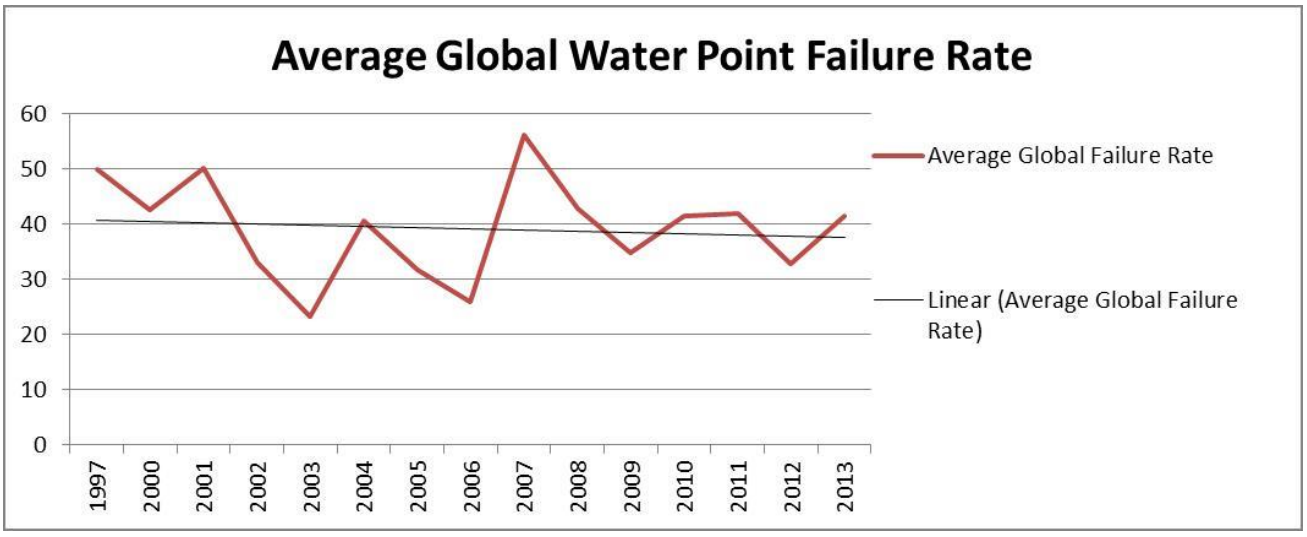
Dots will continue to change from green to red at more or less the same rate until fundamentally something happens to alter water point management systems

-Steven Sugden

The state of play

Enoch Cudjoe highlighted learning from a pilot assessment conducted across three districts by IRC in 2011, which revealed 30-35 percent of all water systems not functional at any given time and in many cases repair response times exceed several weeks. Reporting on the 2013 Sector Performance Report for Malawi, Boyce Nyirenda identified similar failure rates, with 30 percent of water services non-functional at any given time. Steven Sugden remarked that the dots on maps will continue to change from green to red at more or less the same rate until fundamentally something happens to alter water point management systems.

Susan Davis shared a graph communicating that the average global failure rate for water points in developing countries has varied over time, but the trend line shows failures have only slightly decreased from 1997 to 2013. These averages are based on summary data from 124 functionality studies globally.



Factors affecting pump functionality

A topic of great interest to the mapping group is the factors which result in poor levels of rural water supply services. Rossa O'Keeffe O'Donovan highlighted the preliminary findings of his PhD research on the effect of pumps isolated from each other, and how this may inhibit the ability to share maintenance. The research identified pumps further from a capital city are less likely to be functional.

Efficiency of user committees

Violet Alinda of Care International in Uganda reported an association between water point functionality and the performance of the water user committee, arguing that ensuring communities have robust and efficient user committees is critical to address the challenges. Tedious Chanyowedza, based in Zimbabwe, suggested that to be effective committee members need institutional support at local authority level so that those members who have moved out are immediately replaced.

Corruption and spare parts

Bill Turner reported an incident of political corruption in the Dominican Republic which interfered with pump maintenance, drawing the conclusion that practitioners must make sure they engage with the traditional power structure and make keep government control at bay. Boyce Nyirenda advised to be watchful for corruption as rarely will rural communities challenge their Village Head even when he gets and doesn't pay back his loan from the water point fund, and also to be conscious that while there are a number of reputable construction contractors, we also know there are many cheats. Boyce also reported a decline in functionality rates in Salami District, Malawi, which he attributes to scarce spare parts of the shallow well hand pump (MALDA) installed in the communities.

Community ownership

Lack of community ownership was raised by several members. Jacinta Olweny wrote that one of the major issues affecting functionality of water pumps is the lack of ownership by the beneficiary communities. Tedious Chanyowedza highlighted that community ownership is not imposed but rather it is cultivated: it starts with "Was provision of the facility a Felt Need? If it was a felt need then it means the community participated fully at all stages of project development. From Planning, Identification, Implementation, Monitoring & Evaluation".

Role of NGOs and government

Shiriin Barakzai agreed that whilst fully participatory planning and selection are required, in addition to ensuring that communities are fully aware of the responsibility that are taking on is necessary, it is also necessary to have in place long term post construction support, as sustaining functionality cannot be achieved by relying solely on community based management. Steven Sugden underlined the problems of community based management, writing that whilst working in Malawi they struggled with achieving water point sustainability through implementing community based management systems, and eventually concluded it was simply not the correct management approach to use. Summing up the issue, Yola

Georgiadou of the University of Twente wrote "A service that asks rural communities to participate in endless committee formation workshops and O&M training, to attend refresher courses on pump maintenance, to volunteer to be mechanics or maintenance workers for minimal wage is servitude, not service".

Options for improving pump functionality

Having investigated a wide span of issues which affect rural water supply functionality, the group provided some ideas and strategies for improving sustainability.

Community sensitisation

Ibrahim Ousmane of SNV Mali wrote that community awareness on the utility of safe drinking water is a prerequisite to expressing needs and hence to sustaining functionality. The importance of training and involvement throughout the project cycle with full user participation including women and men, and those with disabilities, was highlighted. Ensuring communities understand their obligations and the reasons why previous programmes have failed was reported by Boyce Nyirenda, who wrote that WaterAid took a year discussing with user communities, district local government, politicians and other key stakeholders why Chagwa Rural Piped Water system, which supports over 15,000 users, failed in Machinga district before embarking on technical rehabilitation.

Training and support

Technical support, support to spare part supply chains and service providers was raised by Boyce Nyirenda, amongst others. Violet Alinda reported that in Uganda there are efforts to promote the hand pump mechanics through training, formation of Association, tooling and skilling. The skills enable participants to be able to assess, undertake minor repairs and report more complex technical issues to the district local governments.

Sustainability snapshot

A tool which provides practitioners with various questions to evaluate likely sustainability and highlight areas to address was recommended by two people as valuable for identifying factors that affect pump functionality. Boyce Nyirenda wrote "WaterAid has developed a monitoring tool known as Post Implementation Monitoring Survey (PIMS). Sustainability Snap Shot and PIMS provide WaterAid with tools through which to better understand the longer term sustainability and use of installed water facilities. Rossa O'Keeffe O'Donovan suggested that it would be interesting to test the tools' predictions, and also hear from people who have used it.

Private sector involvement

Private sector involvement sustaining functionality was suggested. Steven Sugden reported that Water for People in Uganda is using private sector metered hand pumps. By tracking water usage and monetizing consumption, Water for People-Uganda hopes to address the chronic issue of broken water pumps in rural areas by using profit to incentivize operators to repair hand pumps and keep water flowing.

Updating water point status using remote technology

Using sensors to monitor pump functionality was also reported. Robert Lee reported Charity Water currently testing a sensor that is retrofitted to an Afridev handpump. It uses capacitance sensors and reports hourly water volumes to detect fluctuations and breakdowns. The devices are predicted to last at least 3 years and Charity Water will installing up to 5000 sensors in 2015, in conjunction with electronic surveys as well and SMS crowdsourced surveys. Robert Hope's reputable work using remote sensors for measuring rural water supplies of was shared. The report details experiences using motion sensor technology in Kenya throughout 2013 with very positive results, including a ten-fold reduction in handpump downtime.

Accuracy of GPS

How important is the accuracy of GPS location readings? The debate focuses upon the value of mobile phones and whether they provide the accuracy required. A wider discussion ensues about the need for geo-referenced data, and the value of collecting water point data if there is no post-construction support in place to respond to service failures.

While the mapping and data is interesting and important, we always have to ask: What decisions can it influence? What will it change?

- Sean Furey

Using mobile phones to collect location data

Many of the mapping group members have experience using mobile phones for data collection. Luchiri Omoto reported on mapping in 4 counties in Kenya using 100 USD smartphones with accuracy of 5 meters, and Philippe Lacour-Gayette of IDO discussed using iPhone and iPad to collect data in Congo where they found the Apple GPS to be excellent, very much similar to the accuracy of the Garmin unit. Gonzalo Crespo wrote that SIASAR (Rural Water and Sanitation Information System), a World Bank supported project, used Android GPS to geo-reference water points in over 7,500 communities and systems, in Honduras, Nicaragua, Panama and the Dominican Republic. He reported that SIASAR collects and uploads data using a specialized app for Android smartphones or tablets, using the Android GPS to geo-reference water points and communities and claims Android GPS performance is more than adequate for this Project and the technical teams from the countries are satisfied with the Android tool.

John Feighery of mWater commented that GPS accuracy is a big concern for several mWater users. Amitangshu Acharya, Akvo's Asia Hub Programme Manager based in New Delhi, warned that in his experience discussions around accuracy are often politically deployed, and are used by bureaucrats and engineers to stall this inevitable process of democratisation of technology, arguing that the social and political trajectory is more important than technical concerns.

Factors were reported to affect GPS accuracy using mobile phones. These included phone signals, low partner technological capacity and the human factor: untrained users taking inaccurate GPS readings. Jeroen Verplanke outlined the human factor, suggesting people are often too impatient when they record a location and therefore require market GPS tools with

GPS trained staff to do actual positioning of objects in the field. Robert Lee echoed this, claiming the biggest problem in water point mapping that we can control is user error. In response, John Feighery commented that mWater are adapting to this in their latest version of the software, by highlighting and reporting GPS accuracy and editing of the saved location.

Consensus on 15 meters accuracy

Three contributors suggested that a 15m radius is sufficiently accurate. Jeroen Verplanke, of the University of Twente, wrote that as long as the engineers do not need to lay pipes to these water point coordinates, the accuracy should suffice in rural areas where you're not likely find two water points within a 15 meter margin. Luchiri Omoto supported this, suggesting the only people who should be concerned on centimetre accuracy are civil engineers, land surveyors & the military. Additionally, Arjen Naafs commented that only if you want to use the measurements as hydro-geological and groundwater monitoring, is the location needed with greater accuracy than can be provided by mobile phone.

Identification, local knowledge and satellite imagery

GPS locations of water points can be supplemented, or replaced, by other information. Shiriin Barakzai suggests that other identifying data - water supply type - would enable a mapper to correctly work out which one is which once in the field. In Nepal, SNV have used paper based data collection for the past few years and not worried about GPS data, instead collecting sufficient identifying information to know which gravity fed scheme was being assessed. Supporting this, Bill Turner highlights the opportunity to use local, context-specific knowledge for identifying water point locations in cases where GPS locations have failed, and Jennifer Green of MIT reported supplementing GPS readings with satellite imagery, using Google Earth, to map the water system created by Oxfam in one of the El Fasher IDP camps in Darfur, Sudan.

Mark Westra suggested out that the typical accuracy of cell phone GPS is a 15-20 metre radius, which is less accurate than a typical 10-15 metre radius of other hand-held GPS devices. Robert Lee, Charity Water's Director of Special Programs, summed up: 'all the big names out there, and even cell phones, are fine for what is needed in water point mapping.'

Arjen Naafs reported the impact of cell-phone signal experienced within WaterAid's post-implementation monitoring, whereby in 2012 staff struggled with inaccuracy and partially unreliable GPS results due to a combination of software timing out and the difficulty of using A-GPS in rural areas with none or just one network signal available. It was considerably improved by using different software for obtaining GPS coordinates and experiences in Bangladesh and Nepal (where often good mobile phone coverage is available)'.

Shiriin Barakzai reported that although SNV Laos used android phones to map water supplies, they found the process beyond the partners' capacity and are still trying to find a method which can be easily updated on a regular basis, writing that although desirable in the long run, they would not be able to produce realtime updated maps through crowdsourcing.

Other points highlighted the importance of standardizing data when locating water points and using a standard position format. Jeroen Verplanke discussed standardizing data when locating water points, writing that in Tanzania 5% of water points are labelled with incorrect unique

indicators, causing challenges for monitoring. Bill Turner reported 'tagging' in Cyprus with a UI and a metal tag to avoid confusion. Jim Anscombe underlined the importance of using a standard position format when both collecting and visualising data, commenting that WaterAid did not initially do this, meaning that small differences between the systems would shoot the position of waterpoints up to 300m and from one constituency or district across the boundary and into the next.

Often reported is the necessity to carry a GPS in addition to the smartphone to ensure the geo-location is recorded.

Using and sharing water point data

The usefulness of mobile phones in water point mapping comes when you can provide the person in the field with historical data

- Arjen Naafs

The importance of using, sharing, and visually representing data once collected was raised. Paraphrasing the issue, Amitangshu Acharya highlighted that for data to be useful it first needs to be shared. The wider the data and its analysis is shared, the greater the potential impact. A good example of effectively using data, shared by Sean Furey, was the water point mapping in Liberia in 2011/12, which has been an important driver for strategic planning by the government and development partners, and has had operational value to NGOs. The challenge now is to keep that dataset up to date and relevant.

Arjen Naafs suggested the usefulness of mobile phones in water point mapping comes when you can provide the person in the field with historical data, such as functionality status of the previous visit, repair history and identification code.

In an effort to make data more accessible across the WASH sector, Brian Banks described a new data sharing platform which has been established. Data from the pilot can be visualised and downloaded from the WASH Data Point website http://www.sustainablewash.org/initiatives/wash-datapoint-pilot. The initiative incorporates developing a robust standard that supports regular updates and provide a view into sustainability over time, which has been nearly impossible to do at scale.

Several members highlighted that governments require summarised information and analysis rather than in depth data on individual water points. Water point data is only valued when it is visualised and shared. Arjen Naafs highlighted that most government organisation, planners and even NGOs only need to have summarised data by administrative units. Therefore as a monitoring tool, visualising aggregated data at administrative units, such as sub-district and district level, is arguably more important than having the exact location on a google earth map of individual water points. Equally, Shiriin Barakzai emphasised the importance of the question "How we can simplify the process of visualisation to support decision making?"

New resources in the community library

The mapping group library now has over 100 unique and unpublished datasets, reports and papers relating to water point mapping. The following are new uploads and links. The library can be accessed here https://dgroups.org/rwsn/mapping/library.

Brian Banks. 2014. Global Water Challenge: Improving Lives through Sharing Water Point Data. Global Environment & Technology Foundation.

Rob Hope. 2014. From rights to results in rural water services – evidence from Kyuso, Kenya. Oxford University. Working paper 1.

Rossa O'Keeffe-O'Donovan. 2012. Working paper: Cost sharing and the costs of not sharing: cooperation and incentives in the maintenance of public goods. Working Paper.

Rossa O'Keeffe-O'Donovan. 2014. PHD proposal overview: Cost sharing and incentives in the maintenance of local public goods within a network.

Ruth Hinds & Alves Nhaurire. 2013. Monitoring and sustaining services – lessons learned from WaterAid's post-implementation monitoring surveys and the use of information and communications technology. WaterAid.

Shiriin Barakzai. Dynamic maps showing WP functionality with a variety of variables in Laos.

Steven Sugden. 2003. Sustainability Snapshot: an indicator of likelihood of sustainability. WaterAid.