

GIS & mapping tools for water and sanitation infrastructure

Recently developed tools that enable web-based geographical representation of data have exciting applications in the design and monitoring of WASH systems. This note introduces three tools currently being used in the sector.

Continuing developments in GIS¹ software are opening up a number of possibilities for capturing and processing geographical data, and then presenting it via the internet. The ability to manage information on water and sanitation services, and then overlay it onto Google Earth images, has wide-ranging benefits for project planning and design, and for monitoring, advocacy and accountability.

This Practice Note introduces three tools of this type - Google Fusion Tables as used by WSUP, WaterAid's WaterPoint Mapper and Water For People's FLOW - and briefly discusses the advantages and disadvantages of each.

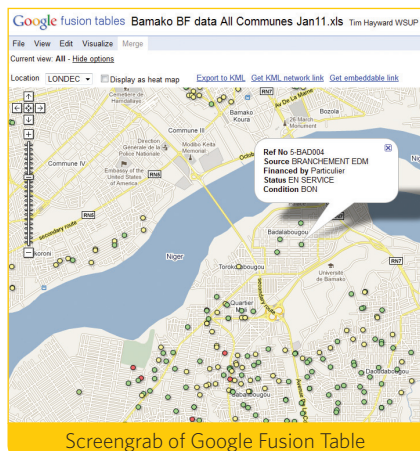
Google Fusion Tables

Fusion Tables are a remarkable recent development by Google, and WSUP has been using them to support its work in Bamako (Mali). Fusion Tables can be accessed on the internet by anyone with a Google account: data stored in a spreadsheet (Excel or CSV; one row per location) can be imported into a Fusion Table which then resides within Google on the internet. The Fusion Table must contain columns for the longitude and latitude (in decimal format) of each location: these columns should be tagged as 'Location' fields using the Modify Columns function (Edit tab).

Then, by selecting Map under the Visualize tab, the table is replaced on screen with a map showing a marker for each location. Clicking on a marker opens a window showing all the data relating to that location. There is also an option to export the data to a KML² file which can be viewed in Google Earth off-line, as described below for the WaterPoint Mapper. An example of what can be achieved can be seen at www.google.com/fusiontables/DataSource?dsrcid=404950. The table contains data relating to all of Bamako's 942 public tapstands.

The principle *advantages* of Google Fusion Tables are simplicity and accessibility. No specialist software is required: just basic internet and MS Office skills. Tables can be shared with different permission levels: for example, full editing permission can be given to community groups, allowing ongoing feedback on service quality. Internet connection speeds are now reasonably fast in most African and South Asian cities, so that access is not a barrier even for under-resourced local government offices or via internet cafés.

Google Fusion Tables are relatively unsophisticated in comparison to the tools discussed overleaf. However, they are well suited for simple applications in the design and monitoring of water and sanitation systems, and can be readily adopted by local government and service providers. In Bamako, the Fusion Table mapping WSUP's survey data on public tapstands has been shared with the *communes*, who are responsible for tapstand licensing: the maps are proving very useful for checking the total number of operational tapstands in each commune, and for identifying problems. Elsewhere, WSUP is starting to use Fusion Tables for mapping and monitoring public toilets in Kumasi (Ghana).

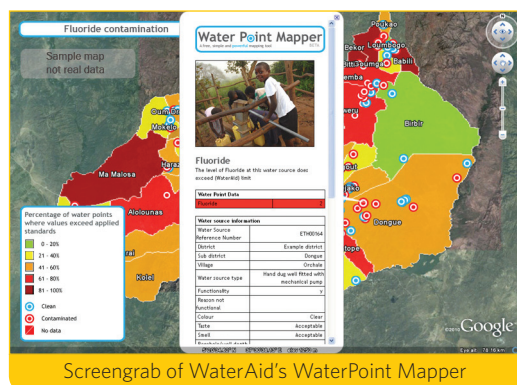


Screengrab of Google Fusion Table

¹ GIS - Geographical Information System

² KML files are overlay sheets that open in Google Earth to show markers and other symbols above chosen locations

GIS & mapping: more sophisticated tools



Screengrab of WaterAid's WaterPoint Mapper

WaterAid's WaterPoint Mapper

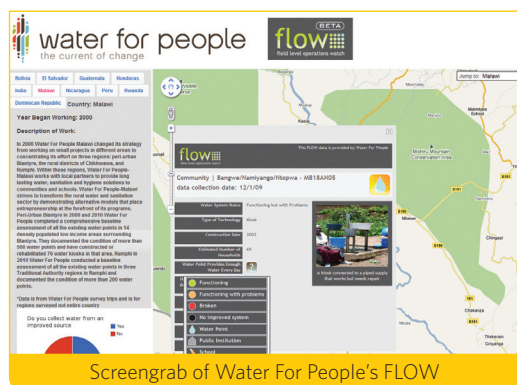
This is a freely downloadable program (www.waterpointmapper.org) that allows data on specific waterpoints to be imported from an Excel spreadsheet and then plotted onto a Google Earth satellite image or map. Thus it offers similar functionality to Fusion Tables: it takes somewhat longer to learn, but it offers additional functions, including automatic mapping of district-level data. Since its development started in 2002, this tool has been successfully used by WaterAid in several countries.

Once appropriate data are loaded, macros within the program can generate a variety of maps, with automatic colour-coding of points to represent any of various characteristics (e.g. number of users, arsenic

level, operational-or-not). These maps (KML files) can be opened in Google Earth on a satellite image of the location of interest: Google Earth (freeware) must be installed on your computer, and you must either have an internet connection, or that location must have been viewed previously in Google Earth (so that the image is held in the computer's cache memory).

A key **advantage** is that the system is purpose-designed for mapping and analysis of waterpoint data. In particular, it allows input of administrative boundaries (e.g. of districts within a city), and then automated calculation and mapping of district-level data: for example, percentage of waterpoints operational, or average arsenic level.

A **disadvantage** is that data input and manipulation are somewhat more time-consuming than with Google Fusion Tables. In particular, input of administrative boundaries requires the user to learn a set of simple procedures.



Screengrab of Water For People's FLOW

Water For People's FLOW

Water For People has invested in the development of a powerful data-gathering and project monitoring tool known as FLOW (Field Level Operations Watch). FLOW uses questionnaires loaded onto an Android³ smartphone, linking to a powerful online database. Data from the phone is transmitted whenever a mobile phone or wi-fi connection can be accessed. Data is shown on a Google Earth satellite or map image with automatic colour-coding of point locations. An information window can be opened to show data for each location, such as waterpoint functionality, water quality, system downtime, finance data, or any other useful information. The tool has user-friendly dashboard outputs, and data can be shown by project or across projects, districts and nationally.

FLOW can be viewed at www.waterforpeople.org/programs/field-level-operations-watch.html and is now being deployed in Liberia, China, Cambodia and Nepal.

Significant **advantages** of this system are the use of the mobile phone as a data-gathering tool, and the ease with which highly informative monitoring data can be made available to anyone with an internet connection. Traditional baseline and follow-up surveys require large amounts of data to be gathered manually by interviews and site surveys; this data must then be entered, again manually, into a program such as SPSS;⁴ geographical representation then requires several further steps. FLOW offers a radically innovative one-step solution.

Disadvantages are that it requires a significant time investment to adapt for any specific use, and needs to be downloaded onto phones before data can be collected. Additionally, Android smartphones remain relatively expensive, though prices are dropping.

³ Android is an open-source operating system for mobile phones

⁴ SPSS is a statistical analysis program

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