Malawi: Groundwater Dossier

Commented [SF1]: Target Audiences

Government

Donor/Development Partners
DFID Country Office
UNICEF WASH team (country/regional)
World Bank
African Development Bank

iNGOs
Millennium Water Alliance

Private Sector

Academic/Research

Key recommendations

Government: National and Local

- Actively engage with the **AMCOW Pan-African Groundwater Program**
- Accept that **handpump services will breakdown and design robust systems** that reduce the number of breakdowns per year and minimise the time it takes to repair a pump (downtime).
- Set **realistic targets for handpump functionality using metrics that provide information on long-term sustainability of the facility**, rather than simple functionality, and collect data accordingly.
- Require all agencies providing drinking water through handpumps to use **standard definitions and methods to measure functionality**. This will enable national measurement of progress towards the **SDG goal of ensuring that everyone has access to drinking water** by 2030.
- Analyse **handpump functionality data** to determine whether irreversible breakdown and abandonment is occurring early in handpump lifecycles, as this indicates problems in site selection, installation, and commissioning. These problems can be rectified through **better planning, improved contracting, and building of capacity of well-drillers.**
- To ensure sustainability of boreholes fitted with handpumps national government should **increase attention and funding for ongoing maintenance and monitoring.**
- Give greater recognition **and support to District Councils and District Water Development Offices**, as their role is crucial to delivering sustainable water services. Provide technical training for Water Point Committees and Area Mechanics to improve technical skills and knowledge.
- Avoid ideological approaches to decentralised service delivery, and focus instead on **context-specific solutions**, including support to successful innovations, and provide spaces to critique dominant approaches to service delivery, as part of an adaptive learning process.
- Policy focusing on extending water supply coverage, at the expense of sustainable service provision, must be revisited.
- **Overlapping roles and responsibilities** for the management and delivery of water supplies need to be clarified.
- Decentralised delivery of water supply services must be matched with **adequate fiscal decentralisation** to ensure that districts have the financial resources needed to perform their role.
- **Districts need structured capacity support** to enable them to adequately support communities in managing and maintaining their water supply.
- Efforts to **calculate the full costs of reaching and sustaining universal water supply access** (using various service options) in the district must be undertaken and integrated into district plans. These must be complemented by efforts to identify and leverage additional funding sources to implement costed plans.

Civil society and national NGOs

- Recommendation !

Commented [HP2]: Inputs welcome

Private sector

- All agencies providing drinking water through handpumps should use **standard definitions and methods to measure functionality**.

International Development Cooperation and Aid agencies (iNGOs, UN organisations)

- Recommendation !

Commented [HP3]: Inputs welcome

Further research

For sustainable rural water services, further research into the political economy of water service provision in Malawi should include analysis of the role of Area Mechanics, their interaction with communities and government or NGO staff, as well as procurement and construction processes in Malawi's drilling sector. Further research is also needed into the district and sub-district politics and governance of water policy and the high-level politics and decision-making of national budgets and plans.

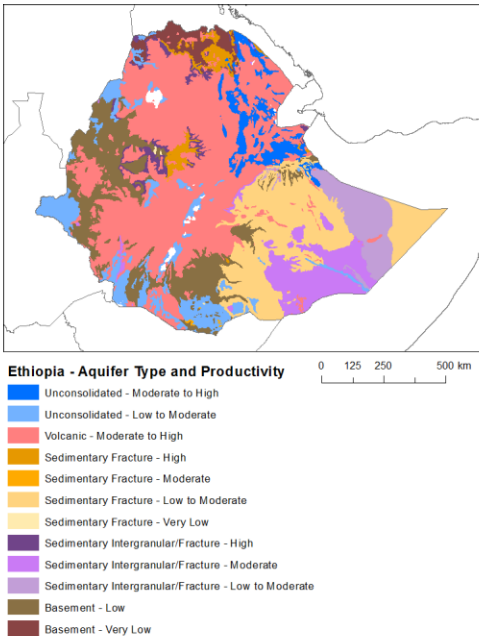
Commented [HP4]: Hidden Crisis inputs welcome here

Context: highlights from the Africa Groundwater Atlas

http://earthwise.bgs.ac.uk/index.php/Hydrogeology_of_Ethiopia

Groundwater quantity

- Annual renewable groundwater resources are estimated at around 36,000 million cubic metres (36 billion cubic metres) , with estimates of total groundwater storage varying from 1,000 to 10,000 billion m³.
- There are a number of groundwater dependent surface waters, including wetlands and lakes. Wetlands are increasingly threatened by deepening, widening and propagating gullies as well as by infestation by invasive weeds. There is low recognition at government level of the fact that wetlands are groundwater dependent.



Groundwater quality

- An estimated 30% of groundwater storage is not available for direct use because of high salinity and/or high fluoride.
- Concentrations of fluoride in groundwater that are higher than the WHO guideline value of 1.5 mg/l have been found across Ethiopia, but are concentrated in the Rift Valley, linked to the volcanic geology. Groundwater fluoride values of greater than 10 mg/l have been found in some areas. As a result of the long-term use of high-fluoride drinking water, both dental and skeletal fluorosis are known to occur in populations from the Rift Valley.
- High values of total dissolved salts in volcanic aquifers in the Rift Valley are linked to the influence of geothermal waters. Increased salinity in many groundwaters in sedimentary aquifers in the south, southeast and northeast of the country, is linked to the dissolution of evaporite minerals.

Groundwater use

- Some 80% of the total national water supply comes from groundwater.
- Groundwater provides most of the water for domestic supply (90%) and industrial use (95%).
- To date only a very small proportion of irrigation demand (<1%) comes from groundwater, including small well irrigation by smallholder farmers, but some larger commercial irrigation schemes are pioneering the use of groundwater. Groundwater use for livestock watering is unknown.
- More hydrogeological research may help increase the use of groundwater for irrigation, for example in proving the existence of a large enough resource that can be sustainably abstracted.

- There are currently no regional or national groundwater level or quality monitoring programmes, and relatively little formal registration of boreholes and other water abstraction points. There is a limited legal framework for groundwater management, but the regulations are not systematically implemented.

Transboundary aquifers

The major transboundary aquifers in Ethiopia are:

- The unconsolidated sedimentary aquifers of Gambella (Upper Blue Nile) and Alwero Sandstone: Ethiopia and South Sudan
- The Bulal Basalt aquifer: Ethiopia and Kenya
- The Hanle Graben aquifer: Djibouti and Ethiopia
- The Sedimentary Basin of Ogaden: Ethiopia and Somalia

No management system exists specifically pertaining to transboundary aquifers. Conflict over water sources in general is common among pastoralists in the border region of Ethiopia and Kenya.

Key activities and findings from UPGro research in Malawi

General UPGro findings with relevance to Malawi

Climate Resilience & Groundwater Resources	▸ Climate change may enhance groundwater recharge in arid and semi-arid areas, presenting opportunities for long-term management as part of national climate adaptation strategies. ▸ Across the West African Sahel, rainy seasons are projected to be later than historically, with fewer but more intense rainfall events. ▸ This may favour more focused groundwater recharge along watercourses. ▸ Observed groundwater levels have generally risen across the Sahel, despite declining rainfall, this "Sahelian Paradox" is thought to be due to changes in the land use and vegetation cover. UPGro research aligns with this view. ▸ Local hydrogeological understanding is required to define the sustainable yield of water points, particularly in weathered basement aquifers. ▸ Numerical groundwater models can be used to assess the sustainability of different groundwater scenarios to inform groundwater management and planning. ▸ Bacteriological contamination of groundwater is likely to be a significant barrier to achieving safely managed water services under SDG6, but this can be tackled by improved construction practices.
Groundwater and Poverty	▸ Communities are routinely under high water stress due to social pressures (e.g. funerals, cultural events) and environmental pressures (e.g. dry periods). These pressures cascade with routine sharing of water points. ▸ Women are more at risk of water scarcity due to gender roles and gender task allocation.
Sustainable Rural Water Services	▸ New methods for defining and measuring water point functionality are required to adequately monitor progress towards SDG6 for safely managed water services. ▸ Affordable maintenance and repair are one of the main predictors of borehole functionality. This highlights the need for effective management models to address poor functionality.
Urban Water Security	▸ In urban areas experiencing rapid population growth, increased demand for water is likely to have a much more significant impact on groundwater than climate change. ▸ Groundwater can only gain a role as a strategic urban resource where an integrated approach to urban water management and governance acknowledges the importance of all available resources. Conjunctive use, managed aquifer recharge, and suitable treatment measures are vital to make groundwater a strategic resource on the urban agenda.

	- Participatory, community-led approaches, such as Transition Management, can provide new and collaborative ways of using and managing urban groundwater.
Agriculture and livelihoods	- Access to groundwater is associated with improved agricultural production, reduced agricultural risk, and improved livelihoods. - Knowledge sharing approaches, such as Rainwatch and Farmer Radio, can be used to increase resilience by communicating farming practices that align with sustainable intensification, climate and groundwater forecasts with farmers.

Malawi-specific activities and findings

Climate Resilience & Groundwater Resources	- Groundwater is generally available through the dry season. Access to functional water services is the key constraint to water availability for communities. - Factors affecting resource availability include water quality, water committee (finances & training), size of village, and proximity to other sources.
Sustainable Rural Water Services	- Communities are routinely under high water stress with diaries showing both regular pressures from funerals, cultural events and dry periods. - Pressures on water points often cascade with routine sharing of water points with neighbouring communities due to poor functionality. - A 2016 survey of boreholes with handpumps across 5 districts of Malawi showed that 74% were working on the day of the survey. Only 41% of handpumps surveyed passed the design yield, reliability and water quality criteria. - The main physical factor affecting handpump performance in Malawi is poor condition of handpump components. However, functionality is considerably higher than in the other study countries, Ethiopia and Uganda, and the resource potential, depth to groundwater and recharge are generally favourable. - Reducing the number of handpump breakdowns and minimising the time it takes to repair them are vital to improve access to water services. - Data collection and analysis on handpump functionality is essential for rapid repair. Metrics should focus on long-term sustainability of the facility, rather than simple functionality at the time of measurement. - Handpump functionality datasets should include information on water point age, frequency of breakdown, and length of downtimes, as well as differentiating 1) water yield and quality limitations, including seasonality constraints 2) limitations in well

siting, design, and installation, and 3) limitations of handpump maintenance and financing arrangements.

- At the District level, a Water Supply Sustainability analysis for Malawi identified the main threats to functionality of rural groundwater supply as lack of investment for ongoing operation and maintenance, poor supply chain for spare parts and lack of skills and knowledge for maintenance, and lack of community ownership. National level support is needed to support districts and communities to maintain functional water services.
- Actors on the frontline of service delivery have considerable responsibility for ensuring the sustainability of water services, but little influence on decisions made 'at the top' and very few resources 'to get the job done'. The water sector in Malawi suffers from a shortage of human and financial capacity in comparison to other sectors.

Case Studies

Measuring progress on water point functionality requires standards definitions and assessments

http://nora.nerc.ac.uk/id/eprint/523090/

Currently, there is no universally adopted definition of water point functionality, or what constitutes a functioning water point. Assessing progress towards the SDGs requires agreed definitions and standard assessment approaches.

The Hidden Crisis project developed a set of common definitions and methods for assessing water point functionality and performance. A tiered approach to defining and measuring functionality was found to be useful to examine functionality for different scales and purposes. This approach has been applied in functionality surveys across Ethiopia, Uganda and Malawi, as part of Hidden Crisis research.

The guidelines for assessing water point functionality are summarised as:

1. Functionality should be measured against explicitly stated standards of the performance of the water point, so that functionality data from different regions and surveys can be compared.
2. It should be measured separately from the users' experience of the service provided.
3. Functionality assessments should be tiered, to ensure a minimum top-tier assessment can be completed by all surveys, but allowing for further, more detailed, tiers of assessments to be conducted at local levels.
4. A distinction should be made between surveying functionality as a snapshot (e.g. for national metrics) and surveying individual water point performance (where a temporal aspect of the water point performance is included in a rapid assessment).

The tiered approach to defining water point functionality involves 4 levels:

1. Binary Functionality – is the water point working and delivering some water (yes/no)
2. Functionality: yield snapshot – does the water point work and provide sufficient yield (10 L/min) on the day of the survey
3. Functionality: reliable yield – does the water point provide sufficient yield (10 L/min) on the day of survey, is it reliable (<30 days downtime in last year) or abandoned (not worked in past year)?
4. Reliable yield and water quality - as 3 above, and also passes WHO guidelines for water quality.

Application of these definitions of functionality in the field have shown that the measure of *reliable yield* gives much more useful information about the service level of the water point than a binary assessment, and generally reduces functionality rates by 50%.

For full details of the definitions and methods developed, please see the technical briefing which has been published here: http://nora.nerc.ac.uk/id/eprint/523090/.

More information

Type	Organisation	Contacts
Ministries and authorities		
UPGro projects in Uganda	Hidden Crisis: Unravelling past failures for future success in Rural Water Supply	Prof. Alan MacDonald (BGS) https://upgro-hidden-crisis.org/
	Resource limitations to sustainability of groundwater well-points in basement complex regions of sub-Saharan Africa	Dr Willy Burgess (University College London) https://upgro.org/catalyst-projects/basement-complex/
UPGro researchers in-country	University of Malawi	Dr Geoffrey Chavula, Dr Evance Mwathunga (Hidden Crisis)
	WaterAid Malawi	(Hidden Crisis)
	University of Malawi	Geoffrey Chavula (Resource limitations project)
Online tools and databases	Africa Groundwater Atlas	earthwise.bgs.ac.uk/index.php/Hydrogeology_of_Ethiopia
	Groundwater Assessment Platform	www.gapmaps.org/gap.protected/
	Water Point Data Exchange	www.waterpointdata.org/
	IGRAC Global Groundwater Information Systems	www.un-igrac.org/global-groundwater-information-system-ggis
	UNHCR WASH Data Portal	wash.unhcr.org/wash-gis-portal/

Commented [HP5]: Inputs welcome

UPGro published work relating to Malawi

https://upgro.org/publications-papers

1. Mwathunga, E.; MacDonald, A.M.; Bonsor, H.C.; Chavula, G.; Banda, S.; Mleta, P.; Jumbo, S.; Gwengweya, G.; Ward, J.; Lapworth, D.; Whaley, L.; Lark, R.M.. 2017. UPGro Hidden Crisis Research Consortium. Survey 1 Country Report, Malawi. British Geological Survey, 19pp. (OR/17/046). http://nora.nerc.ac.uk/id/eprint/518402/
2. Mwathunga, E.; Fallas, H.C.; MacAllister, D.J.; Mkandawire, T.; Makuluni, P.; Shaba, C.; Jumbo, S.; Moses, D.; Whaley, L.; Banks, E.; Casey, V.; MacDonald, A.M.. 2019 Physical factors contributing to rural water supply functionality performance in Malawi. Nottingham, UK, British Geological Survey, 24pp. (OR/19/057).
3. Naomi Oates and Evance Mwathunga (2018). A political economy analysis of Malawi's rural water supply sector. Overseas Development Institute 2018, pp35.
4. Bawi Consultants (2018). District Water Supply Sustainability Assessment, Final Country Report Malawi. UPGro Hidden Crisis.
5. Richard C. Carter & Ian Ross (2016). Beyond 'functionality' of handpump-supplied rural water services in developing countries. Waterlines, 35(1), DOI: 10.3362/1756-3488.2016.008
6. UNC Water Institute WaSH Policy Research Digest Issue #3, March 2016. Detailed Review of a Recent Publication: Getting handpump functionality monitoring right can help ensure rural water supply sustainability.
7. Bonsor, H., MacDonald, AM., Casey, V., Carter, R., Wilson, P. 2018. The need for a standard approach to assessing the functionality of rural community water supplies. Hydrogeology Journal, 26; 2, 367-370. https://doi.org/10.1007/s10040-017-1711-0
8. Whaley, L., Cleaver., F. 2017. Can 'functionality' save the community management model of rural water supply? Water Resources and rural development; 9: 56-66. http://dx.doi.org/10.1016/j.wrr.2017.04.001
9. Liddle, ES., Fenner, R. 2017. Water point failure in sub-Saharan Africa: the value of a systems thinking approach Waterlines; 36: 2: 27pp. http://www.developmentbookshelf.com/doi/10.3362/1756-3488.16-00022
10. Howard, G., Calow, R., MacDonald, A., Bartram, J. 2016. Climate change and water and sanitation: likely impacts and emerging trends for action, Annual Review of Environmental Resources, 41: 253-276. https://doi.org/10.1146/annurev-environ-110615-085856
11. Cleaver., F, Whaley, L. 2018. Understanding process, power, and meaning in adaptive governance: a critical institutional reading. Ecology and Society; 23 (2): 49. https://doi.org/10.5751/ES-10212-230249.
12. Whaley, L. 2018. The Critical Institutional Analysis and Development (CIAD) Framework. International Journal of the Commons; 12 (2): 137-161. http://doi.org/10.18352/ijc.848
13. Whaley, L., MacAllister, D.J., Bonsor, H.C., Mwathunga, E., Banda, S., Katusiime, F., Tadesse, Y., Cleaver, F., MacDonald, A.M. 2019. Evidence, ideology and the policy of community management in Africa. Environmental Research Letters. https://iopscience.iop.org/article/10.1088/1748-9326/ab35be
14. Fallas, H. C., MacDonald, A.M., Casey, V., Kebede, S.,Owor, M., Mwathunga, E., Calow, R., Cleaver, F., Cook, P., Fenner, R.A., Dessie, N., Yehualaeshet, T., Wolde, G., Okullo, J., Katusiime, F., Alupo, G., Berochan, G., Chavula, G., Banda, S., Mleta, P., Jumbo, S., Gwengweya, G., Okot, P., Abraham, T., Kefale, Z., Ward, J., Lapworth, D., Wilson, P., Whaley, L. Ludi, E. 2018. UPGRO Hidden Crisis Research consortium: Project approach for defining and assessing rural water supply functionality and levels of performance. British Geological Survey (BGS) Open Report, OR/18/060, pp 25. http://nora.nerc.ac.uk/id/eprint/523090/
15.

Credits

This briefing note was prepared for the UPGro (Unlocking the Potential of Groundwater for the Poor) programme (2013-2020) funded by DFID, NERC and ESRC. Edited by Sean Furey (Skat Foundation) with contributions from Heather Plumpton (Walker Institute) [… add your name here if you edit this document]