

Hidden Crisis:

Unravelling past failures for future success in Rural Water Supply

Water point functionality: new tools and insights from physical science study of selected districts of Uganda



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UP
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Unlocking the
Potential of
Groundwater for
the Poor

Funded by:



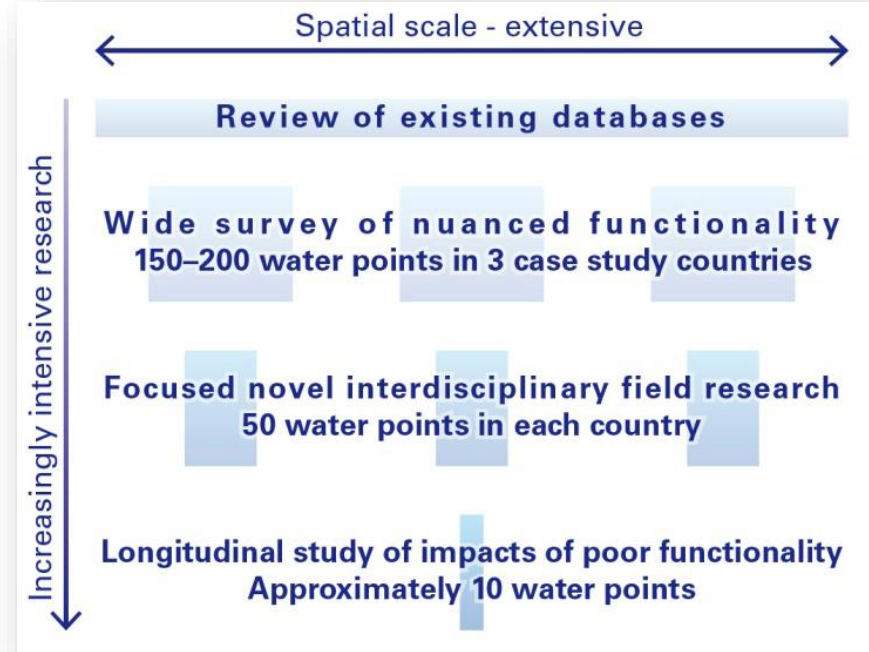
**Functionality a
big problem in
rural water
supply**



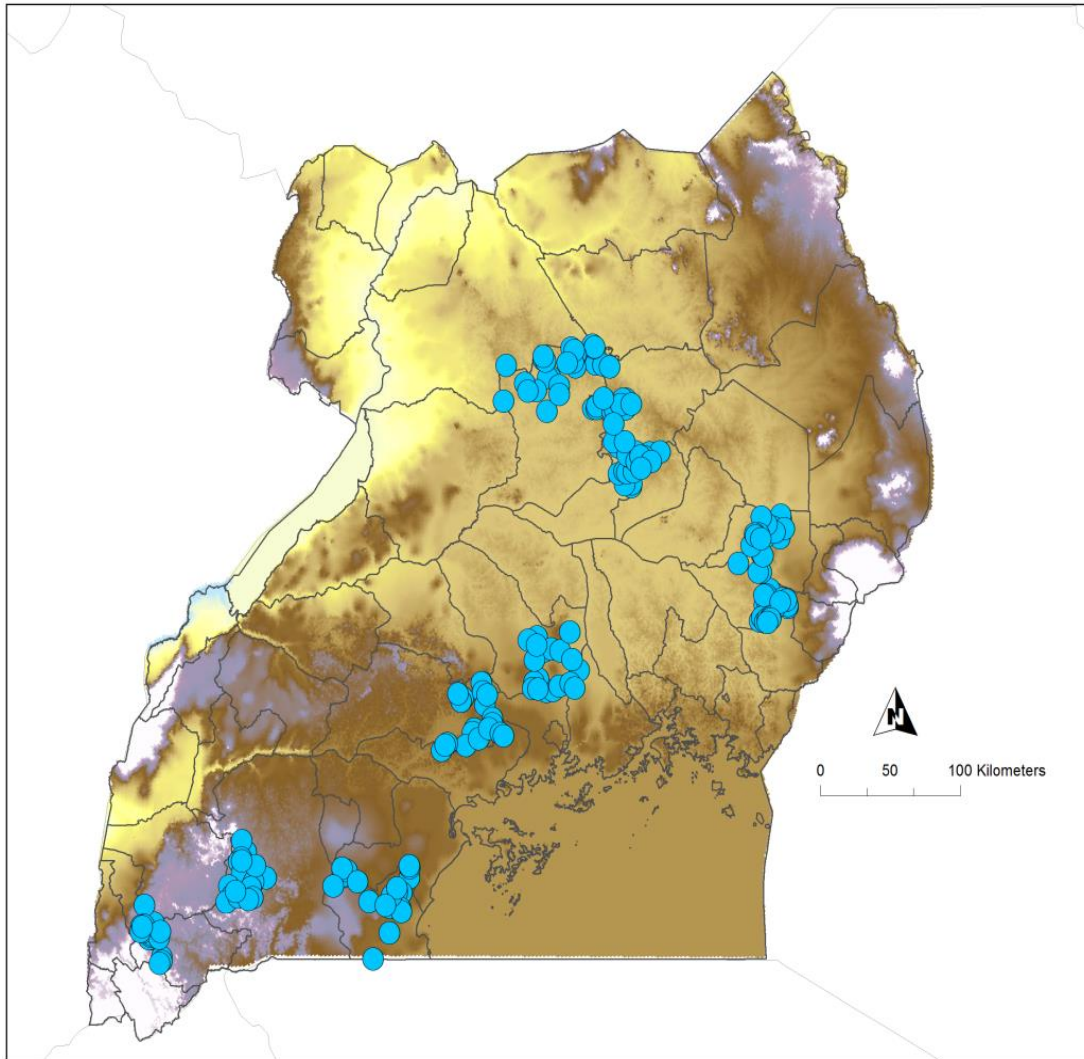
Research objectives

move *from anecdote to evidence*

1. Define functionality
2. Apply to Uganda, Ethiopia and Malawi
3. Detailed interdisciplinary analysis of water points
4. Longitudinal studies for richness and trends
5. Wider analysis for context



Survey 1 districts ($n = 200$) - stratified random survey of HPBs to find extent of true functionality

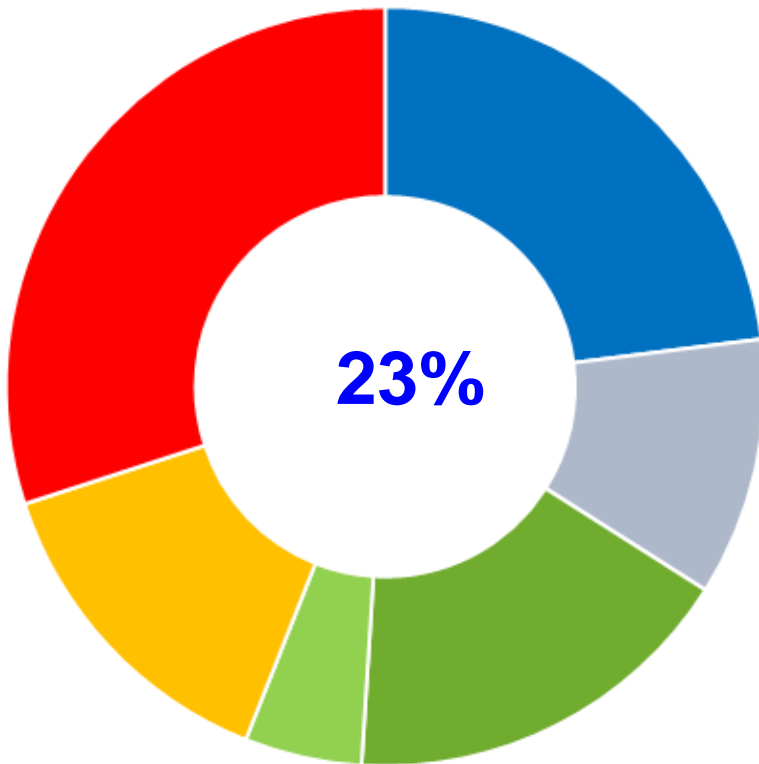
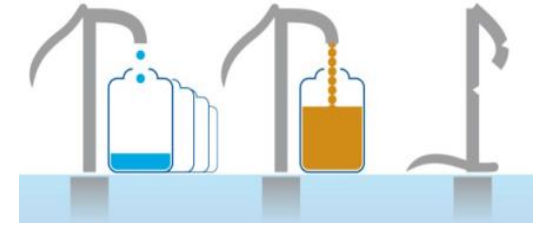


- *LUWERO - Wet, Sedimentary, Better Off*
- *MBARARA - Wet, Sedimentary, Better Off*
- *MITYANA - Wet, Sedimentary, Better Off*
- *RAKAI - Wet, Sedimentary, Better Off*
- *RUKUNGIRI - Wet, Basement, Better Off*
- *BUDAKA - Wet, Sedimentary, Poor*
- *KUMI - preventative maintenance strategy*
- *DOKOLO - Wet, Basement, Poor*
- *LIRA - Wet, Basement, Poor*
- *OYAM - Wet, Basement, Poor*

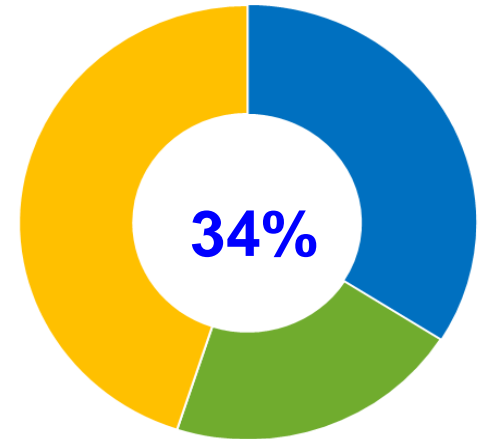
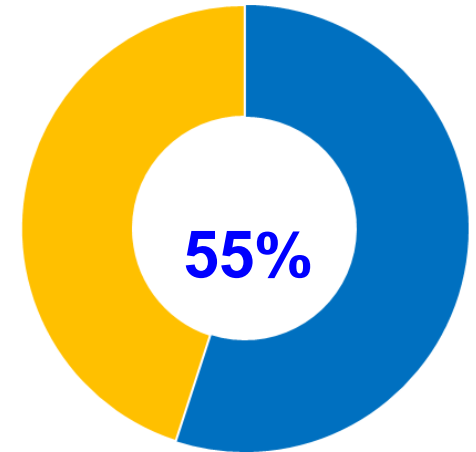
Tiered definitions of functionality (*n* = 200)

Category	Criteria	%
Basic	HPB working on day of survey (yes/no)	55
Snapshot	HPB works with sufficient yield (10 L/min) on day of survey	34
Functionality performance	HPB with sufficient yield (10 L/min); reliable (<30 days downtime in last year) or abandoned (not worked in past year)	23
Functionality including water quality	All above and passes WHO inorganic parameters, and TTC standards.	18

Uganda

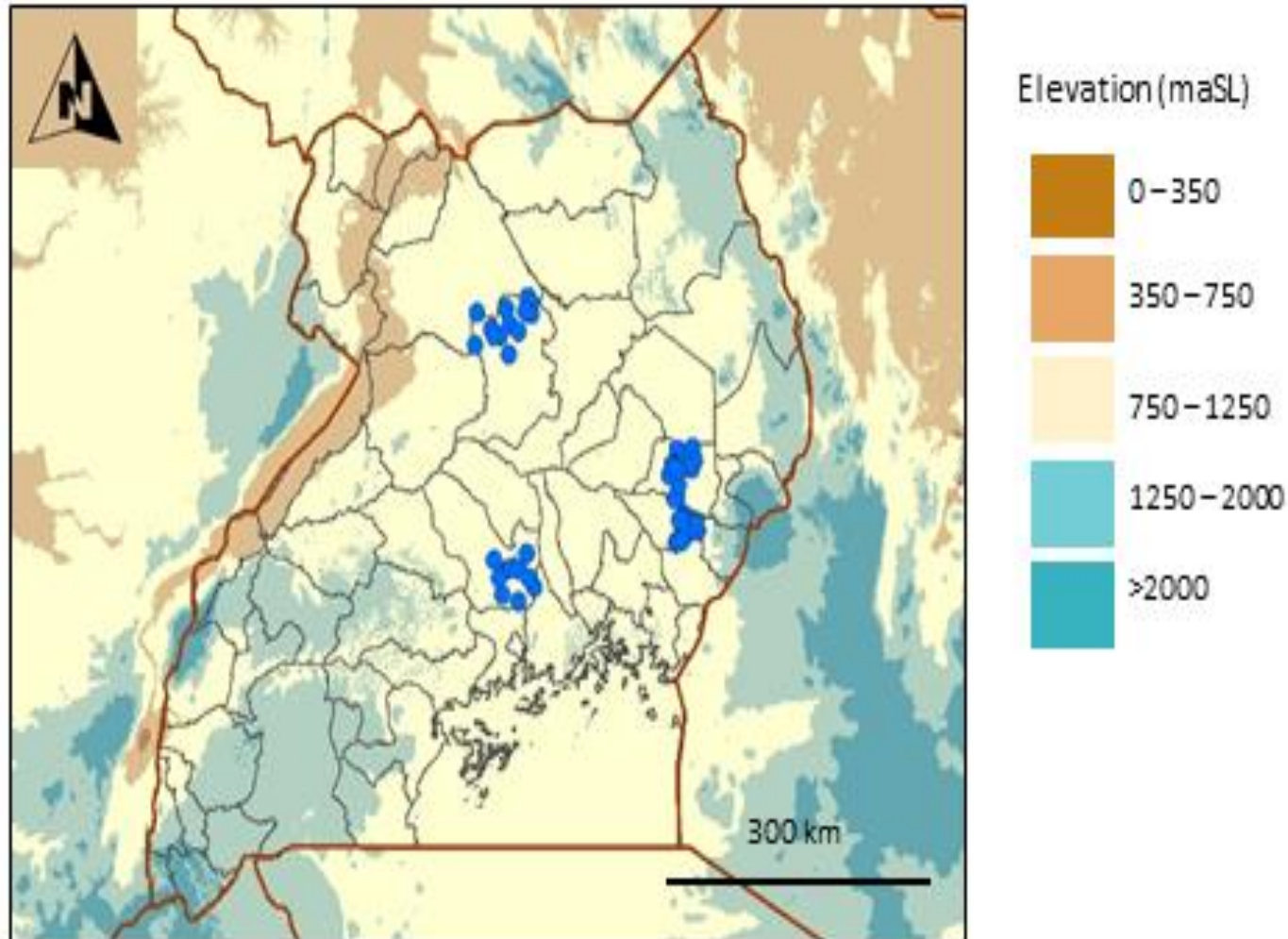


- Fully functioning
- good yield, unreliable
- poor yield
- poor yield , poor reliability
- No Flow but worked in last year
- Abandoned - no flow in last year



Also by including water quality the percentage reduces to **18%**

Survey 2 districts ($n = 50$) - WHY hand pumps are not functional



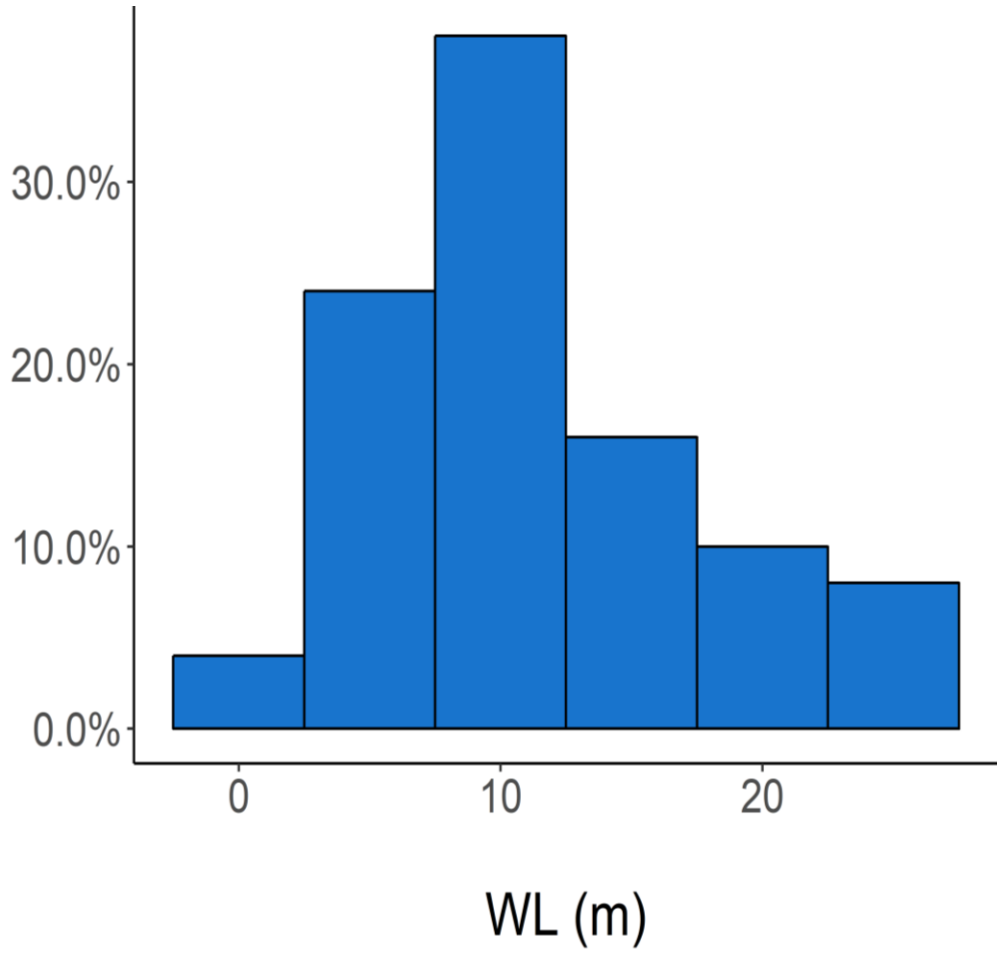
Survey 2: deconstructing 50 water points



Deconstruct pump

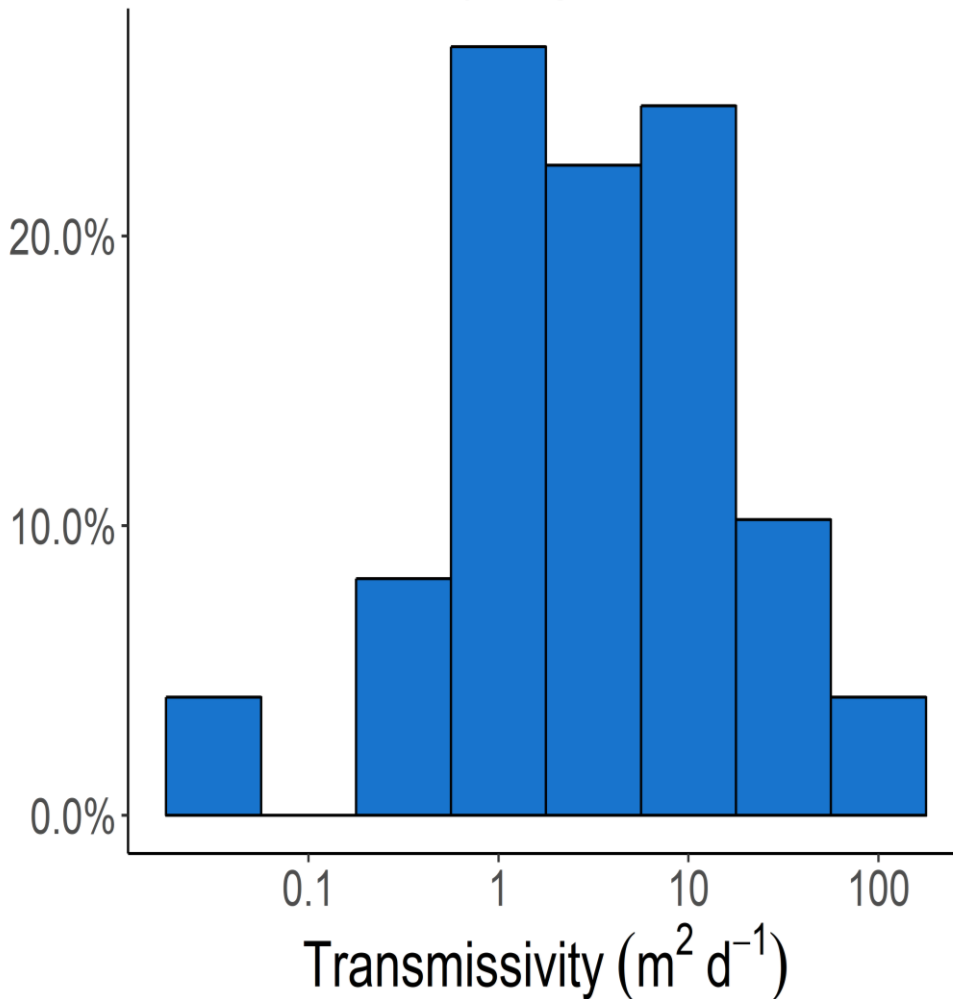


Depth to groundwater



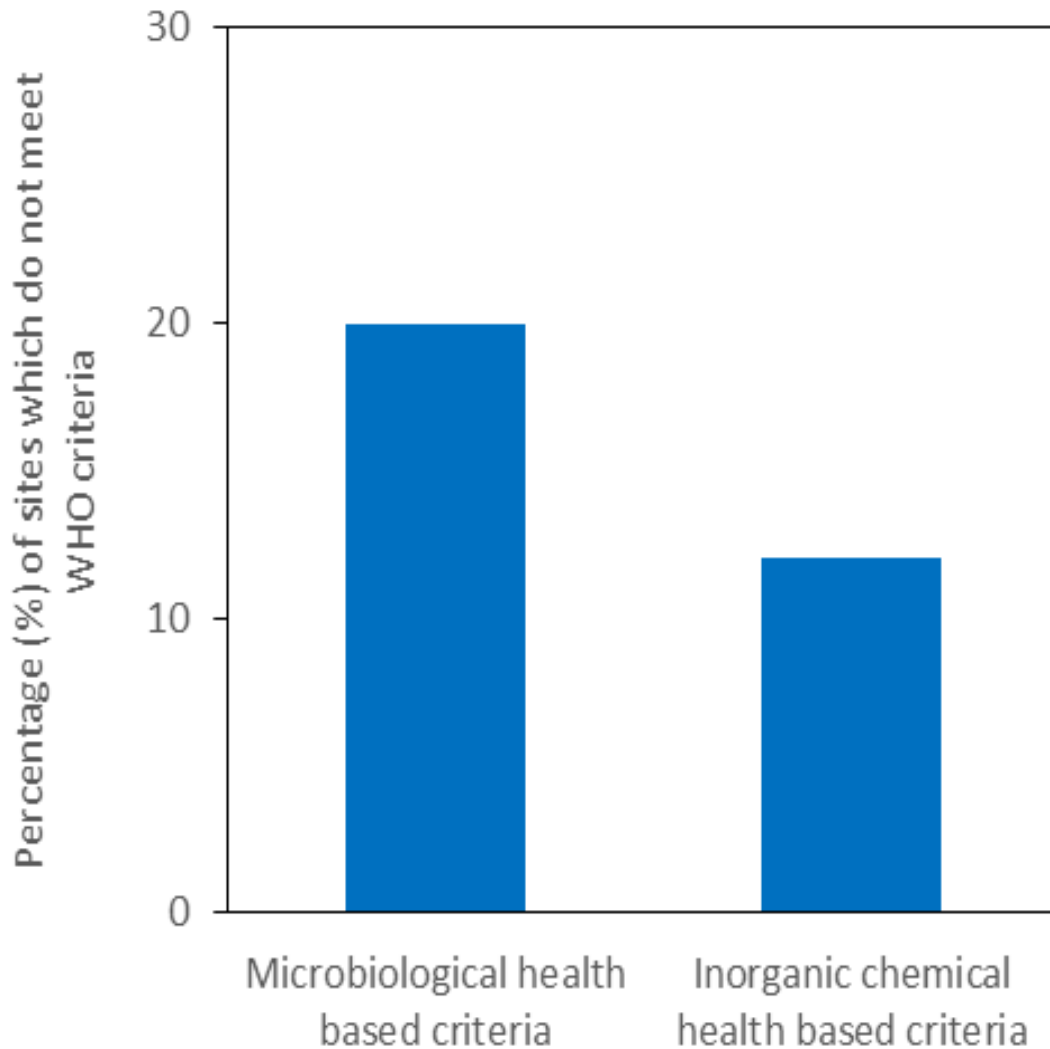
Generally quite shallow with **mean depth of 10 m bgl** - which is optimal for the operation of handpump mechanisms;

Aquifer transmissivity



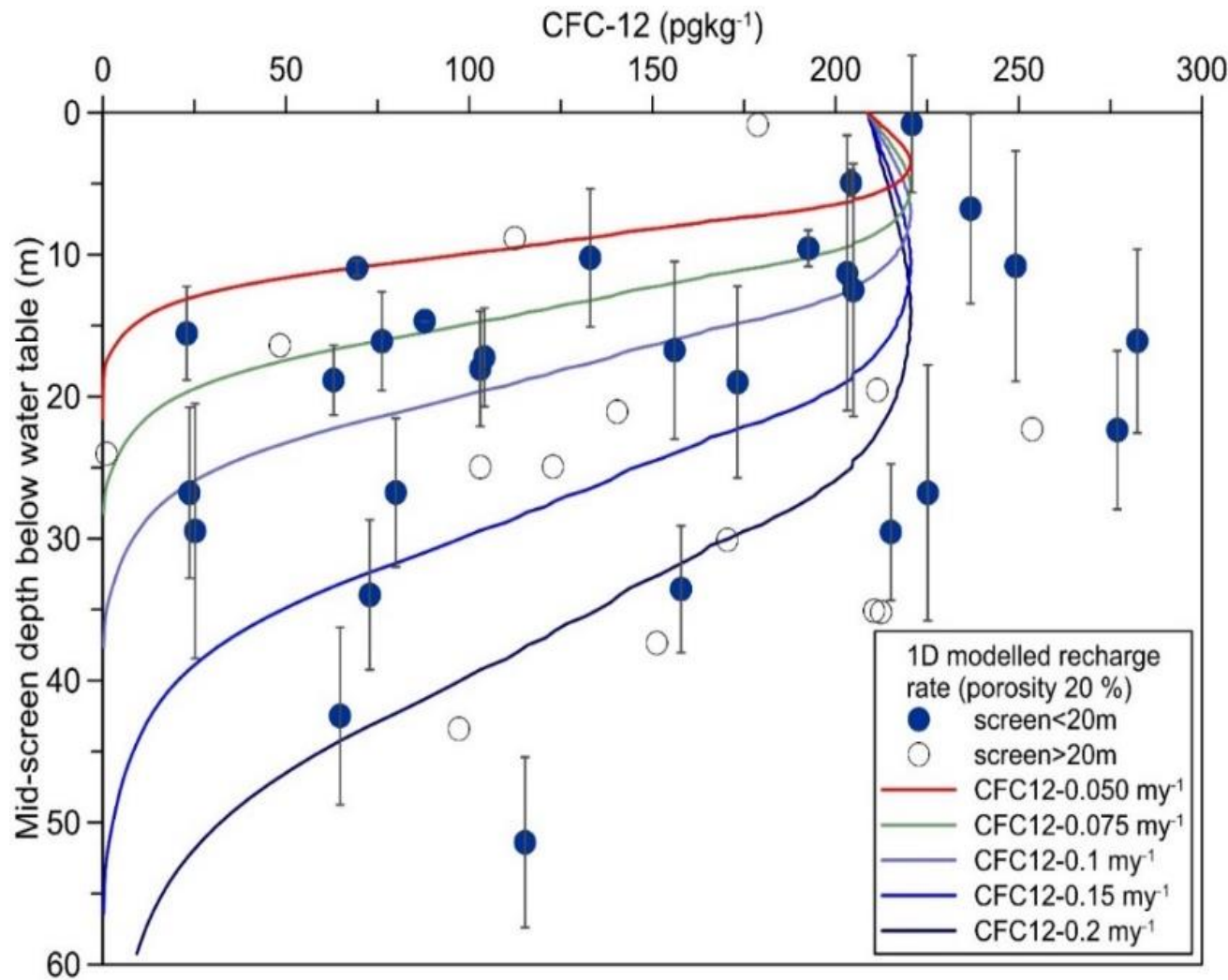
- Significant variability between sites reflect heterogeneity of weather basement aquifer;
- **Median** and **Mean T value of 4 m²/d and 10 m²/d**, respectively;
- Overall, **70%** of sites have sufficient **T value (>1.5 m²/d)** to meet demand of community water supply;

Water Quality



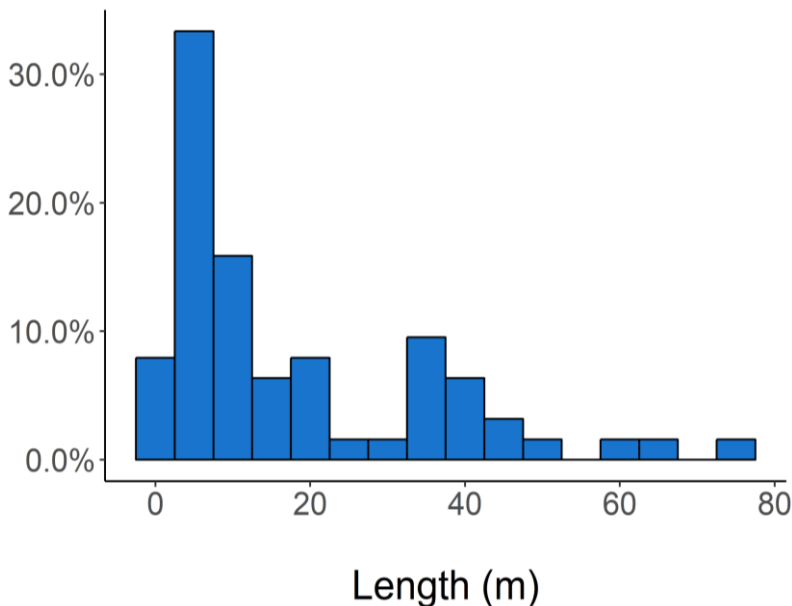
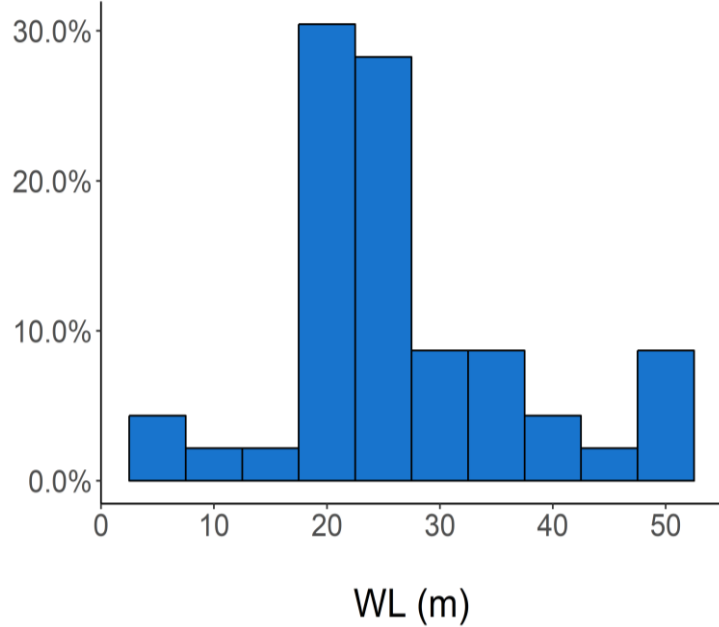
- **Inorganic water quality** is good with only **12%** of sites **failing** WHO standards of water quality indicators;
- **Pathogen** contamination affect **20%** of sites;
- Improved well construction and completion could help improve issue;

Resource resilience – climate and abstraction



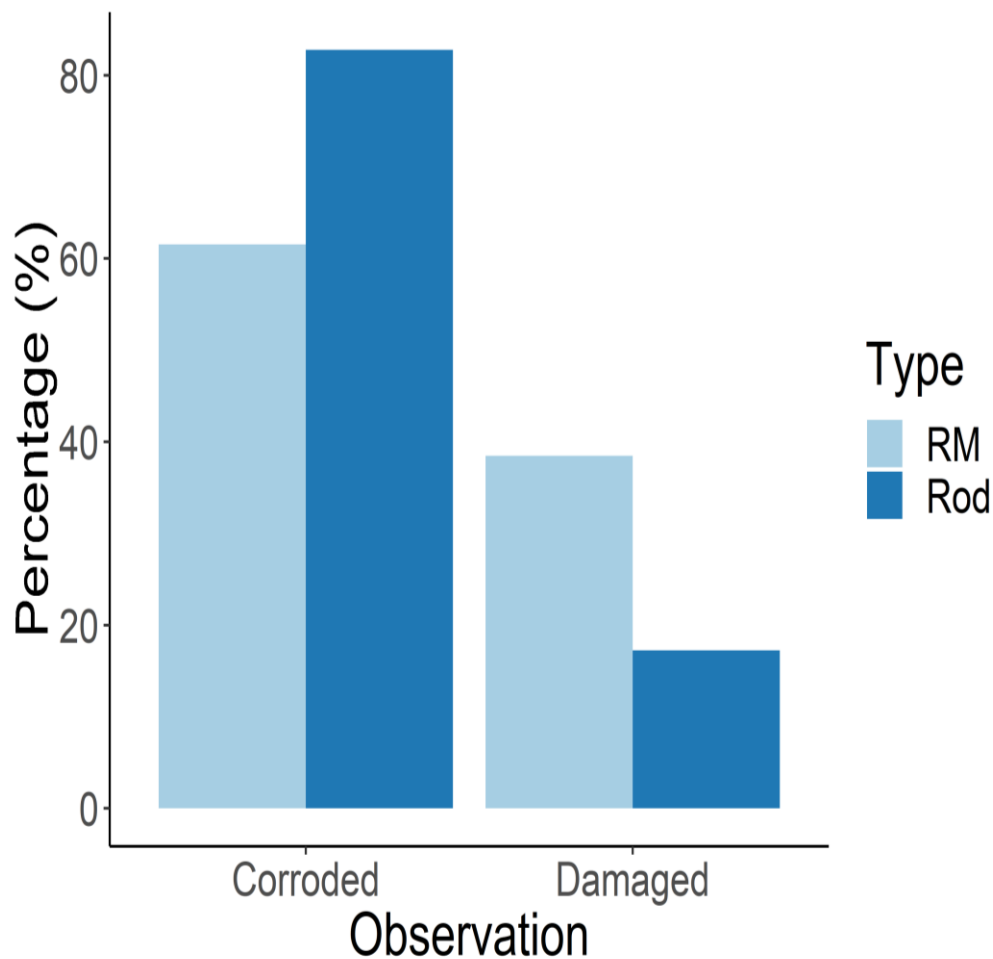
- Generally resilient to climate variability for yields associated with drinking water.
- Groundwater is a mix of modern (<50 years old) and older water;
- Indicate active recharge of several mm per year;

Water point construction



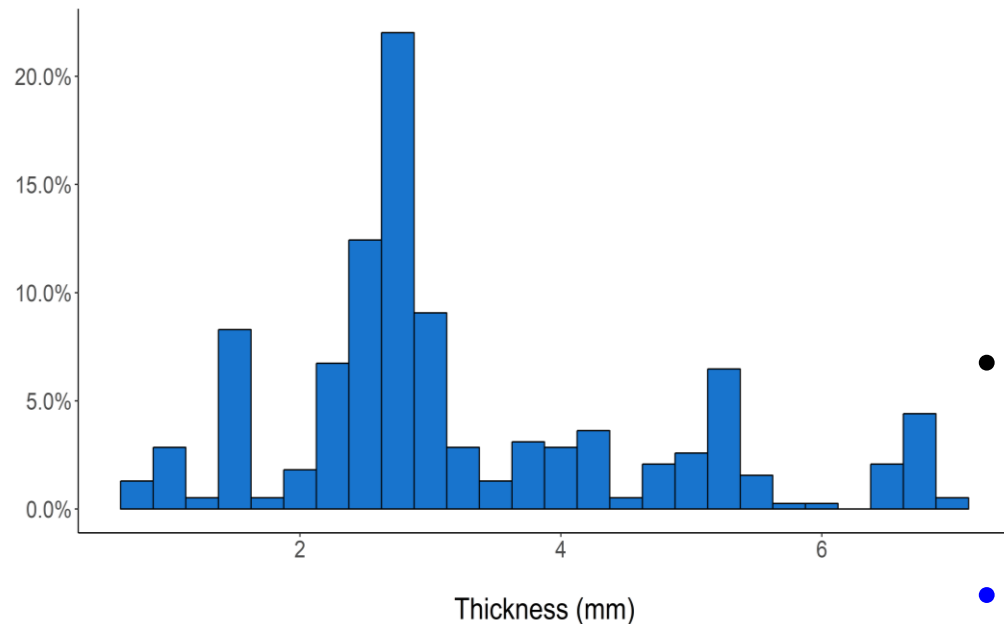
- Average borehole depth is **55 m**, and average length of screen or uncased section across sites ranges from **10 to 20 m**;
- **10%** of HPBs had screen or uncased section length **<3 m**, but with no observed impact to functionality performance;
- **Pump depth from 20 to 30 m bgl**;
- Where **pump depth >40 m bgl**, **depth to groundwater** is generally still **>20 m bgl** - operational conditions are within handpump specification and capacity;

HPB Condition

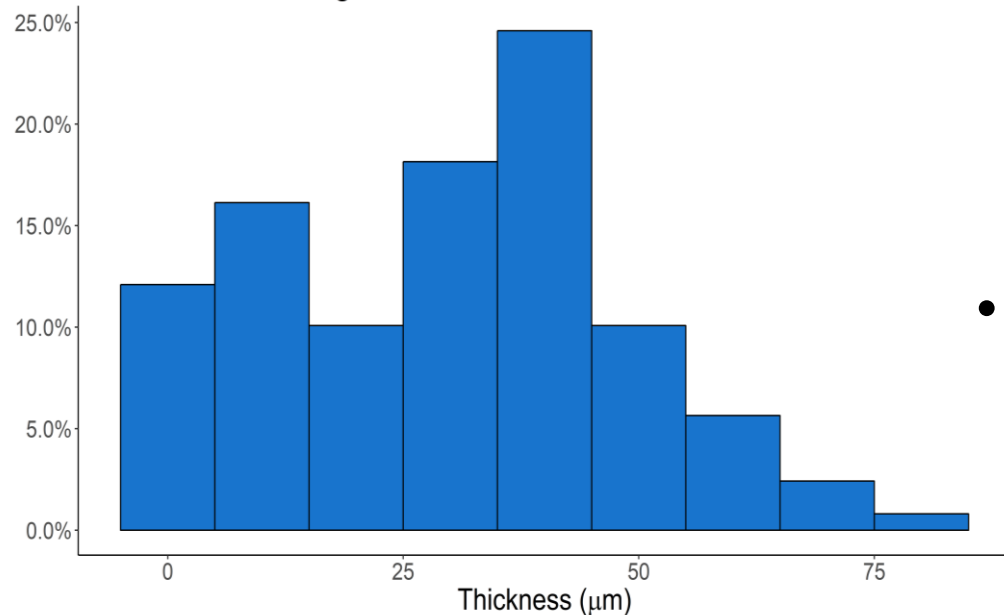


- **Corrosion** and **general damage** affected handpump components in **>75%** of the HPBs;
- **Rising main** sections and **pump rods** were significantly affected by **corrosion**, with **>60%** being in poor condition;

IM2 RM Thickness



IM2 RM Galvanising thickness



- **Variable material competency** in **>90%** of HPBs (from corrosion, manufacturing variability) – potential for damage;
- Significant variation (**±75%**) in **thickness of rising main sections**;
- **65%** of handpumps had rising main **thickness less** than India Mark II specification (**3.25 mm ±0.2 mm**).
- Galvanised thickness of rising mains was **below** India Mark II specification (**70-80 µm**) in **>90%** of handpumps;

Summary

- Definitions matter!
- Survey methods repeatable;
- Most sites have acceptable inorganic and organic water quality;
- Handpump rising main and rods are often in poor condition and need repair, replacement and maintenance;
- Many sites don't have high T values and will not cope easily with higher yielding pumps;



Acknowledgements



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