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**UCL**

**Resilience of urban groundwater to contamination:  
evidence from allied observatories in Uganda,  
Senegal and Kenya** [www.afriwatsan.org](http://www.afriwatsan.org)

*AfWA2020 Kampala (Uganda)*



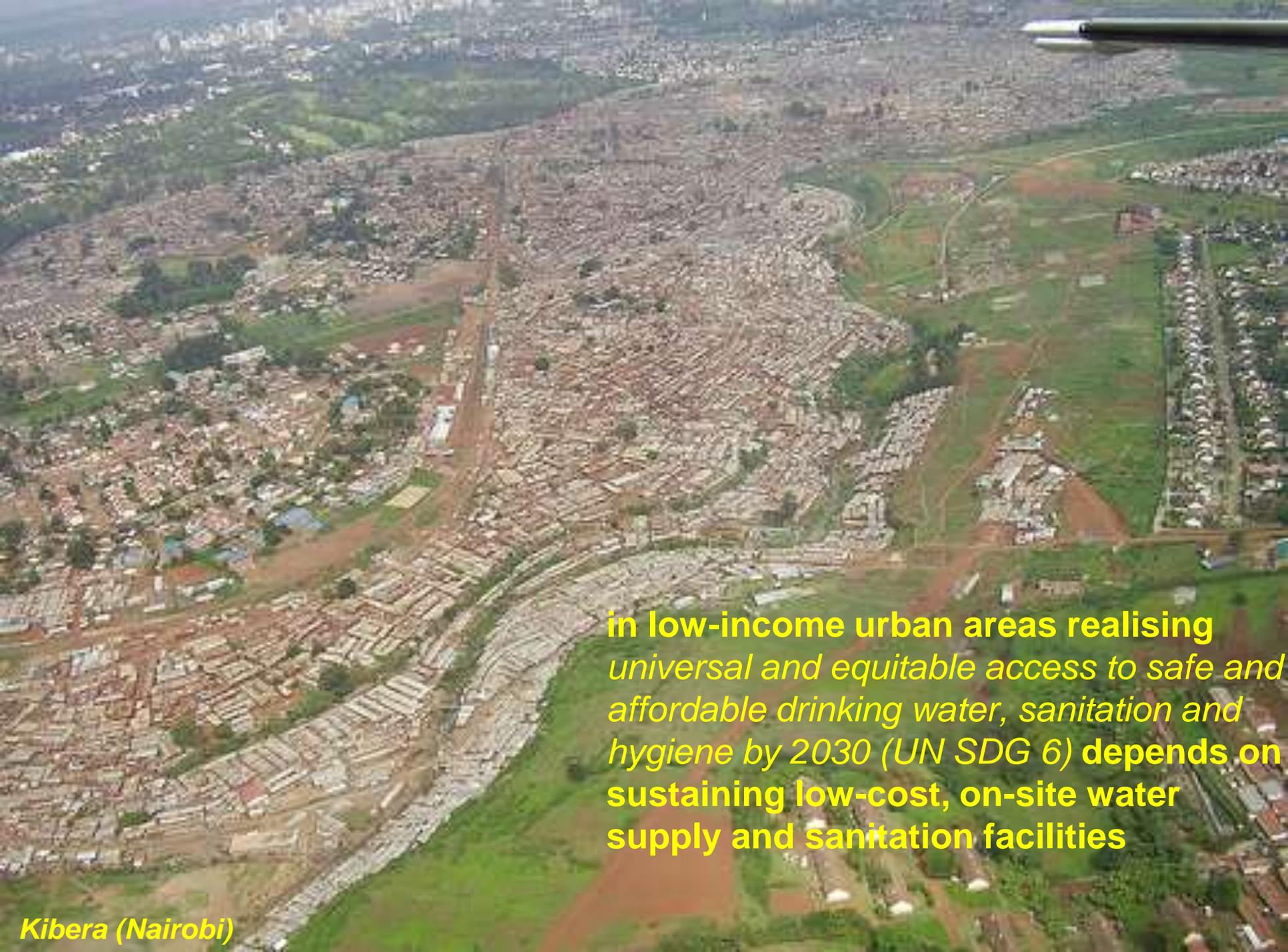
AfriWatSan



UKaid  
from the British people

THE  
ROYAL  
SOCIETY

*The Royal Society – DFID Africa Capacity Building Initiative*



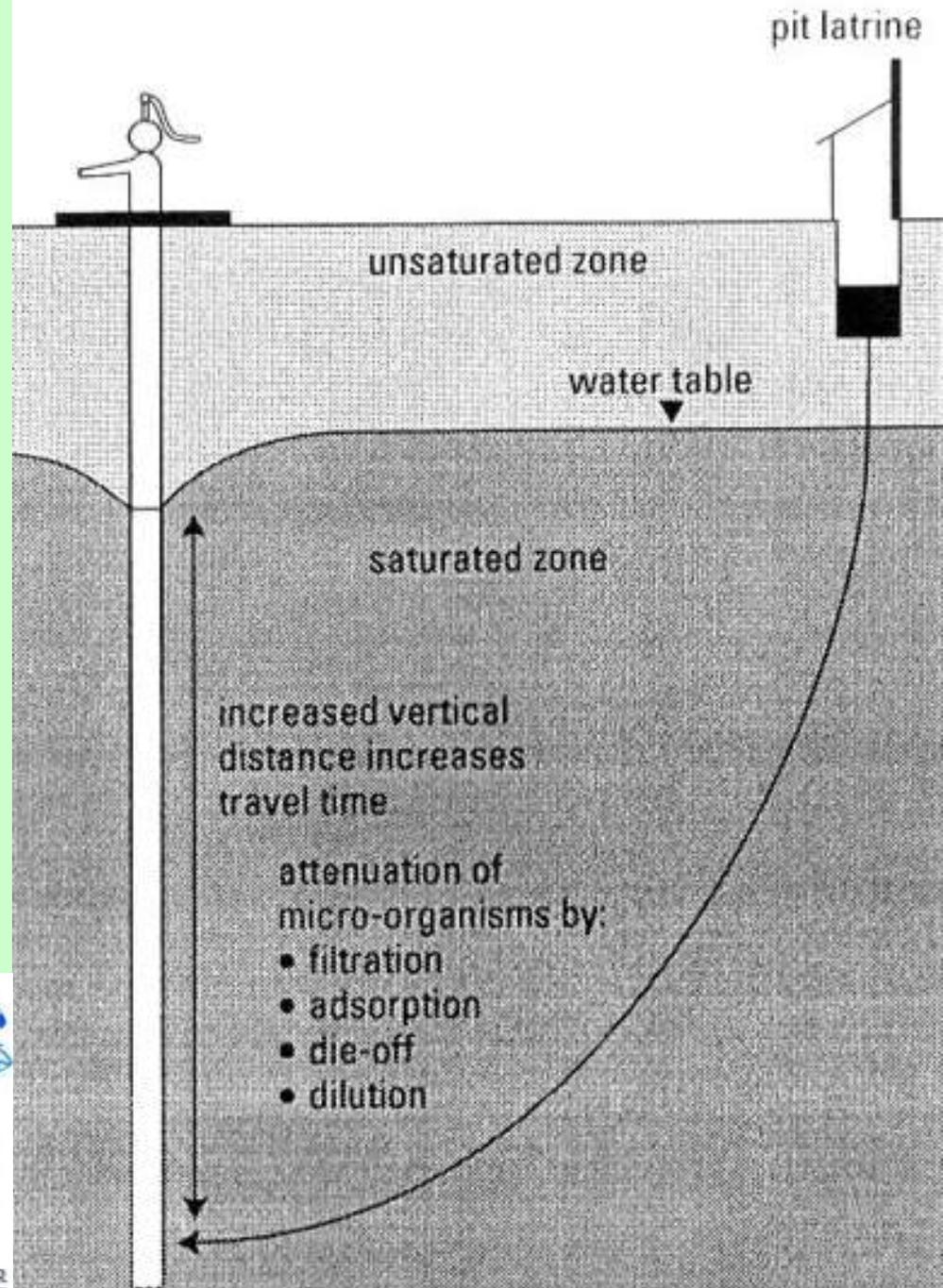
**in low-income urban areas realising universal and equitable access to safe and affordable drinking water, sanitation and hygiene by 2030 (UN SDG 6) depends on sustaining low-cost, on-site water supply and sanitation facilities**

***Kibera (Nairobi)***

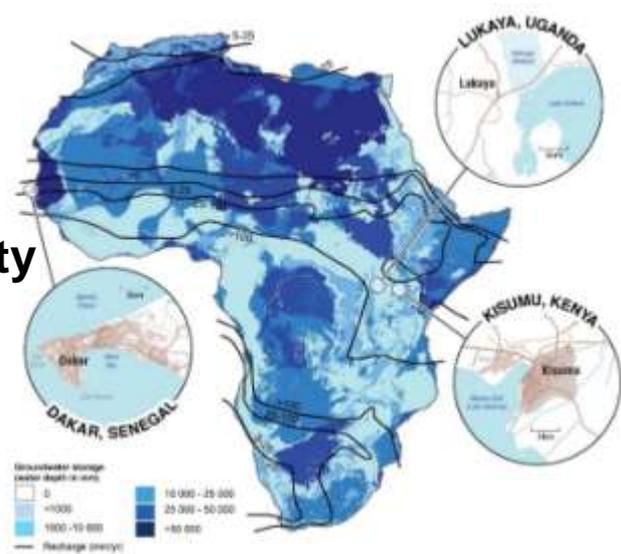
# research challenge:

- How to sustain conjunctive use of the subsurface for on-site water supply and sanitation facilities?

# research partners:



mega-city



town

city



Kisumu



Lukaya

10 04 2018



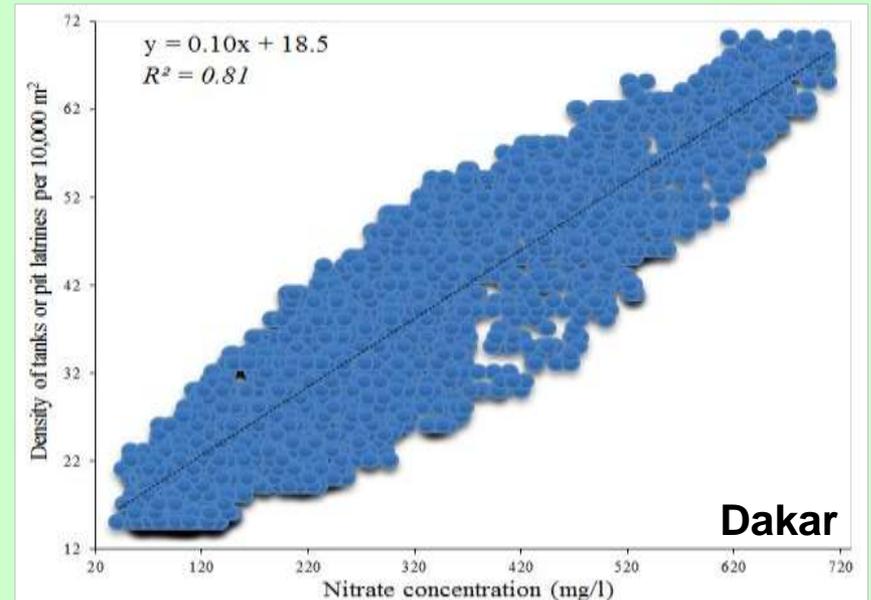
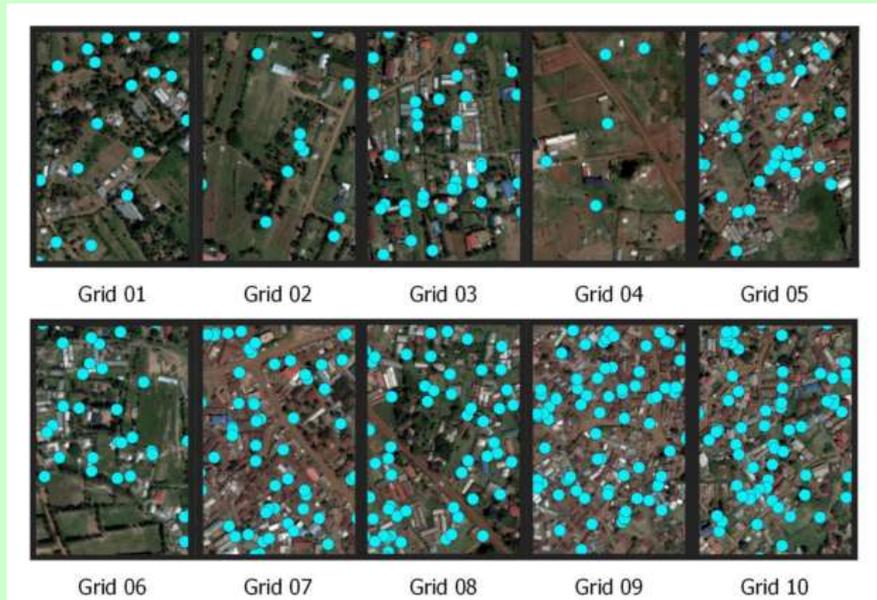
Dakar

- aligned surveys & monitoring protocols across 3 urban observatories



# **AfriWatSan observatories: mapped on-site sanitation densities correlated to nitrate concentrations in groundwater**

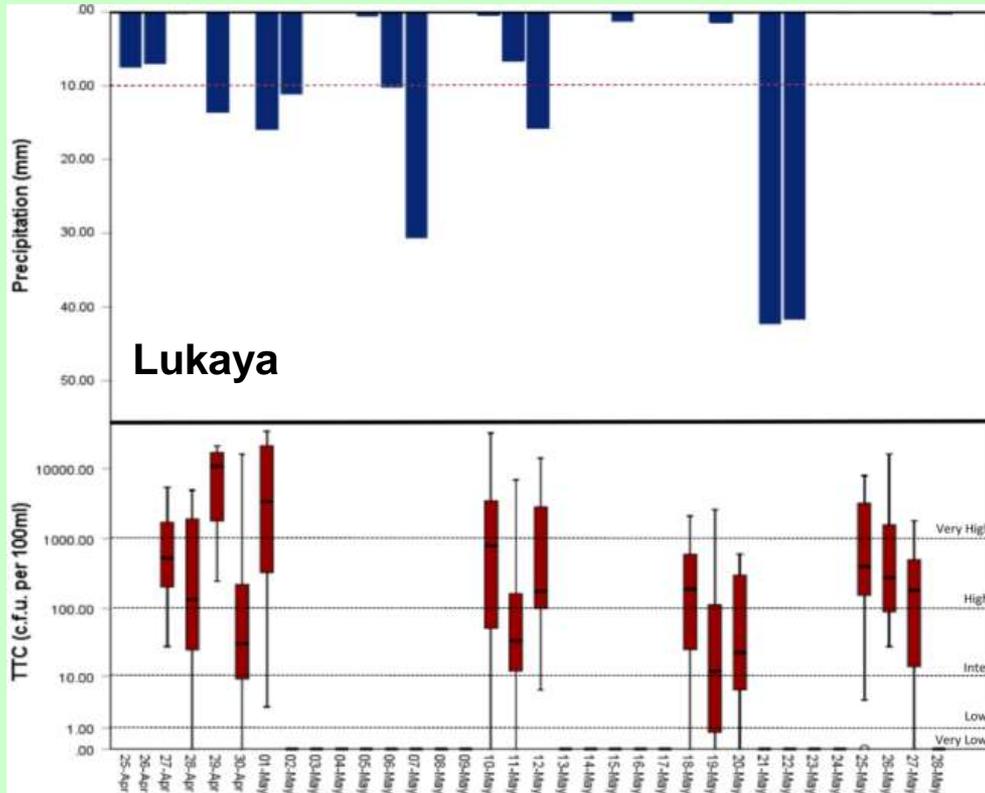
- optical satellite imagery used, supported by ground surveys



- provides empirical measure of an aquifer's ability to attenuate faecal loading below WHO nitrate guideline value of 50 mg/L:
  - 7 pit latrines per ha (weathered crystalline rock - Kisumu)
  - 24 septic tanks per ha (Quaternary sands - Dakar)

# ***AfriWatSan* observatories: faecal bacteria counts observed to rise in shallow wells after heavy rain events (> 10 mm/day)**

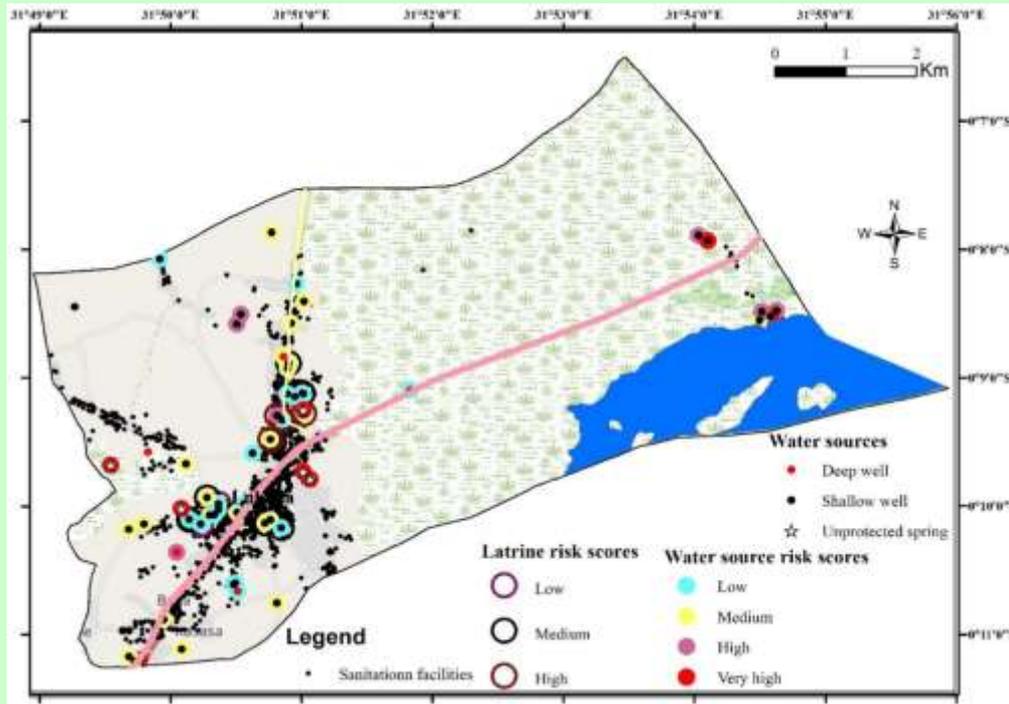
- faecal particles trace rapid infiltration pathways (macropores)
- consistent with rapid responses observed from piezometry



***AfriWatSan* observatories: magnitude of faecal contamination not well related to WHO sanitary risk scores**

# ***AfriWatSan* observatories: potential misrepresentation of ‘access to safe water’ in Lukaya based on WHO/UNICEF JMP criteria for “improved sources”**

- no “safely managed” on-site water sources
- ~55% of improved water sources comprising primarily shallow hand-dug wells show gross faecal contamination by *E. coli*



***Nayebare et al., 2019. WASH conditions in a small town in Uganda: how safe are on-site facilities? Journal of Water, Sanitation and Hygiene for Development***

[doi.org/10.2166/washdev.2019.070](https://doi.org/10.2166/washdev.2019.070)

# ***Summary:***

- 1. network of urban groundwater observatories established in a ‘mega-city’ (Dakar, Senegal), ‘city’ (Kisumu, Kenya) and ‘town’ (Lukaya, Uganda);***
- 2. ability of shallow aquifers to attenuate faecal loading from on-site sanitation demonstrated empirically;***
- 3. vulnerability of shallow groundwater revealed from amplified faecal bacteriological contamination following heavy rainfalls;***
- 4. Potential misrepresentation of ‘access to safe water’ based on WHO/UNICEF JMP criteria for “improved water sources” – demonstrating gross faecal contamination***

# ***Policy implications for urban groundwater:***

- 1. Enable identification of areas where on-site sanitation may exceed the attenuation capacity of exploited aquifer – relevant not only to urban areas but also conditions in IDP/refugee camps***
- 2. Anticipate incidents of urban groundwater contamination and adaptive responses (e.g. boil-water advisories, improved design and operation of on-site sanitation).***

# www.afriwatsan.org

## Sustaining low-cost, urban water supply and sanitation systems in Africa

*AfriWatSan* is developing the scientific evidence to inform policies and practices sustaining low-cost, on-site water supplies and sanitation systems in urban Africa and to strengthen the capacity of individuals and institutions to conduct this vital research.

### AFRIWATSAN PROJECT



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LATEST RESOURCES