Promoting Safe & Sustainable Well Construction in Malawi

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MALAWI

Pop: 15 million
85% live in rural areas
Agriculture
GNI <$1.00/day
English & Bantu dialects
‘The Warm Heart of Africa’
MZUZU, MALAWI

- NGWREF’s first DN E&T grant
- Two courses over a week
  - 3 day – Drillers (incl. interpreter) - 27
  - 2 day – NGO’s, Government & Students - 17
- Partner – SMART Centre, Mzuzu U
- Setting the bar – Recognizing challenges as opportunities
**E. coli Free Drinking Water Wells**

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### ESTABLISHED GOALS, GUIDELINES & STANDARDS

**World Health Organization (WHO)**

According to World Health Organization (WHO), testing for organisms such as *Escherichia coli* (*E. coli*) as an indicator of faecal pollution is a well-established practice. This is the practice of testing for faecal contamination in the assessment of drinking water quality. *E. coli* is used as the verification or surveillance parameter.

Thermotolerant *E. coli* can be used as an alternative to the test for *E. coli* in many circumstances. Water intended for human consumption should contain no faecal indicator organisms. In the majority of cases, monitoring for *E. coli* or thermotolerant *E. coli* provides a high degree of assurance because of their large numbers in polluted water. The WHO guideline value clearly indicates that *E. coli* or thermotolerant *E. coli* should not be detectable in any 100 ml sample. (Guidelines for Drinking Water Quality – Fourth Edition WHO, 2011)

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### PROPER WELL CONSTRUCTION – BUILDING ASSETS

**Location, Location, Location**

- Begin with the end in mind – *E. coli* free.
- Proximity and gradient from open defecation must be considered.
- Setbacks are only lateral guidelines.
- Think 3 dimensionally – i.e. a safe target aquifer.

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### BACKGROUND

**United States Environmental Protection Agency (USEPA)**

National Primary Drinking Water Regulations

- Contaminant: 
  - *Escherichia coli* (faecal coliform and *E. coli*)
  - MCLG: 0 mg/L
  - MCL: 0 mg/L

**NOTES**

1. Maximum Contaminant Level Goal (MCLG) – The level of a contaminant in drinking water below which there is no known or expected risk to health.
2. Maximum Contaminant Level (MCL) – The level of a contaminant in drinking water, beyond which public health could be at risk.
3. The system has an acute MCL (Maximum Contaminant Level) violation.

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### METHODS

**The Safety and Difficulty of Constructing and Maintaining a Sanitary Sewer System, and the Cost of the Large Annular Surface Seal Required**

**NOTE:** A dug well should not be confused with a manually drilled well.

**WATER SUPPLY WELL GUIDELINES for use in DEVELOPING COUNTRIES – Schneider, S. Third Edition 2014**

**USGS & CDC studies find hand dug wells more likely to be *E. coli* contaminated.**

**Quality of Water from Domestic Wells in Principal Aquifers of the United States (USGS, 1976-2004)**

A Survey of the Quality of Water Drawn from Domestic Wells in Nine Midwestern States (USGS)

**A Well Construction Cost-Benefit Analysis (CBA): For Water Supply Well Guidelines for use in Developing Countries (J Whinnery, 2012)**

Demonstrated that properly constructed wells with ongoing operation and maintenance that are *E. coli* free will have 40 times more value than the cost.

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### DOCUMENTATION & REPOSITORY

**Well logs (labels) and well logs (as-built), along with a publicly accessible repository of the well logs, provide:**

- Location information for other wells
- Design information for other wells
- Drilling plan information for other wells
- Aquifer characterization

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### CONCLUSIONS

- Wells can and should be constructed to provide safe and sustainable drinking water supplies. Safety no longer means ‘clean’; safety means it must as a minimum be *E. coli* free. Sustainable no longer defines the short term yield of a well; it means the long term protection of the groundwater resource from contamination and waste.
- Safe and sustainable wells are assets.
- Improperly constructed wells have a negative cost-benefit ratio and may have a far reaching negative impact on the sustainability of safe drinking water. Proper decommissioning of wells is expensive. Such wells are liabilities.
- Continued education and training reminds us of the bar to be achieved and how we can get there in a positive impact on millions more lives.

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### CONTACT

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PDF of CBA and WATER SUPPLY WELL GUIDELINES book are available at: www.schneiderwater.com, click on hydrophiliarchy, then book cover.
SAFETY & SUSTAINABILITY

- Public Safety - **Safe vs clean** drinking water
  Goal is SAFE = ZERO E-coli (<1/100ml)
  & within guidelines for other minerals/chemicals

- Safety: Those constructing (e.g. dug wells)

- Up to 80% non-functioning wells in SSA

- Groundwater resource protection – quantity and quality (future generations)
COURSE FORMAT

- Powerpoint
- Course text – including ‘homework’
- Whiteboard – w/discussions
- Classroom demos
  - Drilling fluid (alternative to dung)
  - Bentonite chips (for annular sealing)
  - Water quality sampling protocol & testing
  - Sand tank demonstration
- Field drilling demonstrations
COURSE PRESENTERS

- MU Water Dept professionals
- Drillers (field demos)
- NGWREF RG
- NGWREF MGWC
CUSTOMIZED CONTENT

- Well Components
- Cost-Benefit Analysis
- Groundwater Flow
- Safety
- Ethics
- Contracts
- Opportunities (distributors)
- Regulations
VISUAL LEARNING - Petrifilm
PERCUSSION - FLOODED RC (SLUDGING) & ROPE PUMPS

DRILLING:

- Capital cost $500
- Portability public transportation
- Cost to operate <$1/hour
- Spare parts readily available
‘A BIG DEAL’

Malawi Minister of Water and Prof. Russel Chidya
RESPONSE
from Malawi

‘Just a note to thank you for a wonderful program here in Mzuzu last week. Both the programs exceeded our expectations, and have challenged us to do a better job for safe and sustainable well construction. But, also to not just accept the status quo.’

R Holm, PhD
E&T IMPACT (since 2011)

- Individuals improving all/part of their well construction; or teaching to others >70
- Wells impacted >7,000
- Individuals impacted (initially) ~2,000,000
- Add’l individuals impacted INCALCUABLE
Build **ASSETS**
Not **LIABILITIES**

“If we don’t take care of our groundwater; groundwater won’t take care of us.”
MAKE AN IMPACT!

Thank You

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click on ‘Hydrophilanthropy’

click on image of front cover: