



## Northern Illinois University

### Improving Groundwater Management in Myanmar through Capacity Building

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## Where is Myanmar?



## Myanmar Background



- Former Military State (Burma)
- Closed to the western world from 1948-2011
- Education System
  - Teacher Rotations
  - Discipline Segregation
- Recently held first democratic elections (2015)



## Purpose



- How did we become involved in Myanmar (Burma)?
- Center for Burma Studies at Northern Illinois University
- National Groundwater Association-Developing Nations Fund
- Research Component



## NGWA-Developing Nations Fund



- Teach Basics of Hydrogeology
  - Groundwater Development
  - Well Construction
  - Wellhead Protection
  - Groundwater Quality/Sampling
- Capacity Building
- Open Source Programs
- Groundwater Equipment



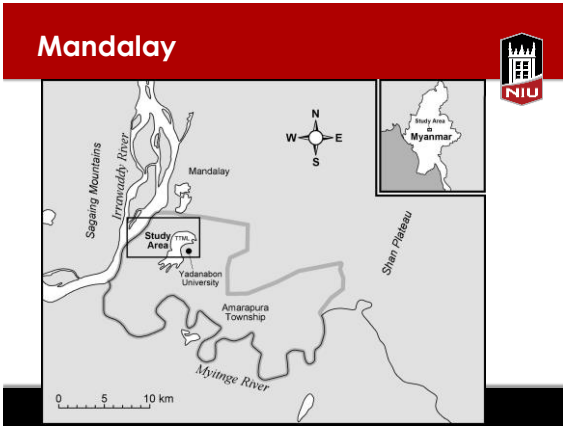
## Workshop



Yadanabon University, Mandalay, Myanmar

- Research Group
- Flash Drives
- Groundwater Lectures
- Hands-on field activities
- Donated Equipment/Books





## Major Issues

- Wastewater
- Solid Waste Disposal
- *E. coli*
- Hygiene

## Wells

## Dug Wells

- Dug wells are about 100 years old
- Brick liner
- Community Use
- Cleaning
- Washing
- 20-50 feet deep
- 4-5 feet in diameter

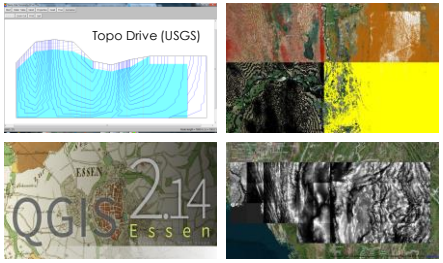
## Dug Well 10

Parameter	Units	Measured	WHO Limits
pH	[H]	7.65	6.0-8.5
Conductivity	µs/cm	2950	1500
Chloride	ppm	276	200
Nitrate	ppm	244	50
<i>E. coli</i>	MPN	>100	<1

## Tube Wells

- Cable tool drill or hand drill
- No grout or sand pack
- Drinking
- Cleaning
- 30-200 feet deep
- ~2 inches in Diameter

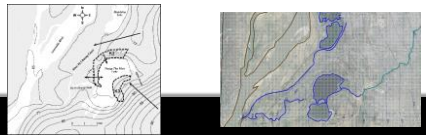
## Open Source Programs



## Numerical Modeling



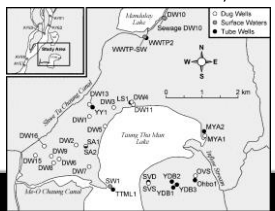
- GFLOW – Numerical Model
- Analytical element groundwater flow model that is readily accessible
- Governing equation and boundary conditions (for steady-state conditions)
  - $Q=KIA$ , Mass balance
- Dupuit-Forsheimer Assumption (2-D, areal view, primarily horizontal flow)



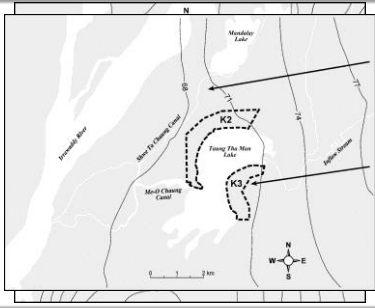
## Numerical Modeling



- Avg. Hydraulic Conductivity (20 m/day)
- Sand and gravel unconfined aquifer
- Channel & Bar Deposits
  - Thin Flood plain deposits
- Connected with Irrawaddy River



## Numerical Modeling



## Numerical Modeling



- Predominant groundwater flow direction is from East to West (GW discharges into Irrawaddy River)
- Coupled surface-groundwater system
- Transient Behavior
- Well construction promotes infiltration of contaminants from the surface
- Physical aspects of aquifer promote fast groundwater movement, which promotes contamination from surface sources

## To be continued...



## Acknowledgements



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- Yadanabon University



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## Acknowledgements



## Questions?

