Review of Groundwater Information in the Lower Mekong Basin

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Bangkok & Khon Kean, Thailand
FIRST MISSION OF USGS IN THE LMB

(April 27 – July 22, 2011)
Objectives of Groundwater Review

- Compile data and information from historical and current groundwater monitoring and assessment studies by National agencies, MRCS, and other sources.
- Summarize current understanding of the conditions and monitoring of the regional groundwater system in the LMB.
- Identify priority concerns for groundwater conditions and gaps in monitoring.
- Propose a preliminary action plan and strategy for future MRCS groundwater monitoring programs in cooperation with National agencies.
Products and Outcome

• First mission of USGS Expert (Matthew Landon) 3 months period, two draft manuscripts were produced:
  – Preliminary Action Plan for MRC Groundwater Monitoring in the Lower Mekong River Basin (LMRB)
• These manuscripts and the information compiled are intended to serve as a foundation for proposals seeking funding for expanded future analysis of groundwater in the LMRB by MRCS and cooperators
Overview of Hydrogeologic Setting of the LMB

LMB Aquifer Types/ Hydrogeologic Provinces (Adapted from Johnson, 1986, Mekong Secretariat, Preliminary Hydrogeologic Assessment of the Lower Mekong Basin)
Reviewing Existing Groundwater Monitoring in the LMB

Legend
- Khorat subbasin GWIP wells
- Sakon Nakhon GWIP wells
- Lao PDR GWIP wells
- Vietnam delta 90s-00s monitor wells
- PRASAC (51)
- JICA/MRD monthly monitoring (52)
- JICA/MRD test (55)

Major rivers and lakes
Groundwater Potential Yield m3/hr
- Unconsolidated, > 80
- Unconsolidated, 30 - 80
- Unconsolidated, 5 - 30
- Unconsolidated, < 5
- Consolidated, > 50
- Consolidated, 15 - 50
- Consolidated, 5 -15
- Consolidated, < 5
- Resistant bedrock, 1-3
- Resistant hard rock, < 2

LMRB drainage boundary

Yield Map Source: Charuratna and Phu (1992)
LMB Saline Groundwater Map

Source: Charuratna and Phu (1992)
Historical and Current GW Monitoring
A Historical Overview of Mekong Committee/National Agency Groundwater Monitoring

- LMB-scale hydrogeologic assessments (Johnson, 1986) and map compilations (Charuratna and Phu, 1992)
- Bimonthly monitoring of water levels and water-quality in wells in Lao PDR, Thailand, and Vietnam during 1990-98 (Groundwater Investigation Programme)
Groundwater Investigation Programme, 1990-98 (Mekong Secretariat and National agencies)

Source: Interim Mekong
Delineation of Areas for Monitoring

Areas of primary aquifers and low-yield or non-aquifers in Cambodia and Lao PDR.
<table>
<thead>
<tr>
<th>Country</th>
<th>Region</th>
<th>Area (km²)</th>
<th>Target area (km²) per well in grid</th>
<th>Number of wells</th>
<th>Grid Number</th>
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</thead>
<tbody>
<tr>
<td>Cambodia</td>
<td>Primary Aquifer</td>
<td>133,784</td>
<td>2,500</td>
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<td>18,531</td>
<td>10,000</td>
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<tr>
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<td>Grid subtotal:</td>
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<tr>
<td>Cambodia</td>
<td>HYCOS station nearby deep wells</td>
<td></td>
<td></td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Cambodia</td>
<td>Total wells</td>
<td></td>
<td></td>
<td>80</td>
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<tr>
<td>Lao PDR</td>
<td>Primary Aquifer</td>
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<td>Lao PDR</td>
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<td>80,367</td>
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<td>HYCOS station nearby deep wells</td>
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<tr>
<td>Lao PDR</td>
<td>Total wells</td>
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<td></td>
<td>81</td>
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</tbody>
</table>
Grid Design

- There are well-established procedures for generating grids for designing groundwater monitoring networks.
- A GIS method of Scott (1990) has been widely used by the USGS in National and California groundwater monitoring programs.
SECOND MISSION OF USGS EXPERTS IN THE LMB
(3 weeks in November 2013)
Focus on Design on Groundwater Monitoring

• Compile existing data and information
• Stated that a regional groundwater database would serve as a foundation for interpretive studies, visualization, and groundwater modeling
• Summarize current understanding of the conditions and monitoring of the regional groundwater system
• Identify priority concerns for groundwater conditions and gaps in monitoring
• Groundwater monitoring programs in cooperation with National Line Agencies
Database – Data Management Principles (USGS)

- Data conform to published standards
- Validity of the data
- Integrity and internal consistency of the data
- Secure and maintain primary data
- Allow easy access to primary data
- Process the data efficiently
- Allow integration of different datasets
- All data should have an owner
- Flexible structure
- Metadata
- Update specific data sources
- Data dictionaries
Database – Groundwater Data

GW Database

- Stratigraphy
- Geology
- Sites
- Aquifers
- Logs
- Samples
- Parameters
- Results
Need for Ongoing Groundwater Resource Assessment – Independent of Monitoring

- Ongoing geologic mapping
- Distribution of unconfined and confined aquifers
- Hydraulic and storage properties and thickness
- Recharge rates
- Groundwater discharge to streams (baseflow)
- Groundwater utilization: well numbers, locations, construction, and withdrawal rates
- Groundwater levels: water-level elevation maps and seasonal fluctuations
- Groundwater-quality assessments
- Water-balance analysis
- Groundwater-age investigations
- Groundwater-flow modeling
Summary

• Groundwater is an important supplemental source of water supply for anthropogenic and natural demands

• Groundwater monitoring and resource assessments have primarily been conducted in Thailand and Vietnam portions of the LMB and selected areas of Cambodia and Lao PDR – the principal gaps in monitoring are in the latter countries
Next Plan Activity

Ground water (GW) monitoring in place to provide information on exchange and interaction between groundwater and surface water. The GW activity will focus on:

1. Finalize the framework and action plan for GW activity for each Member country
2. Collect and analysis all available GW data in the LMB
3. Install pilot wells for GW level monitoring at various selected sites, bases on fund availability
4. Develop GW Database, bases on USGS’s guideline
5. Build up capacity on groundwater data management in regional and national levels
Thank you for your attention