Baseline Information for Hydrological Scenario Modelling

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URADAPT 3rd Stakeholder Forum
Coconut Groove Hotel, Accra

Tuesday, January 18, 2011
Outline

- Introduction
- Baseline for hydro modelling in Densu Basin
- WR availability and use in the Volta Basin
- Baseline for flood modelling
Introduction I

The main objectives of hydrological modelling under URAAdapt are to:

1. Assess the impact of various climate change and other scenarios on water availability (Renewable water) in the Densu Basin.

2. Simulate the impact of various water demand and allocation scenarios on water use in the Densu Basin.

3. Assess the impact of various climate change and other scenarios on flooding in the city of Accra.
Impact assessments as envisaged under URAdapt would require proper definition of baseline conditions, e.g., current situation. For hydrology, this means ascertaining, for a stated period, the:

1. **Average basin**
   - rainfall, extreme rainfall recurrence, streamflow, GW recharge, AET, baseflow, water abstraction for various purposes and landuse/cover.

2. **Basin WR vulnerability** (indices of WR vulnerability, stress and scarcity).

**Assumption:** No scenarios on soils and geology.
### Baseline for Densu I

**Surface Water resources:**
Mean Annual Rainfall – 1,230mm or 3,198 million m³

<table>
<thead>
<tr>
<th>Water abstraction scheme</th>
<th>Capacity million m³/year</th>
<th>Estimated streamflow million m³/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weija</td>
<td>97.8</td>
<td></td>
</tr>
<tr>
<td>Other schemes:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U/S Potable</td>
<td>3.8</td>
<td></td>
</tr>
<tr>
<td>Irrigation</td>
<td>4.0</td>
<td></td>
</tr>
<tr>
<td>Total, other schemes</td>
<td>7.8</td>
<td></td>
</tr>
<tr>
<td>Basin Total</td>
<td>105.6</td>
<td>280.0</td>
</tr>
</tbody>
</table>

Vulnerability index (Raskin *et. al.*, 1997) - 37.7%

- 20-40% Water scarcity
- >40% Severe water scarcity

Compiled from (WRC, 2007)
Volta Basin Water Resources I

Surface Water resources:

<table>
<thead>
<tr>
<th>Water abstraction scheme</th>
<th>Capacity million m³/year</th>
<th>Estimated streamflow million m³/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>U/S Potable</td>
<td>160</td>
<td></td>
</tr>
<tr>
<td>Irrigation + livestock</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>Basin Total</td>
<td>1,160</td>
<td>32,730.0</td>
</tr>
</tbody>
</table>

Vulnerability index (Raskin et. al., 1997) - 3.5%

20-40% Water scarcity

>40% Severe water scarcity

Compiled from de condappa et al, (2009)
Volta Basin Water Resources II
Impacts on inflows at the Akosombo dam from 3 scenarios over a period of 20 years.

The scenarios (implemented in WEAP):
- Development of SRs, with a growth in water demand from SRs by 10% per year.
- Climate change with a drier climate.
- Climate change with a wetter climate.

Reference (Base) period: 1980-2000
Volta Basin Water Resources II

The CC scenarios:

Reference

North -> South
Drier

Rainfall (mm)
- 300 - 600
- 601 - 900
- 901 - 1,200
- 1,201 - 1,500

South -> North
Wetter

Reproduced from "The Atlas of the Water Resources in the Volta basin", BFP Volta
Volta Basin Water Resources II
Results from scenario analyses

For SRs
A reduction of about 3% in inflows at Akosombo by the end of the 20-yr period. However, about 110,000 ha more put under irrigation by the end of the period.

For CC
Estimated flows at Akosombo are 24.2 and 33.5 Mm$^3$ for the drier and wetter scenarios respectively. Power production at Akosombo resulting in turbined water of 31.6 Mm$^3$ as for the reference period is only possible under the wetter scenario.
## Baseline for flood modelling I

Annual 1 day and 2 to 5 consecutive days’ maximum Rainfall:

<table>
<thead>
<tr>
<th>Return Period (Years)</th>
<th>Annual Maximum Rainfall (mm) expected in</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 day</td>
</tr>
<tr>
<td>2</td>
<td>84.1</td>
</tr>
<tr>
<td>5</td>
<td>121.5</td>
</tr>
<tr>
<td>10</td>
<td>147.1</td>
</tr>
<tr>
<td>20</td>
<td>171.6</td>
</tr>
<tr>
<td>50</td>
<td>205.4</td>
</tr>
<tr>
<td>100</td>
<td>231.0</td>
</tr>
</tbody>
</table>

Extracted from Kwaku and Duke, (2007)

1975-2004 daily rainfall data for KIA used
Baseline for flood modelling II

Flood risk zones of Accra:

Extracted from Kofi Nyarko, (2000)
THANK YOU, for your attention

Map from BFP Volta