Presentation: Some Hydrological Considerations for the Spatial Review of the National Water Resources Monitoring Network

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SOME HYDROLOGICAL CONSIDERATIONS FOR THE SPATIAL REVIEW OF THE NATIONAL WATER RESOURCES MONITORING NETWORK

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- DWS: RQIS
- DWS: IWRP
- All DWS Regional Office
- >100 people providing input to process
Presentation Objectives

• DWS Network Review Project
• Reminder of the network review process.
• Describe theoretical spatial criteria used for
  – Hydrological Considerations
  – (Geo-hydrological Considerations)
Review, evaluation and optimisation of the National Water Resources Monitoring Networks Project

Aim to:

• undertake an **evaluation of each the 10 monitoring networks** in their **present condition**,  

• **redesign and realign** (where necessary) the networks with the **strategic and management requirements of the DWS and SA**,  

• **optimise the networks** as far as possible, and  

• ensure **sustainable, relevant and up-to-date data of an acceptable quality**.

Outcome:

National Water Resource Monitoring Implementation Strategy
Redesign, realign and optimise.

- Extensive process undertaken to get status quo of current monitoring activities and integrity of data.
- Require independent way of evaluating existing network to assess adequacy of meeting of DWS needs.
- What are the objectives of a national water resources monitoring network?
- Who are the main clients?
- Where and what should we be measuring?
National Network Spatial Review Process

• Gaps
• Redundancies/Duplications
• Priorities & Info yield

Recommendation for optimal network configurations

Current Network Sites → Review Network → Theoretical Network Sites

Workshops per WMA

• Network Inventory
• Data Integrity

Google Earth

????
Theoretical Water Resources Monitoring Network.

- A chance for a **new beginning**.
- Totally **independent** of current monitoring activities.
- Take **no constraints** into account (except the physical impossible)
- Would be **Theoretical Optimal Network** that would **meet all DWS: WIMs legal and other requirements to monitor water resources nationally**.
## National Water Resource Monitoring Objectives

<table>
<thead>
<tr>
<th>Priority class</th>
<th>Objective</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Resource and infrastructure planning</td>
<td>To provide adequate monitoring data for determining the availability and quality of current and future water resources, aimed at providing strategic decision support for the equitable and sustainable allocation of resources to the population, environment and other economic sectors of society through planned infrastructure development and other interventions.</td>
</tr>
<tr>
<td>2</td>
<td>Resource operations and management</td>
<td>To provide timely monitoring data for the efficient operation and management of water resources to ensure the protection of resources and water users and to allocate water equitably and sustainably.</td>
</tr>
<tr>
<td>3</td>
<td>Warning systems</td>
<td>To provide timeous water resources monitoring data for early-warning systems to mitigate negative impacts on humans, infrastructure, the economy and riverine and coastal ecosystems.</td>
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<tr>
<td>4</td>
<td>Compliance and auditing</td>
<td>To provide water quality and quantity monitoring data to ensure compliance and auditing functions required for water use licensing, and other functions.</td>
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</tbody>
</table>
National Network Spatial Review Process

- Gaps
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Recommendation for optimal network configurations

Current Network Sites
- Network Inventory
- Data Integrity

Workshops per WMA

Theoretical Network Sites

Prioritised National Objectives

Review Network

Google Earth
Development of a theoretical monitoring network

Why monitor? What has priority?

National Water Resources Monitoring Objectives

Legal and Scientific Processes to meet needs

Where should we monitor? What and how often?

Theoretical Monitoring Sites

National Spatial Datasets

Spatial monitoring criteria to support legal/scientific processes
## Sub-objectives and processes

<table>
<thead>
<tr>
<th>Main objective</th>
<th>Sub-objective</th>
<th>Process</th>
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</thead>
<tbody>
<tr>
<td>Resource and infrastructure planning</td>
<td>Quantify available resource</td>
<td>Rainfall-runoff modelling</td>
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<td></td>
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<td>Groundwater modelling</td>
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<td></td>
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<td>International obligations</td>
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<td></td>
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<td>Research and baseline catchments</td>
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<td></td>
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<td>Reserve requirements</td>
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<td></td>
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<td>Estuarine requirements</td>
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<td></td>
<td>Determine fitness for use of resources</td>
<td>Quality trend and threshold analyses</td>
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<td></td>
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<td>Salinity modelling</td>
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<tr>
<td></td>
<td></td>
<td>Eutrophication modelling</td>
</tr>
<tr>
<td></td>
<td>Development options analysis system operating rules</td>
<td>Water resource systems modelling, including demand projections</td>
</tr>
<tr>
<td></td>
<td>Infrastructure design</td>
<td>Sediment analysis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Flood analysis</td>
</tr>
</tbody>
</table>
Development of a theoretical monitoring network

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National Spatial Datasets
Placement of theoretical monitoring site

The following groupings of *considerations for site placement* relative to spatial datasets were used:

- Hydrological/Geo-hydrological
- Ecosystem
- Anthropogenic
Hydrological Criteria

Based on **natural characteristic** of each primary/secondary basins:

- Location of high runoff areas
- Distribution of total flows per quaternary
- International obligations

All based on WR2012 Data and “national catchment tree”
Hydrological Criteria: Natural Unit Runoff per Quaternary

- Need to measure areas of **high runoff** ("Water Towers")
- Used **Natural MAR** for each quaternary in terms of **unit runoff**
- Plotted in following categories (mm/a):
  - 0 – 10
  - 10 – 20
  - 20 – 50
  - 50 - 100
  - 100 – 200
  - 200 – 500
  - 500 -1000
  - >1000
Hydrological Criteria: Base Distributions

• Generated two datasets:
  – Total (cumulative) natural MAR at the outlet of each quaternary.
  – Total natural flows for each current monitoring site (rivers and dams – ignore W-Components) – Cheat!

• Generated histograms per primary river catchment or group of rivers (coastal) of:
  – % of total flows for
  – set ranges of flows

• Dependant on shape of catchment boundaries and distribution of rainfall
Conclusions

- All monitoring network reviews, redesigns and optimisation should **start with the objectives** of the network.

- From hydrological and geo-hydrological perspectives:
  - Expected natural conditions could support decision support on spatial distributions of network
  - High yielding areas should be monitored as priority
  - For surface water the flow characteristics of a range of representative flows should be covered
  - For groundwater baseline stations is key with trend monitoring for anthropogenic effects.
Geo-hydrological Criteria

• Same review process followed as for surface water

• Status Quo of groundwater level network established in September 2014.

• Developed theoretical network in terms of baseline monitoring sites using GRA2 national datasets.

• On WMA workshops:
  – Identified trend monitoring sites
  – Assigned existing sites as baseline and trend sites
Datasets

- Transboundary aquifers
- Aquifer yield classification
- Recharge
- Negative land cover
- Water quality maps
- Vulnerability
- Land cover
- AMD/Fracking/RBIG/IDZs
- RQO sites
- Bulk water Users
A National Framework for Ground-Water Monitoring in the United States

Prepared by The Subcommittee on Ground Water of The Advisory Committee on Water Information

Approved by The Advisory Committee on Water Information
Theoretical Baseline Sites
Theoretical Baseline and Trend Sites
Status Quo Monitoring
September 2014
Integrated Theoretical and Existing Network
Reports and data


Or

DWS Website|Projects and Programmes|
Review, Evaluation and Optimisation of the National Water Resources Monitoring (NWRM) Network Project