Exploring Ways to Benchmark River Basin Performance

Chris Morris, Senior Water Resources Engineer

NARBO Third General Meeting, 21 February 2008, Surakarta.

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Where are we?

Overall basin performance Benchmarking

NARBO Benchmarking

Basin Status Benchmarking

Other areas..?

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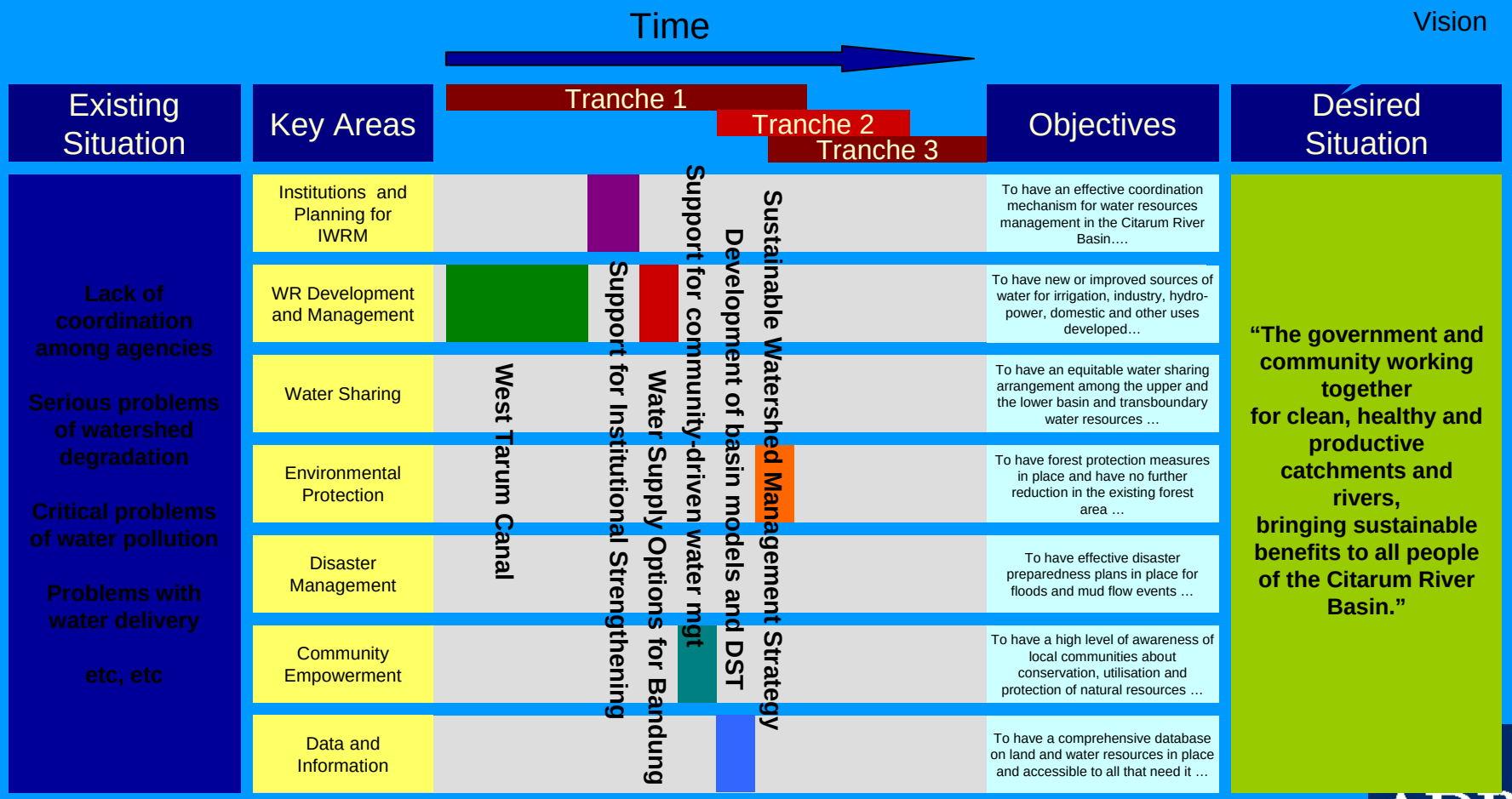
Citarum River Basin Strategic Planning Framework

Constructing Roadmaps



NARBO Benchmarking

- RBO Status
- RBO Governance

- Planning
- Water Allocation
- Data Management

- Cost Recovery
- Financial Efficiency

- HR Development
- Technical Development
- Organizational Development

- Customer Involvement
- Customer Feedback
- Environmental Audits
- Basin Livelihood

The Design of a IWRM Basin Performance Benchmarking Program

Research, June 2007 to Feb 2008, by:
Kei Saiki, The University of Tokyo

Supported by:

Asian Development Bank

Balai Besar WS Citarum (Citarum RBO)

PJT 2, PJT 1, IWMI

Languan Lake Development Authority

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Study outputs?

Design of a river basin performance benchmarking program

- performance indicator design,
- benchmarking guideline, and
- design of an output publication

Verification in 2 river basins

Verification process?

IWRM Elements and Existing River Performance Benchmarking Systems

River Basin Organization
Stakeholder Participation
River Basin Planning
Public Awareness
Water Allocation
Water Rights
Wastewater Permits
IWRM financing
Economic Instruments
Regulations
Infrastructure for Multiple Benefits
Private Sector Contribution
Water Education

Watershed Management
Environmental Flows
Disaster Management
Flood Forecasting
Flood Damage Rehabilitation
Water Quality Improvement
Water Quality Monitoring
Wetland Conservation
Fisheries
Groundwater management
Water Conservation
Decision Support Information

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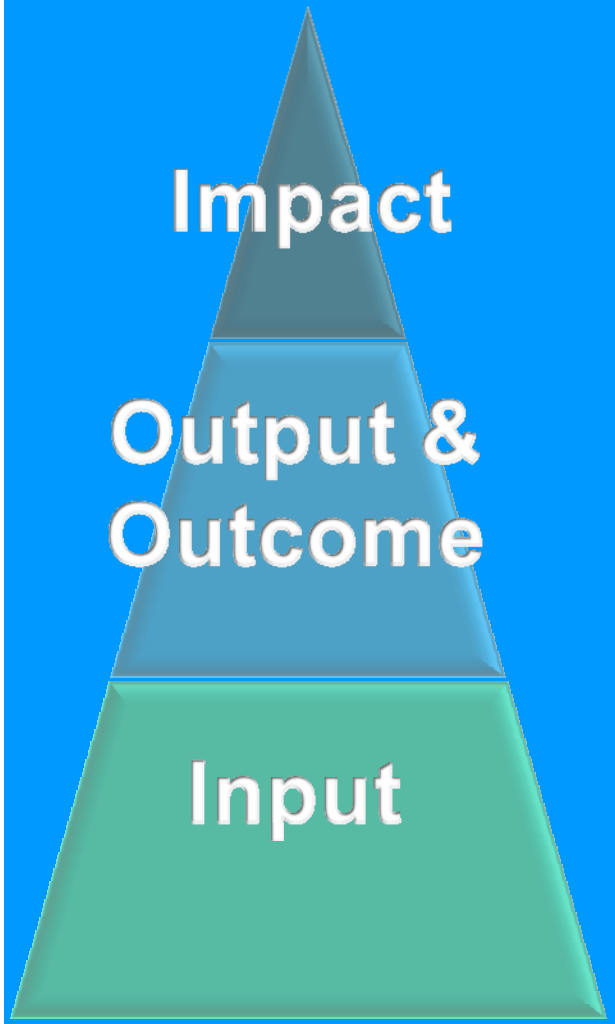
IWRM Diagram



Economic Benefit

Basic Livelihood

Environmental Sustainability

Water Utilization

Disaster Vulnerability

Envt'l Management

Basin
Status
Benchmarking

River Basin Organization

Internal Business Process

Finance

Learning and Growth

Stakeholders

NARBO
Benchmarking

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Classification of indices

Physical performance ⟷ **Human activities performance**

Recreational water quality

Flood vulnerability

Chemical Spills

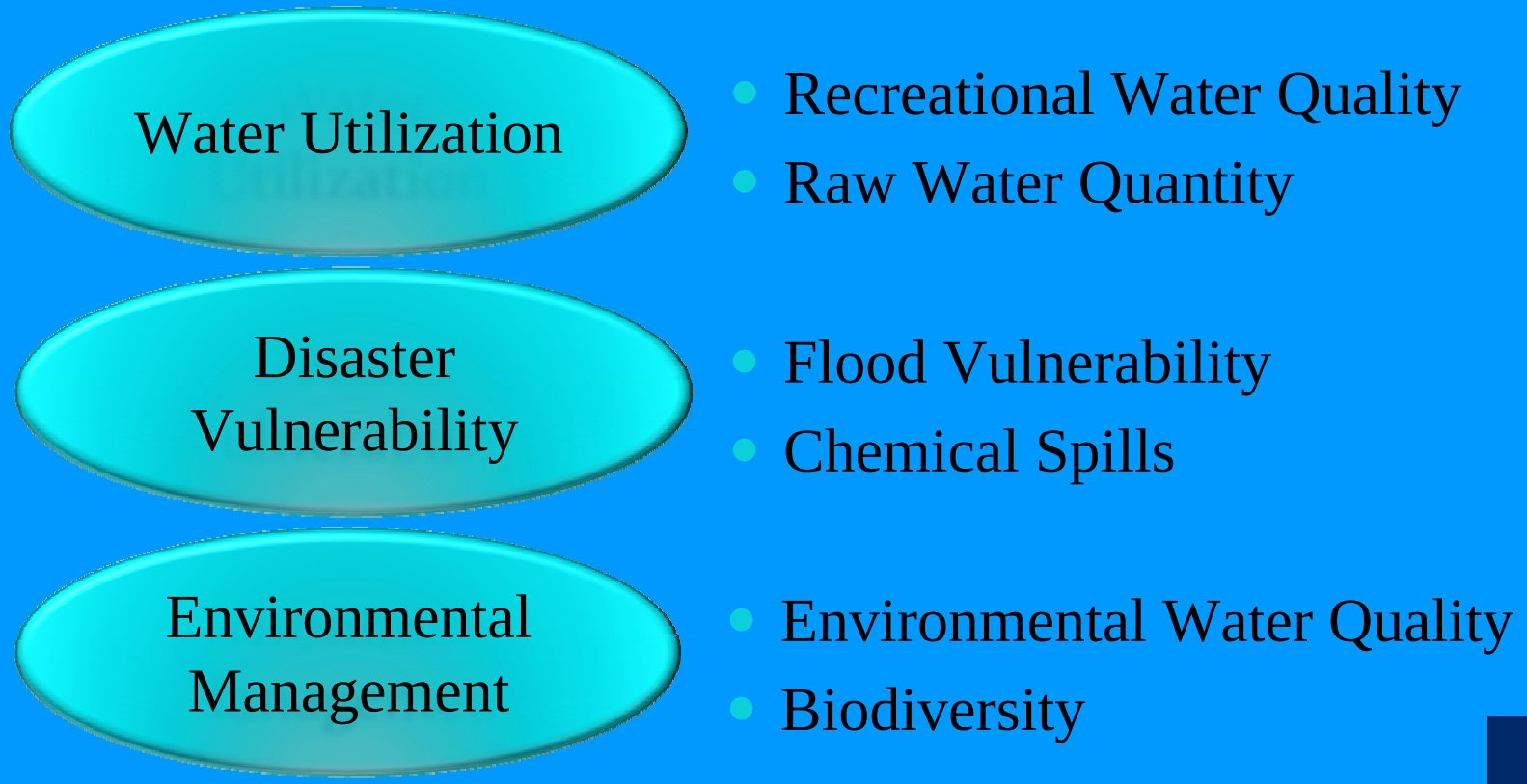
Environmental Water Quality

Biodiversity

Raw water supply

(Flood Vulnerability)

Basin Status Benchmarking



- Recreational Water Quality
- Raw Water Quantity

- Flood Vulnerability
- Chemical Spills

- Environmental Water Quality
- Biodiversity

Recreational Water Quality

Fecal Coliforms

Score	4	3	2	1	0
Fecal coliforms (count / 100ml)	< 200	< 1,000	< 2,000	< 10,000	10,000 <

Definition of Water Quality Score

4; Fine quality; Suitable for recreational use
3; Fair quality; Acceptable for recreational use
2; Moderate quality; Acceptable for fish farming and animal husbandry
1; Poor quality; Limited agricultural use
0; Highly poluted quality; Dangerous for any use

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Raw Water Supply

Water Supply / Planned Ratio

$$SPR = \frac{1}{N}\sum\left(\frac{O}{P}\right)_i$$

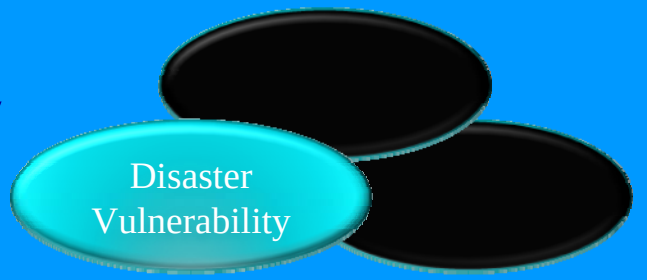
Where:

SPR =	Supply Planned Ratio Index
N =	Number of planning segments in a year
O =	Observed amount of water supply
P =	Planned amount of water supply
i =	planning segment

Score	4	3	2	1	0
ASPR	97.5% <	95% - 97.5%	92.5% - 95%	90% - 92.5%	< 90%
MSPR	95% <	90% - 95%	85% - 90%	80% - 85%	< 80%

ASPR: Annual average SPR
MSPR: Minimum SPR throughout a year

Flood Vulnerability



Flood Vulnerability Index

$$FVI = \frac{1}{N}\sum\left(\frac{D}{P}\right)$$

Where:

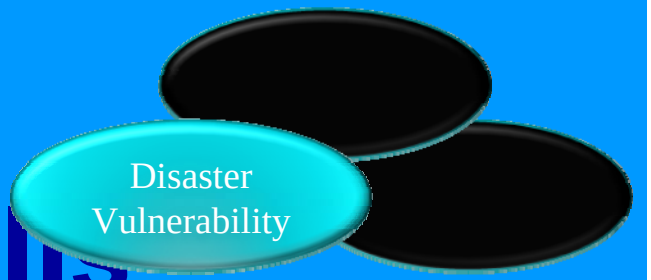
FVI = Flood Vulnerability Index

N = Target period [year]

D = Number of people killed in flood events in a year in the target catchment

P = Population within the catchment in a year

Score	4	3	2	1	0
Number of people killed per million	FV < 0.30	< 1.00	< 4.00	< 10.0	10.0 < FV



Chemical Spills

Cadmium

Score	4	3	2	1	0
Cadmium (mg/L)	< 0.003	0.003 - 0.01	0.01 - 0.05	0.05 - 0.15	0.15 <

Zinc

Score	4	3	2	1	0
Zinc (mg/L)	< 0.03	0.03 - 0.05	0.05 - 0.12	0.12 - 0.20	0.20 <

Definition of Water Quality Score

4; Safe water with toxic substances kept in safe level
3; Safe water with toxic substances kept in acceptable level
2; Water with toxic substances in alarming level
1; Water with toxic substances in dangerous level
0; Water with toxic substances in catastrophic level

Environmental Water Quality

- Dissolved Oxygen

Score	4	3	2	1	0
Dissolved Oxygen (mg/L)	7.0 <	5.0 – 7.0	3.0 – 5.0	1.0 – 3.0	< 1.0

- Total Phosphorus

Score	4	3	2	1	0
Total Phosphorus (mg/L)	< 0.04	< 0.2	< 1.0	< 5.0	5.0 <

- Ammonia Nitrogen

Score	4	3	2	1	0
Ammonia Nitrogen (mg/L)	< 0.20	0.20 - 0.50	0.50 - 1.0	1.0 - 2.0	2.0 <

Biodiversity

$$BDI_i = \frac{Obs_i}{Exp_i} \times 100$$

Where:

BDI =	Biodiversity Index
Exp =	Expected number of species at selected sites in the catchment
Obs =	Observed number of species at selected sites in the catchment
i =	Elements to be assessed i.e. fish, macro-invertebrate, and aquatic plants.

- Fish
- Macro-invertebrates
- Aquatic Plants

Score	4	3	2	1	0
BDI (%)	75 <	50 - 75	25 - 50	0 - 25	0

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Available data

Sub-Indicator	Citarum River Basin	Laguna Lake Region
Fecal Coliforms	○	○
ASPR	○	×
MSPR	○	×
FVI	△	○
Cadmium	○	○
Zinc	○	○
Total Phosphorus	×	○
NH4-N	○	○
Dissolved Oxygen	○	○
Fish O/E	×	×
Invertebrates O/E	△	×
Aquatic Plants O/E	△	×

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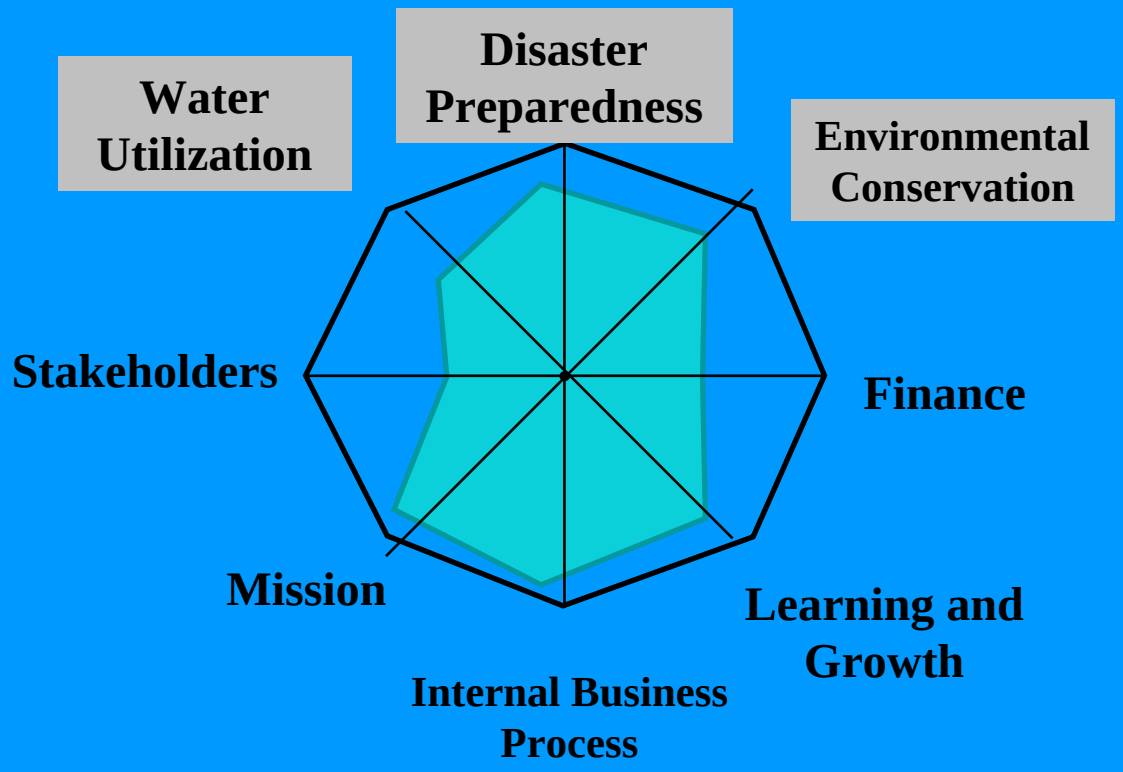
Citarum BS Benchmarking

Key Performance Area	Maximum Score	Basin Score
Water Utilization	**4.0**	**0.5**
Water Quality	4.0	1.0
Fecal Coliforms	4.0	1.0
Raw Water Supply	4.0	0.0
ASPR	4.0	0.0
MSPR	4.0	0.0.
Disaster Vulnerability	**4.0**	**3.0**
Flood Vulnerability	4.0	4.0
FVI	4.0	4.0
Chemical Spills	4.0	2.0
Cadmium	4.0	2.0
Zinc	4.0	2.0
Environmental Conservation	**4.0**	
Water Quality	4.0	1.5
Total Phosphorus	4.0	N.A.
NH_4-N	4.0	0.0
Dissolved Oxygen	4.0	3.0
Biodiversity	4.0	
Fish O/E	4.0	N.A.
Invertebrates O/E	4.0	N.A.
Aquatic Plants O/E	4.0	N.A.
Average Score	**4.0**	**(1.50)**

Laguna BS Benchmarking

Water Utilization	**4.0**	
Water Quality	4.0	0.0
Fecal Coliforms	4.0	0.0
Raw Water Supply	4.0	
ASPR	4.0	N.A.
MSPR	4.0	N.A.
Disaster Vulnerability	**4.0**	**2.75**
Flood Vulnerability	4.0	2.0
FVI	4.0	2.0
Chemical Spills	4.0	3.5
Cadmium	4.0	3.0
Zinc	4.0	4.0
Environmental Conservation	**4.0**	
Water Quality	4.0	1.7
Total Phosphorus	4.0	1.0
NH_4-N	4.0	2.0
Dissolved Oxygen	4.0	2.0
Biodiversity	4.0	
Fish O/E	4.0	N.A.
Invertebrates O/E	4.0	N.A.
Aquatic Plants O/E	4.0	N.A.
Average Score	**4.0**	**(2.00)**

An Example of a Basin Performance Report Diagram



Expected Output of Benchmarking Recommendations

1. Basin performance report
2. Set basin performance targets
3. Set next benchmarking program
4. Recommendation for data management system improvement

Reinforcement
Why Benchmarking?

A process of continuous improvement through:

- comparison with peer RBOs, and
- comparison with the same RBO in different timeline.

Detect the gaps for sound investment

Not a solution, but a tool

Key Lessons and Issues from Implementation

Benchmarking program side

- Data availability
- Adequacy of grading threshold values

RBO side

- Strong commitment
- Institutional arrangement
- Constraints

  time and capacity

Technical Issues raised

Elements

- Sediment problem
- Forestry (land use)
- Groundwater management
- Solid waste management

Definition

- Raw water supply
- Flood vulnerability

Threshold Values

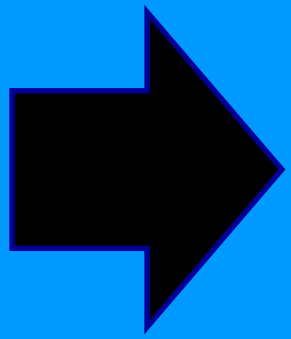
- Single or multiple

“Basin Performance”
Future Research

Water-related

Water quality,

Water supply,



Expansion

Infant mortality

Literacy

Livelihoods

For More Information

Chris Morris, cmorris@adb.org

Kei Saiki, c370071@yahoo.co.jp

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