

Water Monitoring

Mapping Existing Global Systems & Initiatives
Background Document - August 2006

Prepared by FAO on behalf of the UN-Water Task Force on Monitoring
Stockholm, 21 August 2006



Water Monitoring

Mapping Existing Global Systems & Initiatives Background Document - August 2006

Prepared by FAO on behalf of the UN-Water Task Force on Monitoring
Stockholm, 21 August 2006

Reprinted 2009

The designations employed and the presentation of material in this information product do not imply the expression of any opinion whatsoever on the part of the Food and Agriculture Organization of the United Nations (FAO) concerning the legal or development status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. The mention of specific companies or products of manufacturers, whether or not these have been patented, does not imply that these have been endorsed or recommended by FAO in preference to others of a similar nature that are not mentioned.

The views expressed in this information product are those of the authors and do not necessarily reflect the views of FAO.

ISBN 978-92-5-106017-9

All rights reserved. Reproduction and dissemination of material in this information product for educational or other non-commercial purposes are authorized without any prior written permission from the copyright holders provided the source is fully acknowledged. Reproduction of material in this information product for resale or other commercial purposes is prohibited without written permission of the copyright holders. Applications for such permission should be addressed to:

Chief

Electronic Publishing Policy and Support Branch

Communication Division

FAO

Viale delle Terme di Caracalla, 00153 Rome, Italy

or by e-mail to:

copyright@fao.org

© FAO 2008

Contents

List of UN-Water members & partners	v
Acronyms	vi
Acknowledgements	vii
Background	1
Monitoring in the mandate of UN-Water	2
The purpose of monitoring	2
Monitoring internationally agreed goals and targets	2
Monitoring the Millenium Development Goals	3
Monitoring the implementation of the JPOI and Agenda 21	3
The call on UN-Water to monitor and report on implementations of CSD-13	3
UN-SD Initiative the System of integrated Environmental and Economic accounting, (SEEA)	4
Terms of reference of this study	4
Definitions used in this report	5
Scope and methodology for the mapping exercise	7
Survey results: a map of global monitoring initiatives	8
Main findings and points for discussion	11
Annexes	14
1. Milestones in international water discussions	14
2. The Millennium Development Goals (MDGs), Targets and Indicators	16
3. World Summit on Sustainable Development, Johannesburg Plan of Implementation (JPOI)	18
4. Integrated Water Resources Management approach	19
5. Indicators: uses and limitations	20
Definition of criteria for choosing water monitoring indicators	22
6. Proposed list of key water indicators for UN-Water	23
6. Proposal for a Federated Water Monitoring System (FWMS)	27
Rationale	27
The Federative principle	28
The unified business architecture	29
Advantages of web services	29
The principles of service-oriented architecture	29
A gateway to local knowledge	30
7. Water monitoring initiatives and datasets	30
8. Reference materials	36

List of UN-Water members and partners

UN-Water is the inter-agency mechanism that promotes coherence and coordination of UN system actions aimed at the implementation of the agenda defined by the Millennium Declaration and the 2002 World Summit on Sustainable Development as it relates to its scope of work.

The Members of UN-Water are presented below in alphabetical order

UN members:

FAO	Food and Agriculture Organization of the United Nations
IAEA	International Atomic Energy Agency
IFAD	International Fund of Agricultural Development
UNCBD	United Nations Convention on Biological Diversity
UNCCD	United Nations Convention to Combat Desertification
UNFCCC	United Nations Framework Convention on Climate Change
UNDESA	United Nations Department of Economic and Social Affairs (UN-Water Secretariat)
UNDP	United Nations Development Programme
UNECA	United Nations Economic Commission for Africa
UNECE	United Nations Economic Commission for Europe
UNECLAC	United Nations Economic Comm. for Latin America and the Caribbean
UNEP	United Nations Environment Programme
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNESCWA	United Nations Economic and Social Commission for Western Asia
UN-Habitat	United Nations Human Settlements Programme
UNHCR	United Nations High Commission for Refugees
UNICEF	United Nations Children's Fund
UNIDO	United Nations Industrial Development Organization
UNISDR	International Strategy for Disaster Reduction
UNU	United Nations University
WHO	World Health Organization (UN-Water Chair)
WMO	World Metrological Organization
World Bank	

Partners:

GWP	Global Water Partnership
IAH	International Association of Hydrogeologists
IAHS	International Association of Hydrological Sciences
IPTRID	International Programme for Technology and Research in Irrigation and Drainage
IWA	International water Association
PSI	Public Service International
Ramsar	Convention on Wetlands
WWC	World Water Council

Acronyms

AWDR	African Water Development Report
CSD	Commission in Sustainable Development
CWP	Country Water Partnership
Eurostat	Statistical Office of the European Commission (EU)
D//A	Domestic/Industry/Agriculture
DDP	Dams and Development Project (UNEP)
EUWI	EU water initiative
FWMS	Federated Water Monitoring System
GEF	Global Environment Facility
GEO	Global Environment Outlook
GRID	Global Resource Information Database (UNEP)
GWP	Global Water Partnership
HDRO	Human Development Report Office (UNDP)
HLCP	UN High Level Committee on Programmes
HTTP	Hypertext Transfer Protocol
IMF	International Monetary Fund
ISD	Indicator of Sustainable Development
ISIC code	International Standard of Industrial Classification code of Economic Activities (UNIDO)
IWG-Env	Interagency Working Group on Environment Statistics
IWRM	Integrated Water Resource Management
JPOI	Johannesburg Plan of Implementation
MDGs	Millennium Development Goals
METIS	Joint UNECE/Eurostat/OECD work session on statistical metadata
OECD	Organisation for Economic Co-operation and Development
RPC	Remote procedure call
SOA	Service-Oriented architecture
SOAP	Simple Object Access Protocol
UNCDB	United Nations Common Database (UNDESA)
UNCED	United Nations Conference on Environment and Development
UNDG	United Nations Development Group
WEHAB	Water, Energy, Health, Agriculture and Biodiversity
WFD	Water Framework Directive (EU)
WMA	Water Monitoring Alliance
WWAP	World Water Assessment Programme
WWDR	World Water Development Report
WSSD	World Summit on Sustainable Development

Acknowledgements

This document was prepared by Jean Marc Faures, FAO Water Unit, on the basis of a research by Giorgio d'Amore, FAO consultant, and on behalf of the UN-Water Task Force on Monitoring. The research benefited from input from several UN-Water partners.

Background

The long-term sustainability of water is in doubt in many regions of the world¹. Currently, humans use about half the water that is readily available. Water use has been growing at more than twice the population rate, and a number of regions are already chronically short of water. Both water quantity and water quality are becoming dominant issues in many countries. Problems relate to poor water allocation and pricing, inefficient use, and lack of adequate integrated management. The major withdrawals of water are for agriculture, industry, and domestic consumption². Most of the water used by industries and municipalities is often returned to watercourses degraded in quality. Irrigation agriculture, responsible for nearly 40% of world food production, uses about 70% of total water withdrawals (90% in the dry tropics).³ Groundwater, which supplies one third of the world's population, is increasingly being used for irrigation. Water tables are being lowered in many areas making it more expensive to access.

Every day, diarrhoeal diseases from easily preventable causes claim the lives of approximately 5000 young children throughout the world. Sufficient and better quality drinking water and basic sanitation can cut this toll dramatically, and simple, low-cost household water treatment has the potential to save further lives.⁴

Major water quality problems stem from sewage pollution, the intensive agricultural use of fertilizers and pesticides, industrial wastes, saltwater intrusion, and soil erosion. In many developing countries, rivers downstream of large cities are little cleaner than open sewers.

In calling for integrated water resource management, the World Summit on Sustainable Development emphasized the need to protect water, its quality, and ecosystem functions through improved assessment and greater understanding of the impacts of climate change⁵. Water for drinking supply, food production, and sustainable urban and rural development have been recognized as key priorities by the International Community.

A global concern has progressively emerged during the last decade, which has translated into numerous actions aimed at reversing the threats to water and expanding the access to related services, especially in developing and transition countries. Various initiatives have been launched by many actors, such as international donors, national public bodies, local communities, private companies and research centres. In some cases, complex sets of tasks and activities are being conceived and implemented.

Governments and donors are increasingly called to put in place a uniform and consistent system to monitor the impacts of water-related initiatives. Moreover, the decision- and policy-making bodies need to expand, and other time to focus, the sources from which to draw information on the results of the water strategies. Overall figures are also required for advocacy and awareness purpose and to fine tune upcoming strategies and policies.

Crucial in this process is mobilizing the required financial resources of donors and lenders, by showing them that the impact of water-related initiatives in poor countries can be reliably assessed and that their impact on human development and environment sustainability is notable. However, experience shows how difficult is monitoring and reporting on the advancements of individual programmes, and verifying that water sound principles are effectively put into practices. International coordination in monitoring the state of the world's water resources, access to basic services and progress towards agreed goals and targets is needed, in order to guide future investments and efforts in achieving these goals.

Monitoring the advancements in water resources management is essential if the political commitment is to be sustained and put into practice. This need has been widely

¹ UN DESA, <http://www.un.org/esa/sustdev/natlinfo/indicators/isdms2001/isd-ms2001isd.htm>

² Table presented is extracted from the FAO Food and Agriculture Statistics Global Outlook, June 2006; data, however, refers to the year 2000. http://faostat.fao.org/Portals/_Faostat/documents/pdf/world.pdf

³ United Nations Economic and Social Council, Comprehensive Assessment of the Freshwater Resources of the World, Report of the Secretary-General, Commission on Sustainable Development, Fifth Session, April 1997

⁴ JMP, Water for Life: making it happen, 2005 http://www.wssinfo.org/pdf/JMP_05_text.pdf

⁵ United Nations, Agenda 21, Chapter 18 <http://www.un.org/esa/sustdev/documents/agenda21/english/agenda21chapter18.htm>

acknowledged in several occasions. In January 1992, the UN Dublin Conference on Water and the Environment established the main principles of modern water management which served as the basis of Chapter 18 of the United Nations Conference on Environment and Development (UNCED) Agenda 21 (Rio de Janeiro, June 1992). It includes the imperative necessity of reliable information for water resources planning and management. This issue has been reemphasized in a recent series of UN conferences, such as the World Summit on Sustainable Development (WSSD, Johannesburg, August-September 2002), the 12th and 13th Session of the Commission on Sustainable Development (CSD, New York, April 2004 and April 2005), as well as other recent international meetings. Moreover, the strategy paper of the European Union Water Initiative (EUWI), launched in 2002, calls for a monitoring and reporting mechanism for progress and quality control.

Monitoring in the mandate of UN-Water

In 2003, the UN High Level Committee on Programmes (HLCP) established "UN-Water as the inter-agency mechanism for follow-up of the WSSD water-related decisions and the MDGs concerning water". The scope of UN-Water's work encompasses all aspects of freshwater, including surface and groundwater resources and the interface between fresh and sea water. It includes freshwater resources, both in terms of their quality and quantity, their development, assessment, management, monitoring and use (including, for example, domestic uses, agriculture and ecosystems requirements). The scope of work of UN-Water also includes sanitation - encompassing both access to and use of sanitation by populations and the interactions between sanitation and freshwater. It further includes water-related disasters, emergencies and other extreme events and their impact on human security.

UN-Water is the inter-agency mechanism that promotes coherence in, and coordination of, UN system actions aimed at the implementation of the agenda defined by the Millennium Declaration and the World Summit on Sustainable Development as it relates to its scope of work.

The main purpose of UN-Water is thus to complement and add value to existing programmes and projects by facilitating synergies and joint efforts, so as to maximize system-wide coordinated action and coherence as well as effectiveness of the support provided to Member States in their efforts towards achieving the time-bound goals, targets and actions related to its scope of work as agreed by the international community, particularly those contained in the MDGs and the JPOI.

One of UN-Water's tasks is to facilitate inter-agency information exchange, including sharing of experiences and

lessons learned, and serve as a clearing house for policy-relevant information, assessment and advice on status and trends at global and regional levels, and for providing Member States with a collective point of entry to the system's initiatives and responses in areas within its purview.

The purpose of monitoring

Several different visions of monitoring have gradually become accepted over the past decades. Some of those focus, for example, on the performance of projects or specific institutions. Some have the beneficiaries as reference for the analysis, and implement a participatory exercise. Some others use finance as the sole criterion. Still others concentrate on information for senior management decision-making. In recent years the impetus towards monitoring the advancement towards the MDGs, both at the national and the global levels, has acquired decisive prominence.

Measuring the performance and impact of complex water-related programmes or initiatives is an essential task. In this way, it would be possible to track the actual implementation of all initiatives and promote the integration of various activities into the overall development frameworks. Monitoring per se is concerned with the procedures and activities for collecting data and information in the formulation and implementation stages of an action or a series of initiatives. It is particularly aimed at providing regular feedback to guarantee coherence, efficiency and effectiveness against the underlying objectives set at the national and international levels. This will both stimulate support to the initiatives being implemented, and improve the formulation of the subsequent programmes, through a "learning circle" informed by the lessons drawn from previous and ongoing activities.

Proper monitoring will ensure that targets are actually being reached, with disbursements linked to effective achievements. Such programmatic approach entails a continuous and ongoing process of aligning the programmes and expenditure allocations with intended outputs and outcomes, with regular midcourse corrections. Among the examples of consistent monitoring practices, that of the European Union emerges as a good practice. Having well understood the virtues of properly monitoring development policies, including in the domestic water sector, the EU features a long-established monitoring methodology and continuously assesses the results of the whole regional development policy, which would be worthwhile to adapt and adopt for use on a larger scale.

Many institutions and organizations at all invest considerable efforts in monitoring water and water-related MDGs.

Efforts are needed to streamline existing initiatives, reduce overlaps, enhance coordination along partners and identify gaps for further action in water monitoring.

Monitoring has several possible uses:

- As a system of early warning;
- To inform decision, focus and orient political and policy reforms, and to channel financial resources in the most effective way;
- To track progress toward given objectives.

Monitoring internationally agreed goals and targets

UN-Water’s terms of reference imply that particular attention must be given to issues related to internationally agreed goals. The Millenium Development Goals and associated targets and indicators, and the programme and associated indicators of the Johannesburg Plan of Implementation, monitored by the Commission for Sustainable Development, are therefore the two primary focus of the study.

Monitoring the Millenium Development Goals

In its 2000 Millennium Declaration, the United Nations adopted eight Millennium Development Goals (MDGs). They have galvanized unprecedented efforts to meet the needs of the world’s poorest and are a reference for most ODA programmes. In support of these goals, the Millenium Project was launched by the Secretary General to recommend the best strategies for achieving the MDGs. It has selected a series of indicators to measure progress towards each goal’s achievement. The full set of MDGs and related target and indicators is presented in Annex.

The Millennium Development Goals Report 2006 is based on a master set of data that has been compiled by an Inter-Agency and Expert Group on MDG Indicators led by DESA. The Group comprises representatives of 25 UN agencies and international organizations whose activities include the preparation of one or more of the series of statistical indicators that were identified as appropriate for monitoring progress towards the MDGs.

Monitoring the implementation of the JPOI and Agenda 21

The Division for Sustainable Development (DSD) within DESA implemented its Programme of Work on Indicators on Sustainable Development, mandated by CSD, between 1995 and 2001. The work programme culminated in a set of 58 indicators, based on a Theme/Sub-theme framework, and presented in the publication “Indicators of Sustainable Development (ISD): Guidelines and Methodologies”. The set was adopted by the CSD in 2001 after extensive consultations and national testing programmes. The main role of the CSD-ISD is to serve as reference for countries to develop

national indicators for sustainable development. The World Summit on Sustainable Development in 2002 and subsequent sessions of the CSD encouraged further work on indicators for sustainable development by countries in line with national conditions and priorities and invited the international community to support efforts of developing countries in this regard.

In December 2005, the DSD decided to review and update its current set of indicators. An Expert Group Meeting was organized in New York from 13 – 15 December 2005, chaired by the Chief, National Information, Monitoring and Outreach Branch DESA/DSD.

While they differ in scope, a particular attention was given to MDG indicators, in order to ensure highest possible coherence between the two sets of indicators. In particular, the meeting endorsed the proposal by WHO to adopt the same indicators for Water Supply and Sanitation as for the MDG.

The interim revised CSD-ISD within the freshwater theme are as follows (see Table). In addition, DSD is considering the possibility to develop a water quality index rather than the proposed three indicators. While there has been wide consultation with agencies in the process, UN-Water as such has not been directly involved.

Sub-theme	Core Indicators	Additional/Secondary Indicators
Water Quantity	Annual Withdrawal of Ground and Surface as Percent of Total Renewable Water	
Water Quality	BOD in Water Bodies	Metal contamination of Fresh Water
	Concentration of Faecal Coliform in Freshwater	

The call on UN-Water to monitor and report on implementations of CSD-13

CSD-13, in its final report, decided “... to call on Governments, and the UN system, within existing resources and through voluntary contributions, and invites international financial institutions, and other international organizations, as appropriate, working in partnership with major groups and other stakeholders, to take action as follows:

- (x) Requests the UN-Water to promote, within its mandate, system-wide interagency cooperation and coordination among relevant UN agencies, funds and programs on these issues, and requests the Secretary General to include

in his report to the CSD the activities of UN Water as they relate to the aforementioned thematic areas, including the roles and responsibilities of relevant UN agencies, funds and programs in implementing and monitoring the water and sanitation agenda, including identifying duplication, overlap and gaps.

4. Without prejudice to the programme, organization and methods of work of the Commission adopted at its eleventh session, decides to devote, in 2008 and 2012, a separate segment at the end of its review sessions, for a duration to be determined by the Bureau in advance, using one to two days as a benchmark, to monitor and follow-up the implementation of decisions on water and sanitation, and their inter-linkages, taken at CSD-13.”

The year 2008 is therefore the next concrete opportunity for UN-Water to show progress in monitoring and reporting on implementation of the global water agenda in a coordinated and coherent way.

UN-SD Initiative the System of integrated Environmental and Economic accounting, (SEEA)

The UN Statistics Division is developing a System of integrated Environmental and Economic Accounting, (SEEA). The SEEA can be used as the information base for the capital approach and in particular the derivation of the wealth of a nation. The SEEA organizes environmental and economic information according to the concepts, classifications and definitions of the System of National Accounts (SNA). This allows for integrated analyses of the interactions between the economy and the environment as well as formulation of policies.

The SEEA encourages the adoption of standards and improves both economic and environment statistics by fostering consistency. A number of indicators related to the environmental and economic aspects of development can be derived from the SEEA and they have the advantage of being consistent and coherent. In addition, the underlying integrated information system allows for in-depth analyses of the processes behind changes in the indicators thus facilitating the formulation of policies. A number of countries regularly compile environmental accounts and use the accounting framework for the derivation of indicators including sustainable development indicators. The linkage with CSD indicators is complex.

Terms of reference of this study

The UN-Water Task-force on monitoring has been requested to map existing monitoring initiatives and report to UN-Water at a special UN-Water meeting organised during the World Water Week in Stockholm in August 2006. In preparation for the meeting, FAO, acting on behalf of the Task-force on monitoring, has accepted to perform this exercise in consultation with UN-Water partners. The terms of reference for the preparation of this report were as follows:

- define the scope of the mapping exercise
- perform a review of major water-related monitoring activities within the UN-System and its partners, through internet and in direct contact with UN-Water partners
- review concepts and definitions related to water monitoring, including databases and indicators
- develop criteria and attributes to describe and analyze the different monitoring activities
- design a framework for classifying the different monitoring activities
- present the results of the review in a report and indicate major issues for discussion by UN-Water in relation to optimising and streamlining global water monitoring efforts and impacts.

Definitions used in this report

Monitoring can be defined as any kind of acquisition or collection of data on a certain activity or process by means of a technical device, an observation system or any other surveying method to assess the current status of the chosen parameters and changes over time. In the case of an activity, monitoring seeks to establish the extent to which input deliveries, work schedules, other required actions and targeted outputs are proceeding according to plan, so that timely action can be taken to correct the deficiencies detected. One of the main characteristics of monitoring is that it is a frequent or continuous process. Monitoring can be considered at two levels. In this report, Target monitoring is highly directed, and provides a way of measuring progress toward achievement of specific objectives and goals (through a set of targets), while System monitoring is more general and is mostly used to measure conditions of a given system and to detect changes. Monitoring is often, but not systematically associated with reporting.

Evaluation is a process of determining systematically and objectively the relevance, efficiency, effectiveness and impact of activities in the light of their objectives. It encompasses the gathering of information, including but not only those obtained by monitoring, and the use of such information to make judgements and take informed decisions about some or all of the aspects of a given process. While monitoring is a continuous process, evaluation is a task that takes place at critical times in a given process. Evaluation is not part of the scope of this study.

Reporting is a category of activities in which data and information are presented to communicate processes, roles, and results and provide support for decision-making. While the reporting process will vary depending on the target audience, a main goal is to move towards closer alignment of values between stakeholders and decision-makers. Reporting activities usually have some degree of one-way information transmission. Reporting may be general or aimed at communicating the results of monitoring processes or evaluation exercises. Reporting activities need to rely on information available through monitoring activities but do not necessarily need to be performed by the institutions in charge of monitoring.

Assessments, and in particular global assessments have been undertaken by many organisations and individuals with the past two decades witnessing the advent of multi-

stakeholder and/or multi-lateral global assessments. There are some common characteristics of the scientific analysis components that underpin the outcomes of all assessments. A key point is that an assessment is not a review of the literature. It can be derived from a literature review, but needs to also provide an assessment of the veracity of the information and the uncertainty of the outcomes within the context of the identified questions or issues within a specified authorising environment.

Indicators are a measure or a statistical value expressed in a meaningful way that provides an indication of the condition or direction over time of performance of a defined process or achievement of a defined outcome. An indicator provides evidence that a certain condition exists or certain results have or have not been achieved. Indicators enable decision-makers to assess progress towards the achievement of intended outputs, objectives and outcomes. Indicators provide objective basis for monitoring progress and evaluating achievements of a give process, and are therefore an inherent part of monitoring and evaluation.

Data Information output by a sensing device or organ representing facts, concepts, or instructions in a formalized manner. For the purpose of this study, we distinguish three types of data:

- Primary Data are data obtained directly from a field measurement.
- Secondary data are data obtained from compilation of lower level data. In the case of international monitoring, secondary data will be compiled from information available at national level
- Tertiary data are international data compiled from international sources.

For the purpose of this study, four dimensions of monitoring are considered:

- *Service* refers to access to services, in particular water and sanitation services;
- *Quantity* refers to elements of the water balance, including water resources, their use etc.;
- *Quality* refers to all aspects of water quality. Water quality monitoring may be applied to any fresh water body, and may also entail monitoring of associated sediments; the emphasis is on levels of chemical, physico-chemical, microbiological and other contaminants, mostly caused by human activity;

- *Governance* is a generic term to refer to all aspects related to water governance, including policies, institutions, management, capacity building, the adoption and proper implementation of international and national water related law/directives/regulations, such as the European Union's Water Framework Directive (WFD), adoption of international and/or transboundary treaties, progress of countries towards producing IWRM etc.

Scope and methodology for the mapping exercise

The scope of the study was voluntarily limited to monitoring initiatives which were global in scope and related to one of the four dimensions considered above: service, quantity, quality, and governance. In so doing, the mapping discarded all local, national and even regional monitoring initiatives unless these were part of a systematic global monitoring effort.

It is also recognised that, while several initiatives and programmes exist that promote better capacity to monitor at local level, these initiatives would not be considered in this study as long as they did not contribute directly, and in the short-term, to the development of global knowledge.

Therefore, the mapping exercise was based on the following principles:

- Assume that the most useful data and information will have a more global scope and a more comprehensive scale;
- Assume that the most commonly used and quoted systems are the most useful and relevant. Assess this in part by following the citation frequency of databases in different 'compilations of databases and monitoring systems';
- Allow that combinations of regional-scale or local-scale, data sources may have relevance when they can be aggregated;
- Concentrate on organizations and agencies that have a global mandate (e.g. the United Nations agencies involved in the water sector, agencies with a global mandate such as global climate change, global remote sensing, etc.) and on the larger scale, regional organizations.

The process followed to map and qualify the different monitoring initiatives was as follows:

- Consult UN-Water partners widely and enquire about existing monitoring initiatives in which they are involved or with which they are associated;
- Consult existing metadatabases on the subject, in particular: the Water Monitoring Alliance, maintained by the World Water Council, and the Assessment of Global Water Databases Initiatives, report produced in the framework of the World Water Assessment Programme in 2002;
- Complement the research with additional internet searches when necessary.

Once a core listing of initiatives was obtained, it was screened against the criteria described above for definition of monitoring. Several important programmes, classified here as "reporting" rather than "monitoring", were maintained in the list, either because of their importance or because of their clear linkages with existing or future monitoring activities. Other initiative of indirect relevance were also analysed and are presented in the report for information purposes although they are not considered here as part of the "core" list of global monitoring initiatives.

An attempt has been made to qualify the different systems identified according to a series of parameters. However, in view of the large heterogeneity of the different initiatives, their difference in scope, methodology, level of comprehensiveness and complexity, it is often difficult to classify monitoring systems or initiatives in a categorical way. The classification and description provided in the result tables are therefore subject to scrutiny and further improvement. The following parameters were used to describe the monitoring initiatives:

- Name
- Responsible institution
- UN Agencies involved
- Type: O: Observation, M: Monitoring, R: Reporting, A: Assessment, Meth: Methodological development
- Creation date
- Phase: I: Initial; O: Operational
- Frequency of measurements and updates: in years, or Irregular, Permanent or Time-bound
- Monitoring target: MDG; WSSD or Water system
- Dimensions covered: Service, quantity, quality, governance
- Products: Country data, point data, spatial data, country reports, global reports, others
- Keywords

The following section presents the result of the survey and preliminary analysis based on the above criteria. It tries to locate and identify the situation in terms of water monitoring information resource to the maximum possible extent. At the conclusion an attempt has been made to detect eventual system (UN-Water) information gap (or weak area, if any) and to identify potential areas of improvement that can cover methodological issues, workload distribution, innovative cost-effective IT and communication and dissemination solutions. The underlying strategy remains to support coherence, consistency and coordination in the UN-Water efforts, and to further efficiency and effectiveness.

Survey results: a map of global monitoring initiatives

The United Nations system is complex. It is not easy to explain what each agency/programme and initiative does, since each one has its own priorities and procedures; and they are of course not invariant over time. Their role within UN-Water and information on their water related activities is available at WWAP portal hosted at the UNESCO web site . UN-Water members have agreed to work together - sharing information, knowledge and know-how - to improve the understanding of the policies and practices that encourage sustainable use of water resources.

The main global water monitoring initiatives are described in details in Annex. There are possibly other water-related dataset held within the UN agencies, which are not public (i.e. not accessible on-line at present). Some databases are not held directly within UN institutions, but they are linked to the UN in various ways. For instance, UNESCO in particular funds or sponsors numerous programmes within universities; some of this data is used in UN reports, such as the World Water Development Report. As such, data is not under the direct control of the agency which commissions it. In this case, uncertainty regarding data quality and UN consistency assessment should be considered.

The Water Monitoring Alliance, an initiative of the World Water Council from its portal at www.watermonitoringalliance.net presents a tool to locate water related data in different regions and for different themes. Data can be searched for within a list of monitoring programmes and related activities, and it is possible to consult the activities sorted by geographical scope, type of activity, or keyword and to consult auxiliary information such as creation date, type, and scope. On its side GWP, proposing and presenting on its forum a list of IWRM websites, also states a value judgment marking some of them with a quality check.

The UN-Water corporate information system has to provide the official and highest-quality data and information that is held by the UN system. It is proposed that the

UN-Water embraces only those data sets which are of global importance, which obtain data directly from individual countries or reliable sources clearly associated to the UN agency sponsoring them.

In whatever modern information system metadata (literally "data about data") , are a crucial kit to allow a trustworthy use of information, in time and space, and not-blind data quality assessment. An important attribute to consider a data set for inclusion it will be so the availability of related metadata, including source and methodology. Metadata have to include the information on where, when, by whom and how (using which methodology) data have been obtained.

Mapping major global water monitoring initiatives

The next two pages present the results of the survey and analysis of main global water monitoring initiatives. A total of 44 initiatives were screened, of which 19 were classified as monitoring activities. Thirteen of these 19 initiatives refer more specifically to a narrower definition of monitoring based on compilation of country or point data or country surveys.

¹ <http://www.unesco.org/water/wwap/partners/index.shtml#top>

² see http://gwpforum.netmasters05.netmasters.nl/en/listofwebsitesFrame_en.html

³ recently (3-7 April 2006) the Joint UNECE/Eurostat/OECD work session on statistical metadata (METIS) has organized a Work session on the topic; documentation available at <http://www.unece.org/stats/documents/2006.03.metis.htm>

Global water monitoring initiatives

Name	Acronym	Responsible institution	UN Agencies involved	Type	Creation date	Phase	Data	Frequency
MAPPING MONITORING SYSTEMS								
Water Monitoring Alliance	WMA	WWC	UNESCO/UN-Water	M, R	2003	O	3	Irregular
World Water Assessment Programme (WWAP)		UNESCO		M, R	2000	O	3	Irregular
MONITORING								
Direct measurement								
Global Climate Observing System (GCOS)	WMA	WMO	WMO, UNESCO, UNEP, ICSU	O	1992	O	1	Permanent
Global Terrestrial Observing System (GTOS)	GTOS	FAO	FAO	O		O	1	Irregular
Integrated Global Observing Strategy (IGOS)	IGOS			O	1998	O	?	Irregular
World Hydrological Cycle Observing System (WHYCOS) Compilation, surveys	WHYCOS	WMO	WMO	O		O	?	Irregular
Aquastat	Aquastat	FAO	FAO	M, R	1993	O	2	Irregular
Global Environment Monitoring System-Water (GEMS-Water)	GEMS-Water	Environment Canada	UNEP	M, R	1978	O	2	Irregular
Global Precipitation Climatology Center (GPCC)	GPCC	DWD (Germany)	WMO	M, R		O	2	Permanent
Global Runoff Data Centre (GRDC)	GRDC	BfG Koblenz	WMO	M, R	1988	O	2	Permanent
Global Water Partnership - monitoring IWRM	IWRM	GWP		M, R	2003	O	2	Irregular
International Groundwater Resources Assessment Centre (IGRAC)	IGRAC	TNO	UNESCO, WMO	M, R	1999	O	2	Irregular
Isotope Hydrology Information System (GNIP-ISOHIS)	GNIP-ISOHIS	IAEA	IAEA	M, R	2000	O	2	?
Joint Monitoring Programme for Water Supply and Sanitation (JMP)	JMP	WHO	WHO, UNICEF	M, R	1990	O	1, 2	5
Millennium Development Goals Indicators website	MDG	UNSD	UNSD UNDESA IAEG	M, R	2006	O	2, 3	1
Ramsar Sites Information Service	Ramsar	Ramsar		M, R	1990	O	2	Irregular
Transboundary Freshwater database	TFD	OSU	UNESCO	M	1994	O	2	Irregular
United Nations Statistics Division (UNSD)/ Environment	UNSD	UNSD	UNSD	M	1946	O	2	1
Water Law and Standards database	Water Law	FAO, WHO	FAO, WHO	M	1999	O	2	Irregular
ASSESSING and REPORTING								
CSD Wand	CSD Wand	DESA	DESA	R	2006	I	3	Irregular
Earth Trends - The Environmental Information Portal	WRI	WRI	UNDP/UNEP ?	R	2000	O	3	2
FAO Wastewater Database	Wastewater	FAO	FAO	R	2005	I	3	Irregular
Geonetwork	Geonetwork		FAO; WFP;	R	2004	O	3	Irregular
Global Environment Outlook (GEO)	GEO	UNEP	UNEP	R	1995	O	3	5
Global International Waters Assessment (GIWA)	GIWA	University of Kalmarr	UNEP; GEF	A	1999	O	3	Irregular
Global Resource Information Database (GRID)	GRID	UNEP DEWA	UNEP	R	1985	O	3	Irregular
International Benchmarking Network (IBNET)	IBNET	WB	WB	-		O	3	Irregular
International Panel on Climate Change	IPCC	IPCC	WMO, UNEP	A, R		O	3	4
Living Lakes Partnership	LLP		Partnership	R	1998			Irregular
Millennium Ecosystem Assessment (MA)	MA		Partnership		2001	O	3	Time-bound
Millennium Project Task Force 7 on Water and Sanitation	MTF	Millennium Project	Millennium Project, JMP	R	2000	O	3	Time-bound
World Water Development Report	WWDR	UNESCO	UN-Water	A, R	2000	O	3	3
OTHER RELEVANT INITIATIVES								
CSD Indicators for sustainable development								
Famine Early Warning Systems Network (FEWS NET)	FEWS NET	USAID	DESA; UN Agencies	Meth.		O	2, 3	Irregular
FAO Country Profiles & Mapping Information System		FAO		M, R	1985	O	-	Permanent
FAO Global Information & Early Warning System (GIEWS)	GIEWS	FAO	FAO	R	2001	O	-	Irregular
GenderStats database of Gender Statistics	GenderStat	WB	WB	M, R	1975	O	-	Permanent
Global Ocean Observing System (GOOS)	GOOS	-	-	-	-	-	-	Irregular
Global Programme of Action (GPA)	GPA	UNEP	UNEP	-	-	-	-	Permanent
Human Development Report	HDR	UNDP	UNDP	-	-	-	-	Irregular
International Hydrological Programme (IHP)	IHP	UNESCO-IHP	UNESCO	R	1990	O	-	1
OECD Development Assistance Committee (DAC)	DAC	OECD	-	-	-	-	-	Permanent
World Bank Development Data and Statistics	Wbdata	WB	WB	M, R	1960	O	-	Permanent
World Conservation Monitoring Centre (WCMC)	WCMC	WCMC	UNEP; WWF; IUCN	M, R	1979	O	2	Irregular
Total/Average					1992			

Global water monitoring initiatives		Monitoring target				Dimension				Products						Keywords
		MDG	WSSD- JPOI-CSD	Water System	Service	Quantity	Quality	Governance	Country Data	Point Data	Spatial Information	Country Reports	Global Reports	Global Reports	Others	
MAPPING MONITORING SYSTEMS																
Water Monitoring Alliance																metadatabase
World Water Assessment Programme (WWAP)																metadatabase
MONITORING																
Direct measurement																
Global Climate Observing System (GCOS)																Climate
Global Terrestrial Observing System (GTOS)																Water balance
Integrated Global Observing Strategy (IGOS)																Ground data
World Hydrological Cycle Observing System (WHYCOS)																Water cycle
Compilation, surveys																
Aquastat																Water & agriculture
Global Environment Monitoring System-Water (GEMS-Water)																Water quality
Global Precipitation Climatology Center (GPCC)																Precipitation
Global Runoff Data Centre (GRDC)																Runoff
Global Water Partnership - monitoring IWRM																Governance, IWRM
International Groundwater Resources Assessment Centre (IGRAC)																Groundwater
Isotope Hydrology Information System (GNIP-ISOHIS)																Isotope hydrology
Joint Monitoring Programme for Water Supply and Sanitation (JMP)																WSS
Millennium Development Goals indicators website																MDG
Ramsar Sites Information Service																Ramsar
Transboundary Freshwater database																river basin
United Nations Statistics Division (UNSD)/ Environment																Statistics
Water Law and Standards database																Laws
ASSESSING and REPORTING																
CSD Wand																Water actions
Earth Trends - The Environmental Information Portal																Environment
FAO Wastewater Database																Wastewater
Geonetwork																Spatial information
Global Environment Outlook (GEO)																Environment
Global International Waters Assessment (GIWA)																
Global Resource Information Database (GRID)																Spatial information
International Benchmarking Network (IBNET)																Performances
International Panel on Climate Change																Climate change
Living Lakes Partnership																Lakes
Millennium Ecosystem Assessment (MA)																Environment
Millennium Project Task Force 7 on Water and Sanitation																MDG
World Water Development Report																Water
OTHER RELEVANT INITIATIVES																
CSD Indicators for sustainable development																CSD
Famine Early Warning Systems Network (FEWS NET)																Food security
FAO Country Profiles & Mapping Information System																Country information
FAO Global Information & Early Warning System (GIEWS)																Food security
GenderStats database of Gender Statistics																Gender
Global Ocean Observing System (GOOS)																Ocean
Global Programme of Action (GPA)																Freshwater/ocean
Human Development Report																
International Hydrological Programme (IHP)																Hydrology, research
OECD Development Assistance Committee (DAC)																ODA
World Bank Development Data and Statistics																Statistics
World Conservation Monitoring Centre (WCWC)																Environment
Total/Average	4	5	32	14	27	26	22	18	20	14	13	25	25	8		

Main findings and points for discussion

The following points are based on an analysis of the systems which have been screened through this survey. It is neither comprehensive, nor can it be fully objective and exact. Time is lacking for an in-depth review of all existing systems. Therefore, the findings below must be considered as a starting point and an opportunity for discussion rather than a definitive judgement on the different initiatives.

1. By nature, most of the global water databases and monitoring systems currently maintained by the various UN agencies and programmes contain **secondary data**; in other words the organisations concerned do not collect the data themselves, but compile and disseminate data retrieved from sources that directly collect data (primary databases). Country-level data is mostly drawn from national sources (that have to be supported to strengthen their outputs) and the main role of the different UN agencies is to compile them and provide global estimate relevant to their respective mandate.
2. In several cases, however, UN agencies or other institutions maintain information systems based uniquely on tertiary data already collected from international sources. While the added value of compiling tertiary data from different international sources may be justified by the need to serve a specific purpose or reach a broader audience, it brings a problem of synchronicity of update, and sometimes of intellectual property and visibility. There are indeed a relatively small number of "primary international datasets" within the UN system and its among partners. One possible role of UN-Water would be to serve as clearing house, identifying and **attributing of primary responsibility to a single institution or programme for each dataset**, thus reducing duplication, avoiding inconsistencies, and streamlining resources. Allocation of a given responsibility could be associated with a set of conditions to be fulfilled to guarantee the quality of the dataset.
3. Water-related targets of the **Millennium Development Goals** are adequately covered by the WHO-UNICEF Joint Monitoring programme which reports regularly on water supply and sanitation. The JMP is also the only comprehensive global monitoring system which includes field surveys and does not rely only on secondary information.
4. However, the fact that **water does not appear anywhere else in the MDG** than under the WSS banner is striking, while it has been demonstrated that water plays a role in practically all the MDG. In particular, Target 9 of MDG 7 Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources should include a water-related indicator. UN-Water may want to negotiate with DESA to consider inclusion of a water indicator in the MDG monitoring process.
5. With regard to **CSD** and the **JPOI**, several independent initiatives have flourished in the last years, at global, regional and local levels. GWP, UNDP, Japan Water Forum and UNEP-UCC regional initiatives have developed a capacity to monitor the adoption of IWRM plans. UN-Water's role would be to provide a **formal framework for the development of an agreed methodology to monitor IWRM plans and their implementation**.
6. The role of UN-Water in **CSD** is also to better interact with UNSD in the definition of water-related indicators of sustainable development. In particular, UN-Water should investigate further the possibility to develop a **Sustainable water development index**.
7. Generally speaking, **information on water quantity seem to be more widely available than water quality data**, in terms of countries coverage. The main cause for this might be that quantities are easier to assess and monitor than quality. A lot remains to be done to obtain a good coverage of world-wide water quality monitoring. GEMS water provides a good platform for further development of global water quality monitoring but it may need to reconsider its approach.
8. Several major monitoring programmes suffer from **irregular updating** which affects their timely and regular reporting capacity.
9. Some monitoring systems are not easily accessible and poorly described and therefore probably of little use for the international community.

8. Several major monitoring programmes suffer from **irregular updating** which affect their timely and regular reporting capacity.
9. Some monitoring systems are not easily accessible and poorly described and therefore probably of little use for the international community.
10. **Data quality** is and remains a major issue in assessing the reliability of monitoring systems. While heterogeneity in the quality of data is intrinsically related to the nature of the data collection process, which relies in most cases on country capacities to collect and handle information, the development of metadata, careful cross-checking of information and systematic description of some standard assessment of quality level can greatly increase understanding about the reliability of information. The UN Statistics group is developing quality control and reporting procedures appropriate to country compilations which should be systematically used for water-related data.
11. There is tremendous **scope for better structuring of information among the different systems**, with large potential benefits for the users of the information. A potential area of improvement is related to innovative cost-effective IT and communication and dissemination solutions. The idea of a **Federated Water Monitoring System (FWMS)**, a web services based UN–Water corporate information system, is described in details in Annex. The approach suggested is that, making use of the latest available technology, while having a single point of entry (portal), the UN–Water corporate information system datasets will stay resident at their respective domain lead Agency, and evocated and combined on internet for dissemination at a user request. Such a solution, other than being of great impact on timeliness since data recalled will be always the last update, may permit saving of resources actually dedicated to replication of secondary data and permit the federation partners to concentrate on their core activity. It will also contribute to enhancing the coherence and comparability among existing systems.
12. While the amount of information available is impressive, **key information is still missing** to get a full coverage of the water sector. **Water productivity** is not available in a systematic way. **Gender**-related information, for instance time spent by women and girls to fetch water in cities and rural areas don't seem to be readily available. Information on **waste-water** production and treatment is still anecdotal, and very little information is available on the role of **civil society**. **Disputes**, a rapidly growing concern, are not reported in a systematic way, except in the case of transboundary waters. Global monitoring of **groundwater drawdown** remains a problem, in particular in conceptual terms (how to represent them). UN-Water may seek to identify major gaps in global water information and focus attention and resources on the development of additional monitoring capacities.
13. Logically, **country-based** information dominates in existing water-related monitoring systems. However, the need exists to start developing information by **river basin**. WRI has made considerable efforts in that sense with the development of its database **Watersheds of the world** which could serve as a framework for the development on a basin-level monitoring capacity.
14. Impressive progresses were made recently in the development of **global spatial information** through GIS. While data quality remains an issue for several of these datasets, the development of common open-sources platforms, like **Geonetwork**, are an excellent example of successful inter-agency collaboration.
15. The number of initiatives classified as **Reporting** or **Assessment** is impressive and growing. While this is probably unavoidable, in view of the different target audiences of each of these initiatives, it should be reminded that all these programmes rely on information collected by the monitoring programmes. In some cases, the usefulness and justification for some programmes relying only on other international sources for their global information is questionable.
16. During the mapping exercise it has been observed that the most of the data used to compile indicators is collected at national level (i.e. from national public administration bodies such as Ministries of Agriculture, Environment, Water or National Statistics Institutes) and it seems that this tendency will be reinforced in the years to come. The need to reinforce country capacities in setting up performing monitoring systems must be reiterated. In parallel with the development and improvement of global monitoring systems to satisfy the needs of the international community, UN-Water must

work towards **strengthening national capacity to collect water data**, especially for developing countries and countries with economies in transition.¹ This includes the development and dissemination of standard methodologies, best practises, starting with updated basic classification, definitions and glossaries through all possible means, including regional workshops, training courses, ad-hoc consultancies, and internet.

17. Related to this point is the formulation of water initiatives **fundraising campaign** to support this institutional building at global and local level. UN-Water should promote programmes aimed at enhancing country capacity in the long path towards water data production, self reliance and sustainability. A future tendency could be that critical information (required to compile higher level indicators) organized in domains could be collected only once (i.e. in a single survey) at the source (country level) and be available, after processing, in the required format everywhere else for domain analysis purposes at national and global level for many secondary processing users.

¹ JPOI Chapter IV, paragraph 27 (included in Annex) states: “Support developing countries and countries with economies in transition in **their efforts** to monitor and assess the quantity and quality of water resources, including through the establishment and/or further development of national monitoring networks and water resources databases and the development of relevant national indicators.”

Annexes

1. Milestones in international water discussions¹

1972

- UN Conference on the Human Environment, Stockholm
- The Stockholm Declaration stressed the responsibility of humans in preserving their natural surroundings. This conference resulted in the creation of the United Nations Environment Programme (UNEP).

1977

- UN Conference on Water, Mar del Plata
- The first UN Conference on water issues.

1981-90

- International Drinking Water and Sanitation Decade

1987

- The Brundtland Report, known as Our Common Future, was published.
- It alerted the world to the urgency of making progress toward economic development that could be sustained without depleting natural resources or harming the environment. The Brundtland Report was primarily concerned with securing a global equity, redistributing resources towards poorer nations whilst encouraging their economic growth. In the report, the term, sustainable development was defined.

1990

- Global Consultation on Safe Water and Sanitation for the 1990's, New Delhi Safe drinking water, environmental sanitation
- The New Delhi statement confirmed and reinforced the outcomes of the Stockholm UN Conference.
- The Summit recognized to promote the provision of clean water in all communities for all their children, as well as universal access to sanitation.

1990-2000

- International Decade for Natural Disaster Reduction

1992

- International Conference on Water and the Environ-

ment, Dublin

- Dublin Statement on Water and Sustainable Development recognized that fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment.
- UN Conference on environment and Development (UNCED Earth Summit), Rio de Janeiro Agenda 21, a comprehensive plan of action to preserve environment, was established. It calls for preservation of the level of freshwater quality and quantity and the necessity for holistic management of freshwater.
- The United Nations General Assembly declared, 22 March to be "World Day for Water"

1996

- UN Conference on Human Settlements (Habitat II), Istanbul
- Habitat Agenda and Declaration of Istanbul were adopted.
- Habitat Agenda is to promote healthy living environments, especially through the provision of adequate quantities of safe water and effective management of waste.'
- Establishment of World Water Council and Global Water Partnership
- World Water Council (WWC) was established as an international think-tank for water issues through the initiative of water specialists, the academic community and international organizations.
- The Global Water Partnership (GWP) was created with the join support of a number of international funding organizations, with a mandate to support integrated water resources management in developing countries.
- World Food Summit, Rome
- Rome Declaration on World Food Security and World Food Summit Plan of Action were adopted.

1997

- 1st World Water Forum, Marrakech
- Marrakech Declaration was adopted, which specified the importance of recognizing the basic human needs for accessing clean water and sanitation, establishing an effective mechanism for management of shared waters, supporting and preserving ecosystems, and encouraging the efficient use of water.
- WWC was given the mandate to develop a vision for Water, Life and the Environment in the 21st Century.

¹ Main source Japan Water Forum <http://www.waterforum.jp/eng/background01.html>

2000

- 2nd World Water Forum, the Hague
- The Declaration of Hague was adopted in the Ministerial Conference held during the Forum. It identified 7 major challenges: Meeting basic needs, Securing the food supply, Protecting ecosystems, Sharing water resources, Managing risks, Valuing water, and Governing water wisely.
- During the Forum, the World Water Vision and Framework for Action were presented.
- 55th UN General Assembly
- The Millennium Assembly of the United Nations
- The Millennium Development Goal was declared, which specified that "By 2015, reduces by half the proportion of people without access to safe drinking water.
- UN General Assembly declared that the Year 2003 will be International Year of Freshwater ".

2001

- International Conference on the Conservation and Management of Lakes
- The Conference declared the Lake Biwa Declaration 2001; "Water is life; lakes are vital for life on earth. Lakes support diverse ecosystems, river systems and cultures."
- International Conference on Freshwater, Bonn
- The conference recognized that water plays a vital role in relation to human health, livelihood, economic growth, as well as sustaining ecosystems.
- 'The conference recommends priority actions under the following three headings: Governance, Mobilising financial resources, Capacity building and sharing knowledge'

2002

- World Summit on Sustainable development, Rio+10, Johannesburg
- The summit reaffirmed the Millennium Development Goals.

2003

- International Year of Freshwater
- The 3rd World Water Forum, Japan, Kyoto, Osaka and Shiga
- Under the three principles of "Open to all", "Created through participation by all", "Translating visions into concrete actions and commitments", the Forum brought together more than 24,000 stakeholders from all regions and sectors.
- G8 (Evian Summit) (Evian: France)
- Evian Summit adopted "Water " G8 Action Plan"

to help meet the Millennium Development Goals of halving the proportion of people without access to clean water and sanitation by 2015.

- Dushanbe International Fresh Water Forum (Dushanbe: Tajikistan)
- This Forum, proposed at the 3rd World Water Forum by H.E. Emomali Rakhmonov, President of the Republic of Tajikistan, was held to provide an opportunity to reflect on world water issues, mainly those concerning Central Asia, and to create new activities following-up to the 3rd World Water Forum.
- The UN General Assembly announced that the decade between 2005 and 2015 will be the International Decade for Action, "Water for Life"
- A new inter-agency Task Force on Gender and Water was inaugurated on September 10 2003. As part of the activities of the International Year of Freshwater 2003, the Task Force will facilitate gender mainstreaming in policies and programmes and assist in the implementation of gender-sensitive water and sanitation activities within and outside the United Nations system.
- UN-Water. The High Level Committee on Programmes (HLCP) in its meeting held on 18-19 September 2003 established "UN-Water as the inter-agency mechanism for follow-up of the WSSD water-related decisions and the MDGs concerning".

2004

- United Nations Secretary-General Kofi Annan established an Advisory Board on Water and Sanitation in 2004 to galvanize global action on these issues. Former Prime Minister Ryutaro Hashimoto of Japan agreed to serve as Chair of the Board.
- The Commission on Sustainable Development, at its twelfth session (2004) reviewed and assessed implementation of thematic issues, including water and sanitation.

2005

- Water for Life Decade: The "Water for Life" Decade was launched on 22 March 2005, on World Water Day. The Decade aims to promote efforts to fulfill international commitments made on water and water-related issues by 2015, placing special emphasis on the involvement and participation of women in these efforts.
- At its thirteenth session, the CSD explored policy options for furthering implementation on the issues of water and sanitation as well as on human settlements as reflected in its decision.

2006

- 4th World Water Forum, Mexico.
- "Local Actions for a Global Challenge"
- A novel local focus has been developed as a means to confront global water problems. A space will be designed for the participation of local actors, so they may contribute with experiences and knowledge.
- The UNDP Human Development Report in the next issue that will be launched in November 2006 will focus on "Water and Human Development".

2. The Millennium Development Goals (MDGs), Targets and Indicators

Goal 1. Eradicate extreme poverty and hunger

Target 1.

Halve, between 1990 and 2015, the proportion of people whose income is less than one dollar a day

Indicators.

1. Proportion of population below \$1 (PPP) per day
2. Poverty gap ratio [incidence x depth of poverty]
3. Share of poorest quintile in national consumption

Target 2.

Halve, between 1990 and 2015, the proportion of people who suffer from hunger

Indicators.

4. Prevalence of underweight children under five years of age
5. Proportion of population below minimum level of dietary energy consumption

Goal 2. Achieve universal primary education

Target 3.

Ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling

Indicators.

6. Net enrolment ratio in primary education
7. Proportion of pupils starting grade 1 who reach grade 5
8. Literacy rate of 15-24 year-olds

Goal 3. Promote gender equality and empower women

Target 4.

Eliminate gender disparity in primary and secondary education, preferably by 2005, and in all levels of education no later than 2015

Indicators.

9. Ratio of girls to boys in primary, secondary and tertiary education
10. Ratio of literate women to men, 15-24 years old
11. Share of women in wage employment in the non-agricultural sector
12. Proportion of seats held by women in national parliament

Goal 4. Reduce child mortality

Target 5.

Reduce by two thirds, between 1990 and 2015, the under-five mortality rate

Indicators.

13. Under-five mortality rate
14. Infant mortality rate
15. Proportion of 1 year-old children immunized against measles

Goal 5. Improve maternal health

Target 6.

Reduce by three quarters, between 1990 and 2015, the maternal mortality ratio

Indicators.

16. Maternal mortality ratio
17. Proportion of births attended by skilled health personnel

Goal 6. Combat HIV/AIDS, malaria and other diseases

Target 7.

Have halted by 2015 and begun to reverse the spread of HIV/AIDS

Indicators.

18. HIV prevalence among pregnant women aged 15-24 years
19. Condom use rate of the contraceptive prevalence rate
 - 19a. Condom use at last high-risk sex
 - 19b. Percentage of population aged 15-24 years with

comprehensive correct knowledge of HIV/AIDS

19c. Contraception prevalence rate

20. Ratio of school attendance of orphans to school attendance of non-orphans aged 10-14 years

Target 8.

Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources

Indicators.

- 21. Prevalence and death rates associated with malaria
- 22. Proportion of population in malaria-risk areas using effective malaria prevention and treatment measures
- 23. Prevalence and death rates associated with tuberculosis
- 24. Proportion of tuberculosis cases detected and cured under DOTS (internationally recommended TB control strategy)

Goal 7. Ensure environmental sustainability

Target 9.

Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources

Indicators.

- 25. Proportion of land area covered by forest
- 26. Ratio of area protected to maintain biological diversity to surface area
- 27. Energy use (kg oil equivalent) per \$1 GDP (PPP)
- 28. Carbon dioxide emissions per capita and consumption of ozone-depleting CFCs (ODP tons)
- 29. Proportion of population using solid fuels

Target 10.

Halve, by 2015, the proportion of people without sustainable access to safe drinking water and sanitation

Indicators.

- 30. Proportion of population with sustainable access to an improved water source, urban and rural
- 31. Proportion of population with access to improved sanitation, urban and rural

Target 11.

By 2020, to have achieved a significant improvement in the lives of at least 100 million slum dwellers

Indicators.

- 32. Proportion of households with access to secure tenure

Goal 8. Develop a global partnership for development. Indicators for targets 12-13 are given below in a combined list.

Target 12.

Develop further an open, rule-based, predictable, non-discriminatory trading and financial system.

Includes a commitment to good governance, development and poverty reduction - both nationally and internationally

Target 13.

Address the special needs of the least developed countries.

Indicators.

- 33. Net ODA, total and to LDCs, as percentage of OECD/DAC donors' gross national income
- 34. Proportion of total bilateral, sectoral-allocable ODA of OECD/DAC donors to basic social services (basic education, primary health care, nutrition, safe water and sanitation)
- 35. Proportion of bilateral ODA of OECD/DAC donors that is united
- 36. ODA received in landlocked countries as proportion of their GNIs
- 37. ODA received in small island developing States as proportion of their GNIs

Target 14.

Address the special needs of landlocked developing countries and small island developing States (through the Programme of Action for the Sustainable Development of Small Island Developing States and the outcome of the twenty-second special session of the General Assembly)

Indicators.

- 38. Proportion of total developed country imports (by value and excluding arms) from developing countries and from LDCs, admitted free of duty
- 39. Average tariffs imposed by developed countries on agricultural products and textiles and clothing from developing countries
- 40. Agricultural support estimate for OECD countries as percentage of their GDP
- 41. Proportion of ODA provided to help build trade capacity

Target 15.

Deal comprehensively with the debt problems of developing countries through national and international measures in order to make debt sustainable in the long term

Indicators.

- 44. Debt service as a percentage of exports of goods and services

Target 16.

In cooperation with developing countries, develop and implement strategies for decent and productive work for youth

Indicators.

45. Unemployment rate of young people aged 15-24 years, each sex and total

Target 17.

In cooperation with pharmaceutical companies, provide access to affordable essential drugs in developing countries

Indicators.

46. Proportion of population with access to affordable essential drugs on a sustainable basis

Target 18.

In cooperation with the private sector, make available the benefits of new technologies, especially information and communications

Indicators.

47. Telephone lines and cellular subscribers per 100 population

48. Personal computers in use per 100 population and Internet users per 100 population

3. World Summit on Sustainable Development, Johannesburg Plan of Implementation (JPOI)

At the 2002 World Summit on Sustainable Development (WSSD) held in Johannesburg, delegates concluding that integrated water resources management and water efficiency planning should be an essential element in all national or regional development strategies by 2005 added this target to the list of Millennium Development Goals (MDGs)¹. Indeed, over the years it has been shown that an integrated approach to water resources management (IWRM) will be critical for achieving many of the MDGs, including not only those related to health, but also to poverty and hunger eradication, education, women's empowerment, environmental sustainability and global partnership for development. It is now recognized that inherent in the concept of IWRM are the principles of water-use efficiency, equity of access, a balance of competing uses, the application of all appropriate environmentally sound technology, and participatory planning and implementation to include all sectors of the economy and all segments of society.

For easy of reference following are the relevant Chapter IV paragraphs²:

IV. Protecting and managing the natural resource base of economic and social development

24. Human activities are having an increasing impact on the integrity of ecosystems that provide essential resources and services for human well-being and economic activities. Managing the natural resources base in a sustainable and integrated manner is essential for sustainable development. In this regard, to reverse the current trend in natural resource degradation as soon as possible, it is necessary to implement strategies which should include targets adopted at the national and, where appropriate, regional levels to protect ecosystems and to achieve integrated management of land, water and living resources, while strengthening regional, national and local capacities. This would include actions at all levels as set out below.

25. Launch a programme of actions, with financial and technical assistance, to achieve the Millennium development goal on safe drinking water. In this respect, we agree to halve, by the year 2015, the proportion of people who are unable to reach or to afford safe drinking water, as outlined in the Millennium Declaration, and the proportion of people without access to basic sanitation, which would include actions at all levels to:

(a) Mobilize international and domestic financial resources at all levels, transfer technology, promote best practice and support capacity-building for water and sanitation infrastructure and services development, ensuring that such infrastructure and services meet the needs of the poor and are gender-sensitive;

(b) Facilitate access to public information and participation, including by women, at all levels in support of policy and decision-making related to water resources management and project implementation;

(c) Promote priority action by Governments, with the support of all stakeholders, in water management and capacity-building at the national level and, where appropriate, at the regional level, and promote and provide new and additional financial resources and innovative technologies to implement chapter 18 of Agenda 21;

(d) Intensify water pollution prevention to reduce health hazards and protect ecosystems by introducing technologies for affordable sanitation and industrial and domestic wastewater treatment, by mitigating the effects of ground-

¹ Report from the 4th World Water Forum Theme, "Implementing Integrated Water Resources Management", March 18, 2006

² Johannesburg Plan of Implementation, CSD http://www.un.org/esa/sustdev/documents/WSSD_POI_PD/English/POIChapter4.htm

water contamination and by establishing, at the national level, monitoring systems and effective legal frameworks;

(e) Adopt prevention and protection measures to promote sustainable water use and to address water shortages.

26. Develop integrated water resources management and water efficiency plans by 2005, with support to developing countries, through actions at all levels to:

(a) Develop and implement national/regional strategies, plans and programmes with regard to integrated river basin, watershed and groundwater management and introduce measures to improve the efficiency of water infrastructure to reduce losses and increase recycling of water;

(b) Employ the full range of policy instruments, including regulation, monitoring, voluntary measures, market and information-based tools, land-use management and cost recovery of water services, without cost recovery objectives becoming a barrier to access to safe water by poor people, and adopt an integrated water basin approach;

(c) Improve the efficient use of water resources and promote their allocation among competing uses in a way that gives priority to the satisfaction of basic human needs and balances the requirement of preserving or restoring ecosystems and their functions, in particular in fragile environments, with human domestic, industrial and agriculture needs, including safeguarding drinking water quality;

(d) Develop programmes for mitigating the effects of extreme water-related events;

(e) Support the diffusion of technology and capacity-building for non-conventional water resources and conservation technologies, to developing countries and regions facing water scarcity conditions or subject to drought and desertification, through technical and financial support and capacity-building;

(f) Support, where appropriate, efforts and programmes for energy-efficient, sustainable and cost-effective desalination of seawater, water recycling and water harvesting from coastal fogs in developing countries, through such measures as technological, technical and financial assistance and other modalities;

(g) Facilitate the establishment of public-private partnerships and other forms of partnership that give priority to the needs of the poor, within stable and transparent national regulatory frameworks provided by Governments, while

respecting local conditions, involving all concerned stakeholders, and monitoring the performance and improving accountability of public institutions and private companies.

27. Support developing countries and countries with economies in transition in their efforts to monitor and assess the quantity and quality of water resources, including through the establishment and/or further development of national monitoring networks and water resources databases and the development of relevant national indicators.

28. Improve water resource management and scientific understanding of the water cycle through cooperation in joint observation and research, and for this purpose encourage and promote knowledge-sharing and provide capacity-building and the transfer of technology, as mutually agreed, including remote-sensing and satellite technologies, particularly to developing countries and countries with economies in transition.

29. Promote effective coordination among the various international and intergovernmental bodies and processes working on water-related issues, both within the United Nations system and between the United Nations and international financial institutions, drawing on the contributions of other international institutions and civil society to inform intergovernmental decision-making; closer coordination should also be promoted to elaborate and support proposals and undertake activities related to the International Year of Freshwater, 2003 and beyond.

4. Integrated Water Resources Management approach

Agenda 21, Chapter 18 states that "Integrated water resources management is based on the perception of water as an integral part of the ecosystem, a natural resource and a social and economic good, whose quantity and quality determine the nature of its utilization"¹.

GWP² defines IWRM as a process that promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.

This approach promotes more coordinated development

¹ <http://www.un.org/esa/sustdev/documents/agenda21/english/agenda21chapter18.htm>

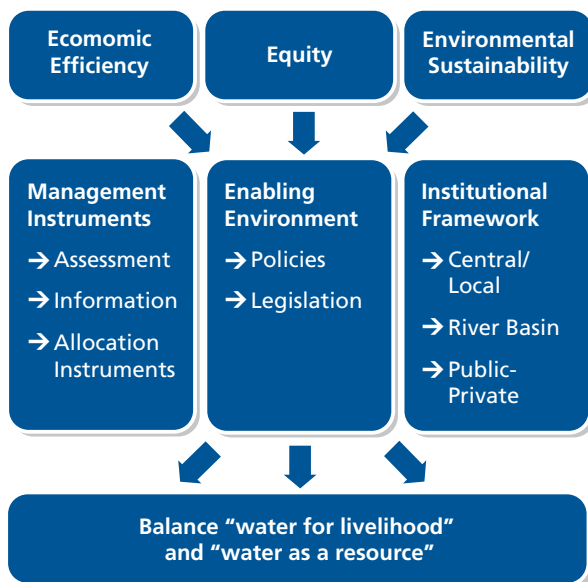
² the GWP's IWRM definition and graph presented are taken by "Setting the stage for change", GWP Feb 2006

and management of:

- land and water
- surface water and groundwater,
- the river basin and its adjacent coastal and marine environment, and
- upstream and downstream interests.

IWRM is also about reforming human systems to enable people to obtain sustainable and equitable benefits from those resources. For policy-making and planning, taking an IWRM approach requires that:

- water development and management takes into account the various uses of water and the range of people's water needs;
- stakeholders are given a voice in water planning and management, with particular attention to securing the involvement of women and the poor;
- policies and priorities consider water resources implications, including the two-way relationship between macroeconomic policies and water development, management, and use;
- water-related decisions made at local and basin levels are along the lines of, or at least do not conflict with, the achievement of broader national objectives; and
- water planning and strategies are incorporated into broader social, economic, and environmental goals.



The "three pillars" of Integrated Water Resources Management

An IWRM approach focuses on three basic pillars and explicitly aims at avoiding a fragmented approach of water resources management by considering the following aspects:

- 1) an enabling environment of suitable policies, strategies and legislation for sustainable water resources development and management

- 2) putting in place the institutional framework through which to put into practice the policies, strategies and legislation
- 1) setting up the management instruments required by these institutions to do their job.

5. Indicators: uses and limitations

Indicators help to simplify complex information so that it is quantifiable, in order that information can be understood and communicated. They help to explain how things are changing over time; analysis of consistent time series *indicators* may suggest predictions of future performance.

Indicators should be well defined and easily understood so that the information they are attempting to explain is implicit. Because 'good' indicators are easy to understand, they offer a tool for *raising awareness about water issues that cuts across every social and political group*. *Developing 'good' indicators is not an easy task, however, and involves collection, collation and systematization of data.*

The need for clarity and ease of understanding means that *indicators often condense large volumes of data into brief overviews and reduce the complexities of the world into simple and unambiguous messages.*

The need for scientific validity, on the other hand, requires that indicators must simplify without *distorting the underlying patterns or losing the vital connections and interdependencies that govern the real world.*

The data for indicator development is drawn from diverse sources. Now more than at anytime in the past researchers have the ability to access vast amounts of information in a "knowledge base" that spans the world¹.

Indicators are therefore important in helping to focus on the main issues and highlighting some significant trends. However, care needs to be taken when utilising the information provided because Indicators simplifying complex information do not provide the full picture.

¹ World Water Assessment Programme, 2002. The term 'knowledge base' has come to mean almost any collection of information or knowledge in a searchable form.

² Working Group "Assessment of quality in statistics", Sixth meeting Luxembourg, 2-3 October 2003, item 4.2: Methodological Documents - Definition of Quality in Statistics http://epp.eurostat.cec.eu.int/pls/portal/docs/page/pgp_ds_quality/tab47141301/definition_2.pdf

Definition of quality in statistics

A useful definition of Quality is found in the ISO 8402 – 1986 as: “the totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs”. Derived from this, Eurostat – the Statistical Office of the European Commission - has proposed the following six criteria² to define Quality of Statistics: relevance, accuracy, timeliness, accessibility and clarity, comparability and coherence. This set of criteria is being adopted also outside EU and it could be worthy to consider it for adoption while assessing water monitoring data and indicators.

Relevance

Relevance is the degree to which statistics meet current and potential users’ needs. It refers to whether statistics that are needed are produced and the extent to which concepts used (definitions, classifications, indicators etc.) reflects user needs.

Accuracy

Accuracy in the general statistical sense denotes the closeness of computations or estimates to the exact or true values.

Timeliness

Timeliness of information reflects the elapsed time between its availability and the event or phenomenon it describes.

Accessibility and clarity

Accessibility refers to the physical conditions in which users can obtain data: where to go, how to order, delivery time, pricing policy, marketing conditions (copyright, etc.), availability of micro or macro data, various formats (paper, files, CD-ROM, Internet...), etc.

Clarity refers to the data’s information environment, whether data are accompanied with appropriate metadata, illustrations such as graphs and maps, whether information on their quality is also available (including limitation in use...).

Comparability

Comparability aims at measuring the impact of differences in applied statistical concepts and measurement tools/procedures when statistics are compared between geographical areas, non geographical domains, or over time.

- The geographical component of comparability emphasises the comparison of data between countries and/or regions in order to ascertain also the meaning of aggregated statistics world wide or at regional level.
- Comparability between domains refers to non-geographical domains, for instance between different sectors (i.e. industry Vs agriculture), between different

types of observed units (i.e. urban households, rural areas etc.).

- Comparability over time refers to comparison of results, derived normally from the same observation, at different times.

Coherence

Coherence of statistics is therefore their adequacy to be reliably combined in different ways and for various uses. When originating from a single source, statistics are normally coherent in the sense that elementary results derived from the concerned survey can be reliably combined in numerous ways to produce more complex results.

When originating from different sources, from surveys of different nature and/or frequencies, statistics may not be completely coherent in the sense that they may be based on different approaches, classifications and methodological standards. Conveying neighbouring results, they may also convey not completely coherent messages, the possible effects of which, users should be clearly informed of.

There is a trade-off between the different components of quality, especially: timeliness/accuracy, accuracy/geographic comparability, relevance/comparability over time, relevance/accuracy, coherence for large domains/relevance for sub-domains, etc.

Although not a measure of quality, the costs involved in the production of statistics as well as the burden on respondents act as a constraint on quality.

The above breakdown of quality into components is not unique neither invariant over time. Other organisations use slightly different sets of quality dimensions. For instance:

- The International Monetary Fund (IMF) has developed its own framework¹ with six components: Integrity, Methodological Soundness, Accuracy and Reliability, Serviceability, Accessibility and Prerequisites of Quality.
- The OECD has developed a quality framework with eight components: Relevance, Accuracy, Credibility, Timeliness, Accessibility, Interpretability, Coherence and Cost Efficiency².

¹ Carson, Carol S., February 2001, “Toward a Framework for Assessing Data Quality”, IMF Working Paper, WPP/01/25

² Quality dimensions, core values for OECD statistics and procedures for planning and evaluating statistical activities, <http://www.oecd.org/dataoecd/26/38/21687665.pdf>

³ from Statistics Canada, 2002, “Statistics Canada’s Quality Assurance Framework”, Catalogue nr. 12-586-XIE, <http://www.statcan.ca/english/freepub/12-586-XIE/12-586-XIE02001.pdf> ;

- Statistics Canada uses six dimensions: relevance, accuracy, timeliness, accessibility, interpretability, and coherence³.
- Statistics Sweden uses five: content, accuracy, timeliness, comparability/ coherence, and availability/clarity¹.

Definition of criteria for choosing water monitoring indicators

Following are the proposed criteria for choosing and defining UN-Water monitoring indicators:

- **policy-relevance** address a key issues
- **responsiveness** change sufficiently quickly in response to varied input
- **analytical soundness** based on sound science
- **measurability** realistic in terms of current or forthcoming data availability
- **accessibility** usable by as many users as possible without modification
- **ease of interpretation** communicate essential information in a way that is unambiguous and easy to understand
- **cost effectiveness** limited costs in proportion to the value of information derived

¹ from Rosén, B., and Elvers, E., 1999, "Quality Concept for Official Statistics" pp. 621-629 in S. Kotz, C.B. Read, and D.L. Banks (eds.), Encyclopedia of Statistical Science, Update Vol. 3, Wiley, New York).

Proposed list of key water indicators for UN-Water

The following list is based on work previously done in the framework of the World Water Assessment Programme. It contains a large number of indicators which are already available within UN-Water member databases, some of which are currently under development, and few newly proposed ones. They could serve as a base for discussion are submitted here for discussion.

Note	Proposed Indicator	Unit of Measure	Initiative	Responsible or sponsoring Agency
Target Monitoring				
Sustainable Development				
	Water development index			
	weighted composite average; to be defined, may be in contact with UNDP Human Development Report Office (HDRO)		WWAP/ HDRO?	FAO/UNDP ?
Csd	Annual Withdrawal of Ground and Surface Water as a Percent of Total Renewable Water	%	AQUASTAT	FAO
Csd	Biochemical oxygen demand (BOD) in Water Bodies	mg/l	GEMS - Water	UNEP
Csd	Concentration of Faecal Coliform in Freshwater	%	JMP	WHO/UNICEF
Millennium Development Goals				
Mdg	Water, percentage of population with access to improved drinking water sources (total, urban and rural)	%	JMP	WHO/UNICEF
Mdg	Proportion of population with access to improved sanitation (total, urban and rural)	%	JMP	WHO/UNICEF
IWRM and water governance				
Jpoi	IWRM planning process stage	scale	GWP	UNDP
jpoi	IWRM financial process stage (self finance and donor support)	scale	UCC	UNEP
jpoi	national governments Portfolio of Water Actions (PWA)	descriptive	CSD WAND	UN

System Monitoring				
Resources				
	Annual precipitation quantity	mm/year and km ³ /year	WHYCOS	WMO
	Annual rain days	number	WHYCOS	WMO
	Annual renewable water resources from snow and ice	km ³ /year	WHYCOS	WMO
	Annual internally produced groundwater	km ³ /year	IGRAC/GGIS	UNESCO/WMO
	Desalinated water produced annually	km ³ /year	AQUASTAT	FAO
	Treated wastewater reused annually	km ³ /year	AQUASTAT	FAO
Stocks and use				
	Total groundwater resources – renewable and non-renewable	km ³	IGRAC/GGIS	UNESCO/WMO
	Total annual renewable water resources (surface and groundwater)	km ³ /year	AQUASTAT	FAO
	Surface Water levels (River, lakes water level)	% of normal value	UCC	UNEP
	Water stress index (renewable water resource per capita)	m ³ /capita/yr	AQUASTAT	FAO
	Wetlands		UCC	UNEP
	Water storage: actual capacity	km ³	GRDC	WMO
	Water storage: actual as % of potential capacity	%	GRDC	WMO
	Water storage: per capita water storage capacity	km ³	GRDC	WMO
	Dams		DDP	UNEP
Other Sustainability				
	National water scarcity indicator	%	AQUASTAT	FAO
	Country dependency on external sources (as % of total renewable water resources)	%	AQUASTAT	FAO
new	Water distribution and delivery efficiency: Water consumption at the served clients (D/I/A) over water effectively put in the water pipe network by Specialized Units (a rate far from 100% denotes high water leakages/evotraspiration in the distribution network).	%	AQUASTAT	FAO

new	Rain Seasonality index (ratio between the amount of rain in each month and annual pluviocity)	%	GPCC	WMO
	Climate Moisture index		WWAP ?	UNESCO
Early Warning				
new	Disaster Preparedness & Response index	to be defined	?	WMO/UNISDR ?
	Forecast Estimated rainfall (amount, seasonality and variance from time series)		GIEWS	FAO
Production and Use				
	Water Production: water supplied to the distribution system	lt/person day	IBNET	World Bank
	Total annual water withdrawals	km3	AQUASTAT	FAO
	Total annual water consumption (net : withdrawals – return flows)	km3	AQUASTAT	FAO
	Water use by sector: % distribution by sector (DIA) over the total	%	FAOSTAT	FAO
	Water use intensity: total agricultural and by crop	lt/1.000 USD output	AQUASTAT	FAO
	Water use intensity: total industry and by economic activity (ISIC code)	lt/1.000 USD output	Environmental Management Service	UNIDO
	Water use intensity: total domestic (per person/per household) withdrawals and by clusters (urban, rural ...)	lt/day	AQUASTAT	FAO
	Annual environmental flow requirements			World Bank UNEP ?
Health and Social Aspects				
	Mortality rate from cholera	%	JMP	JMP
	Prevalence of diarrhoeal disease in children under 5 years of age	%	JMP	JMP
	Droughts – total number of people killed/affected	no.	GRID	GRID
	Floods – total number of people killed/affected	no.	GRID	GRID
new	Gender aspect: women hours per day spent for fetching water (total, urban and rural)	no	?	?

new MDG3 related	Gender aspect: girls school-days per year lost for fetching water (total, urban and rural)	no	?	UNDESA?
	Development Aid and support for drinking water and sanitation		JMP	WHO/UNICEF
Economic Aspects				
	Irrigated land	km2	AQUASTAT	FAO
	Irrigated land as percentage of cultivated land	%	AQUASTAT	FAO
	Extent of land salinized by irrigation	km2	AQUASTAT	FAO
	Importance of groundwater for irrigation	%	AQUASTAT	FAO
	Irrigated production as percentage of agricultural production	%	AQUASTAT	FAO
	Hydropower generation – Technically exploitable capability		UNIDO	UNIDO
	Hydropower development – Capacity; Actual generation; Under construction; Planned		UNIDO	UNIDO
	Price paid per litre of water (average, urban, rural)	USD	IBNET	World Bank
	Price paid per litre of water as proportion of per capita daily income (average, urban, rural)	%	IBNET	World Bank
	Annual investment in water sector (incl. environment)	USD	IBNET	World Bank
	Annual water-related investment through loans from international banks	USD	IBNET	World Bank
	Water sector share in total government spending	%	IBNET	World Bank
	Water sector share in total external assistance	%	IBNET	World Bank
	Impact of droughts as % of annual GDP	%		WMO/WB ?
	Impact of floods as % of annual GDP	%		WMO/WB ?
	Impact of water accidents (toxic agents spillover..) as % of annual GDP	%		WMO/WB ?
Quality Aspects				
	Concentration of Nitrogen (NO3+NO2) in Water Bodies	mg/l	GEMS - Water	UNEP
	Concentration of Chemical Oxygen Demand (COD) in Water Bodies	mg/l	GEMS - Water	UNEP

Annual environmental flow requirement (theoretical) (total and selected water bodies)		GEMS - Water	World Bank/UNEP ?
Actual annual flow available to aquatic ecosystems (total and selected water bodies)		GEMS - Water	World Bank/UNEP ?
Sediment trapping by large dams and reservoirs		Sediment database	FAO
Trends in freshwater habitat protection		IPCC	UNEP
Living Planet Freshwater Index (Trends in freshwater species)		WCMC	UNEP
Biodiversity Indicators for National Use		WCMC	UNEP
Isotopic composition of precipitation		GNIP/SHOIS	IAEA
Water quality of selected water bodies	weighted scale	GEMS - Water	UNEP

6. Proposal for a Federated Water Monitoring System (FWMS)

Rationale

Many of the agencies and programmes of the United Nations spend substantial amounts of resources to develop and maintain data sets related to water but there is at present no systematic single point of entry which gives access to all this data. The creation of a UN-Water corporate information system may add value to the many existing efforts in data collection, development and dissemination of relevant water indicators, which are currently under way.

The Commission on Sustainable Development at its 13th session in 2005 specifically called for:

- (i) Improving data collection at all levels;
- (ii) Enhancing the comparability of data at the regional and global level . . .”

The decision of CSD also requested the Secretary General to report on the activities of UN-Water, with regard to “the roles and responsibilities of relevant UN agencies, funds and programs in implementing and monitoring the water and sanitation agenda, including identifying duplication, overlap and gaps”. UN-Water is the virtual organisation which links the UN agencies and programmes active in water issues. The overarching objective of this proposal is to assist UN-Water in fulfilling its mandate to harmonise and make more efficient and effective the activities of its members, with regard to water monitoring.

The Statistical Commission of the Economic and Social Council of the United Nations at its 34th session requested the United Nations Statistics Division (UNSD) to set up an Interagency Working Group on Environment Statistics (IWG-Env) to steer developments in this area. The permanent members of IWG-Env are in principle those international organizations or agencies that have a well-established international programme on environment statistics, including direct and regular collection of comprehensive environment statistics from countries. The founding members of the Group are UNSD, OECD, EUROSTAT, UNECE and UNEP. The secretariat is provided by UNSD. According to its work programme IWG Env focuses on the harmonization of methodological and data work in environment statistics. A sub-set of IWG-Env deals specifically with water statistics, and includes also FAO. A meeting in July 2005 which brought together UN agencies with water officials of member countries discussed the collection of water statistics at a country level, and the development of a system of water accounting. However, this is a long-term project which does not currently meet the immediate information needs of the world’s water community, nor of member countries.

At the UN-Water meeting in Paris in February 2005, the member agencies of UN-Water confirmed their commitment to monitor the state of the world’s water resources and water-related development issues, as per the UN-Water terms of reference. The need to set up a thematic group on water statistics within UN-Water was discussed, as well as the need for linkage with UNSD. The following agencies and programmes indicated interest in contributing to

such a group: FAO (lead), UNESCO, UNDESA, UNEP, WMO, UNECA, UNESCWA, UNESCAP, WHO, GWP, WWAP.

The aims of this group are:

- to set standards for data collection and reporting, including criteria for inclusion of data in the information systems and quality control;
- to harmonise existing databases and those under development, to ensure that water data held within the UN system is consistent and up-to-date, and meets the needs of member countries; and
- to synchronise the collection of water data, so as not to increase the reporting burden on member countries.

UN-Water may add value by capturing and communicating effectively the existing water monitoring activities of its members, and thereby making these activities more useful and relevant.

The present proposal accordingly focuses on the development of a UN-Water corporate Federated Water Monitoring System (FWMS). The creation of this information system will raise the profile of its component datasets, providing additional visibility for the activities of individual agencies. Its existence will also provide an incentive to continue monitoring activities, and to update existing datasets.

The goal of the UN-Water is to provide the international community with a set of reliable, relevant, coherent and timely data to monitor trends and achievements in the water sector. This goal can be achieved with FWMS focusing upon the following:

- to fasten the accessibility providing a single point of entry for country-level data on water held within the UN system
- to provide water data that is relevant, up-to-date, reliable and accompanied by related under-laying meta data
- to uphold the consistency and coherence of water data across the UN agencies
- to strive for global coverage and cross-domain integration
- to streamline the data collection process and avoid duplication of effort.
- to speed-up data processing and dissemination over the internet
- to guarantee data transparency and friendly user interface
- to be a gateway to complementary also local databases

- to include features for data query, extraction and visualisation and export to most commonly used formats

The set up a global UN-Water information system to be called FWMS is based on a Federative Data Warehouse Architecture reflecting the federative UN-Water nature. The idea is the shifting from mapping the “portals” (simple updated tidy collection of web sites) or replicating “secondary” data to establishing a Federative Data Warehouse providing acceptable level of consistency.

The Federative principle¹

The shared characteristic of all federative behaviour is the principle of “maintaining each member’s independence while obligating them to perform for the common good according to their ability”.

Federalism is therefore the structural and organizational principle by which basically independent, autonomous entities join forces to form a higher-level whole in order to combine a required level of uniformity with the kind of diversity that is indispensable if the organization wants to be successful and the components want to keep their own sovereignty on their particular mandate.

A business acting federatively — and the federation itself — profits from its network when the overall benefits increase and the overall costs drop. Federatively organized partners are characterized by a central and shared interest in forming a joint value creation network that leaves the individual members freedom to pursue their own particular aim. Federative organizations are led by a unit that is close to its customers (users). All related units operate within a space comprising shared processes, standards, guidelines and ethical norms.

While the construction of a integrated database requires filtering, aggregating and transforming the detailed source databases to a common denominator a federative information systems requires uniformity of syntax and semantics as a sufficient prerequisite for efficient communication, the trust-based exchange of information, orientation towards shared goals, and the development of output that fit together seamlessly.

Federative processes lower costs and boost effectiveness by allowing the partners to focus on their core competencies, and increase flexibility in the design and adaptation of corporate processes.

¹ this section is heavily based on “The Federative Principle in Business Architecture”, Kurt Schwarzenbacher and Johann Wagner, http://interop-esa05.unige.ch/INTEROP/Proceedings/Industrial/IND3_wagner.pdf

The unified business architecture

The unified business architecture starts with a single database which contains the information the businesses, partners and customers (users) need. It is based on the joint supply of services and portlets (graphical user interface modules), which can be combined via a network to new solutions or portals. It builds on the cross-company orchestration of automated and intellectual services through workflows.

Business functions, applications, processes or components are made available in the form of web services. Their interfaces are specified in a uniform standard and can be activated network-wide using a standardized message format.

Web services are modular, encapsulated IT functions with their own data sovereignty which can in turn use other web services to perform complex tasks on the internet or intranet within new solutions. Web services are nothing but applications which are addressed by a client via a message in SOAP format over HTTP, i.e. over a network.

Advantages of web services

- Web services provide interoperability between various software applications running on disparate platforms/operating systems.
- Web services use open standards and protocols. Protocols and data formats are text-based where possible, making it easy for developers to comprehend.
- By utilizing HTTP¹, web services can work through many common firewall security measures without requiring changes to the firewall filtering rules. Other forms of RPC² may more often be blocked.
- Web services allow software and services from different companies and locations to be combined quite easily to provide an integrated service.
- Web services allow the reuse of services and components within an infrastructure.
- Web services are loosely coupled thereby facilitating a distributed approach to application integration.

The widespread use of web services therefore has the potential to integrate and, if necessary, adapt many different applications (services) on different platforms quickly and efficiently over IT networks. Today, there are frequent requests for integration on the basis of standard solutions

from leading IT companies like SAP, Siebel, PeopleSoft or Oracle.

The UN-Water dissemination default view could be the set of agreed list of indicators that could become also part of the WWDR routine reports. A milestone in the FWMS quick start would be the identification of the corresponding core repositories (i.e. agency/initiative) that can be activated by the FWMS via web services.

To become acting partner of FWMS data and indicators to be published (along with their metadata and micro-data) should be assessed against the seven “choosing” criteria of policy-relevance, analytical soundness, measurability, accessibility, ease of interpretation and cost effectiveness.

With this solution, while safeguarding standard high level production, valuable datasets may be faster included under the FWMS single point of entry (portal); originating Agencies/Initiatives will remaining in charge for the update of their proprietary information guaranteeing the fastest update of the data published by the federation without bringing in the burden of traditional integration.

The principles of service-oriented architecture

First and foremost, **service-oriented architecture (SOA) is an organizational** concept for the communication and exchange of IT services. SOA is based on the heterogeneity of technologies and suppliers with respect to services, and most of all on the autonomy of the partners in the network. Since web services are a technical implementation of the federative principle, they are useful for setting up a SOA³.

A service-oriented architecture has the following distinctive features:

- It spans wide geographic distances.
- It includes areas with different security mechanisms.
- It uses different platforms for its services.

¹ Hypertext Transfer Protocol (HTTP) is the method used to transfer or convey information on the World Wide Web. It is a patented open internet protocol whose original purpose was to provide a way to publish and receive HTML pages

² Remote procedure call (RPC) is a protocol that allows a computer program running on one computer to cause a subroutine on another computer to be executed without the programmer explicitly coding the details for this interaction. When the software in question is written using object-oriented principles, RPC may be referred to as remote invocation or remote method invocation.

³ Understanding SOA with Web Services, Eric Newcomer and Greg A Lomow, ISBN: 0321180860 <http://www.bookplus.fi/product.php?&isbn=0321180860&CustID=5b5ebcc5c923c39bd1038fbc5ad39698>

Service oriented architecture (SOA) with web service give also users the chance of a customized view of the information on the different datasets saving the diversity that a strict integration may put in danger, upholding the democracy of the net.

A gateway to local knowledge

Some regional, river basin, country, or other way local databases and information sources could, collectively, provide some global scale information. Access to federation can be granted also to local (as seen opposed to global world wide) providers to support, encourage and promote local awareness and to enlarge horizontally the knowledge base, keeping in mind the quality and copyright issues, metadata availability and uniformity of semantics

In the environment disciplines, and water is no exception to it, it is well known that local geocoded data are of the highest importance, especially with reference to early warning. A practical example is the amount of emissions to the air of a given gas in a country that may be irrelevant if there is a wide dispersion but lethal if concentrated. Back to water, the exact localization of a water reservoir provides additional very effective information not included in the total amounts of stocks at national level; basic local information may not contribute to assess compliance towards MDGs, but still may save lives.

Local concerns could be as much valuable as global issues and local to local exchange of experience and information may sustain global goals. "Local Actions for a Global Challenge" it has been the novel focus developed as a means to confront global water problems in occasion of the 4th World Water Forum, held in Mexico, March 2006.

7. Water monitoring initiatives & datasets

INITIATIVE / dataset	Full name	Supporting Agency
AQUASTAT	Aquastat	FAO

AQUASTAT is FAO's global information system of water and agriculture developed by the Land and Water Development Division of FAO. The objective of AQUASTAT is to provide users with comprehensive information on the state of agricultural water management across the world, with emphasis on developing countries and countries in transition. The information system consists of:

→ Database	Online data by country
→ Country Profiles	Standardised text by country and summary tables
→ Regional Overviews	Standardised text by region and summary tables
→ Spatial Information	Spatial data on water resources and irrigation
→ Institutions	Online database of national and regional institutions
→ Water resources	Renewable water resources per country
→ Agricultural water use	Review of agricultural water use per country
→ Documents	Online publications and links to document databases
→ Links	Interesting links on water and agriculture
→ Glossary	Definition of variables

CSD WAND	Water Action Network Database	UNDESA Sustainable Development Division
----------	-------------------------------	---

At the conclusion of the 2004-2005 Implementation Cycle of the UN Commission on Sustainable Development (CSD), governments agreed to "develop web-based tools to disseminate information on implementation and best practices" to support international efforts to achieve the internationally agreed goals related to water and sanitation. Building on the wealth of information collected during the 2003-2005 CSD Cycle and in the Portfolio of Water Actions developed by Japan for the Third World Water Forum in 2003, the UN Department of Economic and Social Affairs (DESA) is developing the CSD Water Action and Networking Database (CSD WAND) to implement the CSD's decision and to provide a growing resource to those working on water and sanitation issues. <http://www.csdwand.net/>

CSD GIRWI – Global Initiative for Rationalizing Water Information System is a new project (not yet started, awaiting authorization from the Italian Government, which is funding the project) which intends to develop robust monitoring tools through a consistent methodology, covering water resources and related infrastructure.

GEMS Water	Global Environment Monitoring System – Water	UNEP
------------	--	------

UNEP GEMS/ WATER Global Environment Monitoring System, Freshwater Quality Programme

UNEP/GEMS Collaborating Centre for Freshwater Qual-

¹ <http://www.worldwaterforum4.org.mx/home/home.asp>

ity Monitoring and Assessment is hosted at the National Water Research Institute of Environment Canada. The UNEP GEMS/Water Programme is a multi-faceted water science programme oriented towards understanding freshwater quality issues throughout the world. Major activities include monitoring, assessment, and capacity building. The implementation of the GEMS/Water programme involves several United Nations agencies.

GEMS/Water Programme provides scientifically-sound data and information on the state and trends of global inland water quality required as a basis for the sustainable management of the world's freshwater to support global environmental assessments and decision-making processes. More than 100 countries participate in GEMS/Water, providing in excess of 2 million data entries. Data records range from 1977 to the present. Starting from March 22nd 2005, World Water Day, GEMS Water Programme has launched GEMStat an online searchable database of global water quality data and statistics for global water assessment. It includes surface waters such as lakes, reservoirs, streams, rivers, estuaries, and wetlands; and groundwater aquifers. All data are subject to standard data integrity review processes.

GEO GRID	GEO data GRID portal	UNEP
----------	----------------------	------

UNEP GRID - United Nations Environment Programme - Global Resource. GRID is a global network of environmental data centres facilitating the generation and dissemination of key environmental geo-referenced and statistical datasets and information products, focusing on environmental issues and natural resources. GRID centres typically have the ability, expertise and specialized information technology (environmental data management, remote sensing/ Geographic Information Systems) to prepare, analyze and present environmental data and information, which are the basis for reliable environmental assessments.

The GEO Data Portal is the authoritative source for data sets used by UNEP and its partners in the Global Environment Outlook (GEO) report and other integrated environment assessments. Its online database holds more than 450 different variables, 136 related to water, as national, subregional, regional and global statistics or as geospatial data sets (maps), covering themes like Freshwater, Population, Forests, Emissions, Climate, Disasters, Health and GDP. They could be displayed over internet as maps, graphs, data tables or downloaded in different common formats.

The set of databases available is significant and comprehensive, ranging from political boundaries through arable land extents to energy production and protected areas. This is an impressive collection of data from many sources coupled with a map interface to navigate the data. An innova-

tive structure and interface make the site easy to use.

On page <http://geodata.grid.unep.ch/results.php> the 136 water datasets available.

GGIS	IGRAC Global Groundwater Information System	UNESCO/ WMO
------	---	-------------

Development of a Global Groundwater Information System (GGIS) is one of the main IGRAC's activities. IGRAC is a non-commercial centre that facilitates and promotes global sharing of information and knowledge required for sustainable groundwater resources development and management. In 1999 UNESCO and WMO took an initiative to set up an international groundwater centre that resulted in launching of IGRAC in March 2003. IGRAC is hosted by the Netherlands Institute of Applied Geoscience TNO in Utrecht, The Netherlands. For the initial years IGRAC receives financial support from the Dutch government. IGRAC has been identified by the World Water Assessment Programme as a pillar of their groundwater assessment programme.

Promotion, improvement and development of Guidelines and Protocols for adequate groundwater data acquisition and groundwater monitoring are one of centre's main activities. IGRAC has prepared a Global Inventory Report on existing guidelines and protocols for groundwater assessment and monitoring. On-line database on inventoried guidelines and protocols in the field of groundwater data acquisition contains at the moment more than 400 document titles. New guidelines are being developed by international working groups established for this purpose.

GIEWS	Global Information and Early Warning System	FAO
-------	---	-----

GIEWS. To keep the world food supply/demand situation under continuous review, issue reports on the world food situation (Publications: Food Outlook, Crop Prospects and Food Situation, etc.), and provide early warnings of impending (also water shortage related) food crises in individual countries. For countries facing a serious food emergency, FAO/GIEWS and the World Food Programme also carry out joint Crop and Food Supply Assessment Missions (CFSAMs). Their purpose is to provide timely and reliable information so that appropriate actions can be taken by the governments, the international community, and other parties.

GIWA	Global International Water Assessment	UNEP
------	---------------------------------------	------

GIWA is a water programme led by the United Nations Environment Programme, UNEP. The aim of GIWA is to produce a comprehensive and integrated global assessment of international waters, the ecological status of and the causes of environmental problems in 66 water areas in the

world, and focus on the key issues and problems facing the aquatic environment in transboundary waters.

GIWA is funded to about 50 per cent by the Global Environment Facility, GEF. Other major donors are the National Oceanic and Atmospheric Administration (NOAA), the Finnish Department for International Development Co-operation, and the Swedish International Development Co-operation Agency (Sida).

GNIP/ ISOHIS	Global Network of Isotopes in Precipitation (GNIP) and Isotope Hydrology Information System (ISOHIS)	IAEA
-----------------	--	------

In 1961, the International Atomic Energy Agency, in co-operation with the World Meteorological Organisation, started a world-wide survey of the isotopic composition of monthly precipitation. Tritium, oxygen-18 and deuterium offer broad range possibilities for studying processes within the water cycle. The GNIP is therefore an interesting tool for climatological (interpretation of paleorecords), atmospheric (validation of global circulation models) and hydrological (large regional and global scale water balances) studies.

The ISOHIS database allows the gathering, storage and dissemination of isotope, chemical, hydrogeological and geographical data of water studies around the world. This represents the first step of a compilation of isotope information on ground and surface water. The primary source of information for ISOHIS is the IAEA archives (technical co-operation and research contract projects).

At the end of 2000, the two databases were combined in a common Web Site called GNIP / ISOHIS in order to facilitate the development and maintenance of the Internet site which offers one source for all isotope hydrology data.

In this Web Site you will find more information on the GNIP programme and the ISOHIS database and you will have access to the data according to search criteria.

GPA	Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities	UNEP
-----	--	------

The Global Programme of Action (GPA) for the Protection of the Marine Environment from Land-Based Activities an intergovernmental programme that addresses the interlinkages between freshwater and the coastal environment.

The GPA Coordination Office is primarily funded through the regular budget of UNEP (Environment Fund) and a Technical Co-operation Trust Fund financed by various govern-

ments including the Netherlands, Norway, Finland, Belgium, United States of America, and the United Kingdom.

The GPA Clearing-House Mechanism is intended to provide a one-stop method that promotes the advertising, discovery, access, dissemination and use of GPA related information and data held by numerous organizations using the decentralized capabilities of the Internet.

GPCC	Global Precipitation Climatology Centre	WMO
------	---	-----

Global Precipitation Climatology Centre. The GPCC is a central element of the Global Precipitation Climatology Project (GPCP) which was established by the WMO/ICSU Joint Scientific Committee for the World Climate Research Programme at its Seventh Session (Lisbon, March 1986). The GPCC itself was established in August 1988 at the Deutscher Wetterdienst (DWD, national Meteorological Service of Germany) starting with a research and development phase. The GPCC it is operated by the DWD as a contribution to international climate observation and research activities. The GPCC has internationally defined functions. In the future, the GPCC will act as a GCOS specified global data centre for precipitation, and in this role, it will continue to participate in the GPCP, as agreed by WCRP, GCOS, and DWD. It also co-operates with WCP-Water, Global Runoff Data Centre (GRDC), UNEP-GRID- Programme, and FAO.

GRDC	Global Runoff Data Centre	WMO
------	---------------------------	-----

The GRDC is the digital world-wide depository of discharge data and associated metadata. GRDC's role is to serve as a facilitator between data providers and data users. It serves under the auspices of the World Meteorological Organization (WMO) and has been established at the Federal Institute of Hydrology (BfG), Germany, as early as 1988 in order to support the hydrological and climatological research community by collection and dissemination of a comprehensive and sound runoff data base (see also History). Its role has been emphasised by WMO Resolution 21 (Cg-XII), 1995, requesting member countries to provide discharge data to the GRDC.

A frequently Quoted Primary Data Source the Global Runoff Data base at Global Runoff Data Centre is focusing the multifaceted world of global river discharge data for the sake of key research linking local and global change issues . Discharge data of rivers of the world (historical time series) 1807 – present. <http://grdc.bafg.de/servlet/is/Entry.987.Display/>

GTOS	Global Terrestrial Observation System	FAO
------	---------------------------------------	-----

GTOS is a programme for observations, modelling, and analysis of terrestrial ecosystems to support sustainable development. GTOS facilitates access to information on terrestrial ecosystems so that researchers and policy makers can detect and manage global and regional environmental change.

GWP	Global Water Partnership- Monitoring IWRM	
-----	---	--

The GWP seeks to support integrated approaches to sustainable water management by encouraging stakeholders at all levels to work together in more effective, efficient and collaborative ways. The Partnership is an international network open to all organizations involved in water resources management, including governments of developing as well as developed countries, UN agencies, multilateral banks, professional associations, research organizations, the private sector and non-governmental organizations.

The GWP's objectives are to:

- Clearly establish the principles of sustainable water resources management,
- Identify gaps and stimulate partners to meet critical needs within their available human and financial resources,
- Support action at the local, national, regional or river basin level that follows principles of sustainable water resources management,
- Help match needs to available resources.

The World Bank, the United Nations Development Program (UNDP) and the Swedish International Development Agency (Sida) created the Global Water Partnership (GWP) in 1996. This initiative was based on promoting and implementing integrated water resources management through the development of a worldwide network that could pull together financial, technical, policy and human resources to address the critical issues of sustainable water management.

IBNET	The International Benchmarking Network for Water and Sanitation Utilities	World Bank
-------	---	------------

The International Benchmarking Network for Water and Sanitation Utilities (IBNET) is an initiative to encourage water and sanitation utilities to compile and share a set of core cost and performance indicators, and thus meet the needs of the various stakeholders. It sets forth a common set of data definitions; a minimum set of core indicators, and provides software to allow easy data collection and calculation of the indicators, while it also provides resources to analyze data and present results. Sharing of results is critical

to successful performance comparisons (benchmarking), and hence tools for data analysis, resources and links to benchmarking organizations. It includes a direct access to a large database for water and sanitation utilities performance data. IBNET supports and promotes good benchmarking practice among water and sanitation services by:

- Providing guidance on indicators, definitions and methods of data collection;
- Facilitating the establishment of national or regional benchmarking schemes;
- Undertaking peer group performance comparisons;
- Establishing links between utilities, utilities associations and regulators

IPCC	Intergovernmental Panel on Climate Change	WMO/ UNEP
------	---	-----------

The Intergovernmental Panel on Climate Change (IPCC) <http://ipcc-ddc.cru.uea.ac.uk/index.html> has been established by WMO and UNEP to assess scientific, technical and socio- economic information relevant for the understanding of climate change, its potential impacts and options for adaptation and mitigation. It is open to all Members of the UN and of WMO. The Data Distribution Centre (DDC) of the Intergovernmental Panel on Climate Change (IPCC) offers access to baseline and scenario data for representing the evolution of climatic, socio-economic, and other environmental conditions. The DDC is overseen by the IPCC Task Group on Data and Scenario Support for Impact and Climate Analysis (TGICA) and jointly managed by the Climatic Research Unit (CRU) in the United Kingdom, the Deutsches Klimarechenzentrum (DKRZ/MPI) in Germany, and the Center for International Earth Science Information Network (CIESIN) at Columbia University, New York, USA.

Millennium Indicator Database	Millennium Indicator Database	UNDESA Statistics Division
-------------------------------	-------------------------------	----------------------------

This site presents the official data, definitions, methodologies and sources for the 48 indicators to measure progress towards the Millennium Development Goals. The data and analysis are the product of the work of the Inter-agency and Expert Group (IAEG) on MDG Indicators, coordinated by the United Nations Statistics Division.

JMP	Joint Monitoring Programme	WHO/ UNICEF
-----	----------------------------	-------------

Since 1990, WHO and UNICEF have teamed up to track progress on global water and sanitation goals through the Joint Monitoring Programme for Water Supply and Sanitation (JMP). <http://www.wssinfo.org/en/welcome.html>

The JMP is the official arrangement within the UN System to produce information for the UN Secretary General

on the progress of achieving the Millennium Development Goals related to water supply and sanitation. Although the JMP has been producing coverage reports since 1990, it was only in 2000 that the JMP statistics were based mainly on data from household surveys such as Demographic and Health Surveys (DHS), Multiple Indicator Cluster Surveys (MICS) and World Health Surveys (WHS).

The JMP monitors trends in coverage; helps build national monitoring capacity in developing countries; develops and harmonizes questionnaires, indicators and definitions to ensure comparability of data over time and among countries; and informs policy makers of the status of the water supply and sanitation sector worldwide through annual publications. The JMP draws guidance from a technical advisory group of leading experts in water supply, sanitation and hygiene, and from institutions involved in data collection and sector monitoring.

Survey and census data are plotted on a time scale from 1980 to the present. Four graphs for each country show both urban and rural coverage for water and for sanitation. A linear trend line, based on the least-squares method, is drawn through these data points to estimate coverage for 1990 and 2002.

User defined query on the database may produce micro-data exportable in CSV format for a spreadsheet, other than graphics and table. Data are accessible at global, regional, group (i.e. developing countries) and single countries. Main data source are assessment questionnaire (WHO & UNICEF field staff) and household sampling surveys.

Sustainable Development Indicators	Sustainable Development Indicators	UNDESA Sustainable Development Division
------------------------------------	------------------------------------	---

A core set of 58 indicators and methodology sheets are made available by UNDESA, CSD secretariat. The core set is derived from a working list of 134 indicators and are presented along with related methodology sheets. They were developed, improved and tested as part of the implementation of the Work Programme on Indicators of Sustainable Development (ISDs) adopted by the Commission on Sustainable Development (CSD) at its Third Session in April 1995 and presented to the CSD in 2001. The United Nations CSD was established by the UN General Assembly in December 1992 to ensure effective follow-up of United Nations Conference on Environment and Development (UNCED), also known as the Earth Summit. The JPOI reaffirmed that the CSD is the high-level forum for sustainable development within the United Nations system.

Transboundary Freshwater Database	Transboundary Freshwater Database	OSU/UNESCO
-----------------------------------	-----------------------------------	------------

To aid in the assessment of the process of water conflict prevention and resolution, over the years has been developed the Transboundary Freshwater Dispute Database, a project of the Oregon State University Department of Geosciences, in collaboration with the Northwest Alliance for Computational Science and Engineering. It includes:

- Atlas of International Freshwater Agreements: Contains an historical overview of international river basin management; a detailed listing of more than 400 international freshwater agreements; and a collection of thematic maps.
- International Freshwater Treaties Database: A searchable database of more than 400 international, freshwater-related agreements, covering the years 1820 to 2002.
- Transboundary Freshwater Spatial Database: Biophysical, socioeconomic, and geopolitical data relating to the world's international river basins are accessible and searchable through spatial and tabular formats.
- International water event database: A searchable database documenting historical international water relations from 1948 to 1999.
- International River Basin Register (updated August 2002): This register lists the world's international river basins, delineated by continent.

Water Law and Standards	Water Law and Standards	FAO/WHO
-------------------------	-------------------------	---------

Since 1999, the WHO Water, Sanitation and Health Programme and the FAO Legal Office have been collaborating on a number of initiatives linked to water law, health and development. A text entitled Law for Water Management: A Guide to Concepts, Developments and Effective Approaches is under preparation. The databases on this website are the other major output of this inter-agency collaboration. The database of national water legislation is ready for use and is linked to FAO's existing FAOLEX database of legislation on natural resources.

UCC Water	Collaborating Centre on Water and Environment	UNEP
-----------	---	------

The UNEP Collaborating Centre on Water and Environment is a centre of expertise of the United Nations Environment Programme (UNEP). The centre supports UNEP in the implementation of its Water Policy and Strategy.

UCC is funded by UNEP, the Danish International Development Assistance (Danida), and DHI Water & Environment. It is hosted by DHI Water & Environment and located at its headquarters in Hørsholm, Denmark. The UCC tracked and

progress reported the status of preparation of “IWRM 2005 Plans and progress of implementation of IWRM reforms” and contribute to its presentation at the 4th World Water Forum in Mexico 2006.

UNCDB water statistics	United Nations Common Database water statistics	UNDESA Stats Division
------------------------	---	-----------------------

Within the UNDESA, the UN Statistics Division (UNSD), frequently quoted primary data source, is the repository of UNCDB, the UN Common Database http://unstats.un.org/unsd/cdb/cdb_help/cdb_quick_start.asp that in the environment section includes secondary water dataset.

The Database draws selectively on statistics from throughout the UN system and covers all countries and areas and over 300 series from more than 30 specialized international data sources.. It includes comprehensive footnotes and meta-information on sources, definitions, and frequency of updates, and provides technical definitions and standards verbatim from their original sources. Users may view data, compile graphs, calculate derived measures, and export data.

The set of UN Statistical databases is comprised of a comprehensive and well-designed set of sites that concentrate on delivering data and some information in an efficient manner. It is updated frequently and can be considered one of the primary data sources.

Wastewater	Wastewater Database	WMO
------------	---------------------	-----

Developed by the Water Quality and Environment Group, the Wastewater Database contains information on wastewater production, treatment, re-use, as well as economic information provided by member states. The Database information is sorted by region and country containing fields on wastewater production, treatment technologies, and financial/economical parameters by country. For each data field, original Reference is available as well as the Data Reference Year which corresponds to the year of data collection, not necessarily the reference publication year. A Glossary containing the definitions of each data parameter is also given. A Comments/Notes field contains additional information pertinent to the data

WCMC	World Conservation Monitoring Centre	UNEP
------	--------------------------------------	------

The United Nations Environment Programme World Conservation Monitoring Centre (WCMC) is the biodiversity assessment and policy implementation arm of the United Nations Environment Programme (UNEP). The centre has been in operation since 1989, combining scientific research with practical policy advice. UNEP-WCMC provides objec-

tive, scientifically rigorous products and services to help decision makers recognize the value of biodiversity and apply this knowledge to all that they do. Its core business is managing data about ecosystems and biodiversity, interpreting and analysing that data to provide assessments and policy analysis, and making the results available to international decision makers and businesses.

WHYCOS	World Conservation Monitoring Centre	UNEP
--------	--------------------------------------	------

The World Hydrological Cycle Observing System (WHYCOS) is a WMO programme aiming at improving the basic observation activities, strengthening the international cooperation and promoting free exchange of data in the field of hydrology. The programme is implemented through various components (HYCOSs) at the regional and/or basin scale. It is guided by the WHYCOS International Advisory Group (WIAG).

WHYCOS is developed for promoting a bottom up approach, from the country level through the basin to global scale. WHYCOS and its components primarily focus on strengthening technical and institutional capacities of National Hydrological Services (NHSs) and improving their cooperation in the management of shared water resources. WHYCOS supports the NHS's to better fulfil their responsibilities, by improving the availability, accuracy, and dissemination of water resources data and information through the development and implementation of appropriate national and regional water resources information systems thereby facilitating its use for sustainable socio-economic development.

WWAP	Water Portal	UNESCO
------	--------------	--------

The UNESCO Water Portal is intended to enhance access to information related to freshwater available on the World Wide Web. The site provides links to the current UNESCO and UNESCO-led programmes on freshwater and is serving as an interactive point for sharing, browsing and searching websites of water-related organizations, government bodies and NGOs, including a range of categories such as water links, water events, learning modules and other on-line resources. It has been the main source for this annex.

The World Water Assessment Programme is an UN-wide programme that seeks to develop the tools and skills needed to achieve a better understanding of those basic processes, management practices and policies that will help improve the supply and quality of global freshwater resources.

The goals are to:

- assess the state of the world’s freshwater resources

and ecosystems;

- identify critical issues and problems;
- develop indicators and measure progress towards achieving sustainable use of water resources;
- help countries develop their own assessment capacity;
- document lessons learned and publish a World Water Development Report (WWDR) at regular intervals.

UN-CSD
Database

UNDESA

CSD Partnerships database <http://webapps01.un.org/dsd/partnerships/public/browse.do> was first launched in February 2004, in response to a request from the Commission on Sustainable Development (CSD) at its 11th session. This database has been recently redesigned (in May 2006) to increase user-friendliness, improve site navigation and enable easier access to partnerships-related information. New features added include a partnerships events calendar and searchable listings of partnerships-related web links, publications and articles. The information contained in this online resource is based on voluntary self-reports from

8. Reference materials¹

Overview

Video message by the UN Secretary-General **Kofi Annan**, “*Water is essential for life*” (available in English only) General Assembly Resolution on the Decade (A/RES/58/217): International Decade for Action, “*Water for Life*”, 2005-2015, 2004 - Arabic, Chinese, English, French, Russian, Spanish

General Assembly Report (A/60/158) on Actions taken in organizing the activities of the International Decade for Action, “*Water of Life*”, 2005-2015, 2005, United Nations, New York - http://www.un.org/waterforlifedecade/sg_report.pdf

Video: “*Water for Life*” produced by **Global Visions** [English] [French] Booklet for the International “*Water for Life*” Decade - English, French, Spanish *Water for Life: making it happen* (2005) – Report, prepared by the WHO/UNICEF Joint Monitoring Programme (JMP) http://www.wssinfo.org/en/40_wfl_2005.html

The 1st World Water Development Report (WWDR): ‘*Water for People, Water for Life.*’ (including complete report) http://www.unesco.org/water/wwap/wwdr/table_contents.shtml

The 2nd World Water Development Report (WWDR2): ‘*Water, a shared responsibility*’ (including executive summary, table of contents and case studies) <http://www.unesco.org/water/wwap/wwdr2/index.shtml>

Report of the Millennium Project Taskforce on Water and Sanitation: ‘*Health, dignity and development: What will it take?*’ http://www.unmillenniumproject.org/reports/tf_watersanitation.htm

Vital Water Graphics: An Overview of the State of the World’s Fresh and Marine Waters <http://www.unep.org/vitalwater/>

WHO Advocacy Guidelines - Chinese, English, French, Russian, Spanish

Historical Documents

Overview: Milestones 1972 - 2003. Stockholm to Kyoto http://www.unesco.org/water/wwap/milestones/index_pr.shtml http://www.unesco.org/water/wwap/panels/black_white/milestones.pdf

Report of the United Nations Conference on the Human Environment, Stockholm, 1972. <http://www.unep.org/Documents.Multilingual/default.asp?documentid=97&l=en>

1977 United Nations Water Conference Documentation can be found in the book: *United Nations Water Conference: Summary and Main Documents*. Ed. by Asit K. Biswas. Pergamon Press, 1978.

The Global Consultation on Safe Water and Sanitation for the 1990s, New Delhi. *New Delhi Statement*, 1990. <http://www.jiscmail.ac.uk/files/WSSCC/NEWDELHI.DOC>

International Conference on Water and the Environment: Development issues for the 21st century. The Dublin Statement. Dublin, 1992. <http://www.wmo.ch/web/homs/documents/english/icwedece.html> or <http://files.inpim.org/Documents/DublinStatmt>

United Nations Conference on Environment and Development A/CONF.151/26 (Vol. I). The Rio Declaration. Rio de Janeiro, 1992 <http://www.un.org/documents/ga/conf151/aconf15126-1annex1.htm>
Agenda 21 <http://www.un.org/esa/sustdev/documents/agenda21/index.htm> in six languages. Agenda 21 Chapter 18 – *Protection of the Quality and Supply of Fresh-water Resources: Application of Integrated Approaches*

¹ UN Water for Life Decade web site http://www.un.org/waterforlifedecade/reference_mat.html

- to the Development, Management and Use of Water Resources* 06/1992 <http://earthwatch.unep.ch/agenda21/18.php> <http://www.un.org/esa/sustdev/documents/agenda21/english/agenda21chapter18.htm>
- The Report of the Commission on Sustainable Development*, 1994 (E/CN.17/1994/20 Chapter I.D. *Review of sectoral cluster: health, human settlements, freshwater resources* E/CN.17/1994/4, and *freshwater* E/CN.17/1994/L. 5) http://www.un.org/esa/sustdev/documents/docs_csd2.htm
- The United Nations Convention to Combat Desertification*, 1994. <http://www.unccd.int/convention/text/convention.php>
- United Nations Economic and Social Council Resolution 1996/50: Integrated water resources development and management* <http://www.un.org/documents/ecosoc/res/1996/eres1996-50.htm>
- United Nations Convention on Non-navigational Uses of International Watercourses*, New York, 1997. <http://www.un.org/law/cod/watere.htm>
- Comprehensive Assessment of the World's Freshwater Resources* (E/CN.17/1997/9) <http://daccessdds.un.org/doc/UNDOC/GEN/N97/003/65/IMG/N9700365.pdf?OpenElement>
- Report of the Commission for Sustainable Development*, 6th Session, 1998 (E/CN.17/1998/2, E/CN.17/1998/20) Decision 6/1. *Strategic approaches to freshwater management*. <http://www.un.org/esa/sustdev/sdissues/water/water1.htm#6th>
- United Nations High Commissioner for Human Rights, Sub-commission on Human Rights, Resolution 2000/8: Promotion of the realization of the right to drinking water and sanitation* (E/CN.4/2001/2 - E/CN.4/Sub.2/2000/46), UN, Geneva, 2000. <http://www.unhchr.ch/Huridocda/Huridoca.nsf/0/d0d5a8e0ca2a7469c1256970004d8213?Opendocument>
- The General Assembly 55th Session Millennium Declaration*, 2000. Target 10: *Halve the proportion of people without sustainable access to safe drinking water*. <http://www.un.org/millennium/declaration/ares552e.htm> <http://www.un.org/millennium/>
- UNESCO World Water Assessment Programme*, 2001: *Water Security: A Preliminary Assessment of Policy Progress since Rio* http://www.unesco.org/water/wwap/wwdr/water_security.pdf
- International Conference on Freshwater 2001*, Bonn, Germany <http://www.water-2001.de/>
- Economic and Social Council Report of the Secretary-General: Water: A key resource for sustainable development* (E/CN.17/2001/PC/17), 2001, United Nations, New York <http://daccessdds.un.org/doc/UNDOC/GEN/N01/273/92/PDF/N0127392.pdf?OpenElement>
- Plan of Implementation of the World Summit on Sustainable Development*, Johannesburg, 2002. http://www.un.org/esa/sustdev/documents/WSSD_POI_PD/English/WSSD_PlanImpl.pdf http://www.un.org/esa/sustdev/documents/WSSD_POI_PD/English/POIToc.htm
- Decisions on Water and Sanitation in the Plan of Implementation of the World Summit on Sustainable Development* http://www.un.org/waterforlifedecade/pdf/ws_decisions_jpoi.pdf
- Committee on Economic, Social and Cultural Rights General Comment No. 15: The Right to Water* (article 11 and 12), (E/C.12/2002/11), UN, Geneva, 2002. <http://www.unhchr.ch/html/menu2/6/gc15.doc>
- Status of preparations for the International Year of Freshwater*, 2003. (A/56/189), United Nations, New York. <http://www.un.org/documents/ga/docs/56/a56189.pdf>
- International Year of Freshwater 2003* <http://www.wateryear2003.org/>
- Compendium of Actions, United Nations Secretary General's Advisory Board on Water and Sanitation*, 2006 http://www.unsgab.org/Compendium_of_Actions_en.pdf
- Commission for Sustainable Development**
Commission for Sustainable Development, 5th Session, 7 - 25 April 1997, New York <http://www.un.org/esa/sustdev/csd/CSD5.htm>
- All documents available in the official UN languages: http://www.un.org/esa/sustdev/documents/docs_csd5.htm
- Comprehensive Assessment of the World's Freshwater Resources* (E/CN.17/1997/9) <http://daccessdds.un.org/doc/UNDOC/GEN/N97/003/65/IMG/N9700365.pdf?OpenElement>
- Protection of the quality and supply of freshwater resources: application of integrated approaches to

- the development, management and use of water resources (E/CN.17/1997/2/Add.17) <http://daccessdds.un.org/doc/UNDOC/GEN/N97/014/14/PDF/N9701414.pdf?OpenElement>
- Commission for Sustainable Development, 6th session, 20 April - 1 May 1998, New York*
<http://www.un.org/esa/sustdev/csd/CSD6.htm>
 All documents available in the official UN languages:
http://www.un.org/esa/sustdev/documents/docs_csd6.htm
Report of the Commission for Sustainable Development, 6th Session, 1998 (E/CN.17/1998/2, E/CN.17/1998/20) Decision 6/1. Strategic approaches to freshwater management. <http://www.un.org/esa/sustdev/sdissues/water/water1.htm#6th>
Report of the Expert Group Meeting on Strategic Approaches to Freshwater Management (E/CN.17/1998/2/Add.1) <http://daccessdds.un.org/doc/UNDOC/GEN/N98/017/43/PDF/N9801743.pdf?OpenElement>
- Commission on Sustainable Development, 8th session, 24 April - 5 May 2000, New York*
<http://www.un.org/esa/sustdev/csd/CSD8.htm>
 All documents available in the official UN languages:
http://www.un.org/esa/sustdev/documents/docs_csd8.htm
Progress made in providing safe water supply and sanitation for all during the 1990s (E/CN.17/2000/13), United Nations, New York. <http://daccessdds.un.org/doc/UNDOC/GEN/N00/347/73/PDF/N0034773.pdf?OpenElement>
- Commission for Sustainable Development. 12th session, 14 - 30 April 2004, New York* : <http://www.un.org/esa/sustdev/csd/csd12/csd12.htm>
 All documents available in the official UN languages:
http://www.un.org/esa/sustdev/documents/docs_csd12.htm
Report of the Twelfth Session (E/CN.17/2004/21 E/2004/29) <http://daccessdds.un.org/doc/UNDOC/GEN/N04/368/10/PDF/N0436810.pdf?OpenElement>
Water: Report of the Secretary-General - Freshwater Management: Progress in meeting the goals, targets and commitments of Agenda 21, the Programme for the Further Implementation of Agenda 21, and the Johannesburg Plan of Implementation. (E/CN.17/2004/4). <http://daccessdds.un.org/doc/UNDOC/GEN/N04/238/81/PDF/N0423881.pdf?OpenElement>
Sanitation: Progress in meeting the goals, targets and commitments of Agenda 21, the Programme for the Further Implementation of Agenda 21, and the Johannesburg Plan of Implementation. (E/CN.17/2004/5). <http://daccessdds.un.org/doc/UNDOC/GEN/N04/235/39/PDF/N0423539.pdf?OpenElement>
- Commission for Sustainable Development (CSD), 13th session, 11 - 12 April 2005, New York:* <http://www.un.org/esa/sustdev/csd/csd13/csd13.htm>
 All documents available in the official UN languages:
http://www.un.org/esa/sustdev/documents/docs_csd13.htm
User friendly Matrix of the Chair's Intergovernmental Preparatory Meeting (IPM) Summary <http://www.un.org/esa/sustdev/csd/csd13/matrix.pdf>
Report on the thirteenth session (E/CN.17/2005/12) <http://daccessdds.un.org/doc/UNDOC/GEN/N05/382/16/PDF/N0538216.pdf?OpenElement>
Freshwater management: policy options and possible actions to expedite implementation: Report of the Secretary-General (E/CN.17/2005/2), <http://daccessdds.un.org/doc/UNDOC/GEN/N04/647/82/PDF/N0464782.pdf?OpenElement>
Sanitation: policy options and possible actions to expedite implementation: Report of the Secretary-General (E/CN.17/2005/3) <http://daccessdds.un.org/doc/UNDOC/GEN/N04/647/76/PDF/N0464776.pdf?OpenElement>
- CSD WAND – Water Action Network Database*
<http://www.csdwand.net/>
- Other relevant websites
Documents web portal of Division for Sustainable Development, DESA: <http://www.un.org/esa/sustdev/documents/docs.htm>
- Freshwater - Sustainable Development Issues:*
http://www.un.org/esa/sustdev/documents/docs_sdis-sues_freshwater.htm
- The UN Commission on Sustainable Development Reports:*
<http://www.un.org/esa/sustdev/csd/review.htm>
http://www.un.org/esa/sustdev/csd/csd_past.htm
- UN documents web portal*
<http://www.un.org/documents/>
- Documents web portal of Office of the United Nations High Commissioner on Human Rights*
<http://www.ohchr.org/english/docsearch.htm>



ISBN 978-92-5-106296-8



9 789251 062968

TC/M/I0889E/1/06.09/500