Theme 3 Report

Managing and Protecting Water Resources and Their Supply Systems to Meet Human and Environmental Needs

Theme Coordinators

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THEMATIC DESCRIPTION

There is no more water on Earth now than there was 2,000 years ago. This limited supply of freshwater must meet the needs of a human population that has tripled in the last century and continues to grow and is becoming more urbanized. Increasing demands for water for energy, food, industrial development, and urbanization have put the squeeze on available resources, causing freshwater ecosystems to disappear at alarming rates. Water stress and contamination are severe worldwide and the cause of widespread waterborne diseases. Water is life but it is not an endless resource.

Theme 3 will explore sustainable solutions to ensure that the coming decades allow humans to meet their needs and protect the ecosystem services upon which we depend. Lessons learned will be the shared and proposed solutions will be discussed in an interactive way in all of the sessions. Bridges will be built across the legal, institutional, socio-economical, political and participatory frameworks for sustainable integrated water resources management.

BACKGROUND ON PROCESS

At the First Coordination Meeting for the Fifth World Water Forum (Fall 2007), participants engaged in a lively discussion on the topic of meeting human and environmental needs for water. It became clear that this is a very difficult theme in that it means real discussion as to how to allocate water to meet all of the world's needs. At the Second Coordination Meeting (Winter 2008), the participants broke into groups across the four proposed topics:

- Topic 3.1 Basin Management and Trans-boundary Cooperation

- Topic 3.2 Managing and Protecting Water Resources and their Supply Systems to Meet Human and Environmental Needs: Ensuring adequate water resources and storage infrastructure to meet agricultural, energy and urban needs

- Topic 3.3 Preserving Natural Ecosystems: Ecosystems for Water and Life
- Topic 3.4 Managing and Protecting Surface, Ground, Soil and Rain Water

The participants discussed key questions, sub-questions, the types of organizations to whom to reach out, and a general process for following through on each topic's development. The Topic Coordinators sent email requests out to a wide variety of networks requesting input. They also reached out to participants at water conferences and request for input was also placed on the Water Forum website. Roundtables were held at Stockholm Water Week through which input was received from participants as well.

Theme 3 generated the most interest with the greatest number of responses to the calls for contribution. It received 31% of the over 700 contributions received. The next highest was Theme 6 at 18%. Topic 3.1 received the most contributions to any topic. Topic 3.3 has made the greatest to attempt to incorporate most of the contributions received, optioning for innovative approaches at holding discussions in order to elicit the greatest number of contributions to participate. The session conveners have chosen to divide their meetings into sub-sessions in order to provide the widest margin for inclusiveness in the discussion process, and 3.3.2.1 and 3.3.2.2 specifically will be conducting a roundtable type of setting to create an environment that allows for the greatest number of views to be exchanged.

Many of the issues to be presented and discussed in Theme 3 are linked with those in other Themes, further helping to bridge the divide on sustainable water management. The sessions have been designed to share some initial thoughts and ideas on solutions, best practices, and lessons learned, while allowing enough time for input from the World Water Forum participants.

This report is not intended to replicate the Session Situation Documents and the Topic Reports. The Topic Coordinators and the Session Coordinators will be preparing reports out of the sessions and topics. These reports will confirm, refute or offer conclusions and recommendations on bridging divides for water, and thus those presented below are offered for discussion and debate. The Topic and Session Coordinators include a wide mix of organizations from different perspectives which has contributed to already some bridging of divides over the two year planning process.

BACKGROUND ON THE CHALLENGES

The hydrologic cycle on Earth supports an abundance of life, including human life. Freshwater ecosystems are supported by the hydrologic cycle, providing immeasurable services and benefits to humans, ranging from food and water purification to spiritual renewal. Despite growing awareness of the importance of healthy freshwater ecosystems, human actions continue to degrade the freshwater ecosystems upon which we depend. Even with the policy movement toward integrated water resource management, a more holistic approach to managing our water to meet human and environmental needs still remains for the most part an ideal.

The hydrological cycle—the Earth's method of recycling our water supply—acts like a giant water pump that continually transfers freshwater from the oceans to the land and back again. In this solar-driven cycle, water evaporates from the Earth's surface into the atmosphere and is returned to the Earth as rain or snow. Part of this precipitation evaporates back into the atmosphere, while another part flows into streams, aquifers, rivers

and lakes, commencing a journey back toward the sea. Still another part sinks into the soil and becomes soil moisture or gets stored as groundwater. Much of the world's groundwater slowly works its way back into the flow of surface water.

The available water supply is not distributed evenly around the Earth, throughout the seasons, or from year to year. Often, sufficient quantities of water are not available where and when humans need them. In other cases, we have too much water in the wrong place at the wrong time. The hydrological cycle does not always cooperate with human's needs and desires for water. Developed and developing countries face water stress that challenges the water resources management community. Increasing occurrences of droughts and floods are producing significant economic and environmental damages. Many emergent and developing countries are in a situation of water poverty that seriously impacts on public health, causing a great impediment for human grown and development.

The Millennium Ecosystem Assessment noted that: "Any progress achieved in addressing the MDGs of poverty and hunger eradication, human health, and environmental protection is unlikely to be sustained if most of the ecosystem services on which humanity relies continue to be degraded." The Assessment also clearly pointed out "The use of…freshwater…is now well beyond levels that can be sustained even at current demands, much less future ones."

Poor rural and urban consumers increasingly view access or entitlement to water as a more critical problem than access to food, primary health care, and education. The UN estimates that by the year 2025, up to 40% of the world's population could live in water scarce regions, including most countries in the Middle East and North Africa, South Asia, South Africa and China. This means that these areas do not have sufficient water resources to maintain their current level of food production or the ability to meet reasonable water needs for domestic and industrial purposes.

Pressure on freshwater supplies is not limited to increased water withdrawals. Groundwater quality in industrialized countries has deteriorated due to nutrient and chemical runoff from agricultural lands. In developing countries 75% of all industrial waste and up to 95% of sewage is discharged into surface waters without any treatment. In urban areas, most water

is used for drinking and sanitation. Water scarcity is exemplified by situations such as: the need to carry heavy pots of water several kilometers every day to meet households needs; destitute farmers losing their lands or the landless losing their jobs because of lack of irrigation water; the loss of wetlands or estuaries because of upstream water depletion; increasing health problems due to water pollution and to a rise in incidence of water-borne diseases.

Water scarcity and poor water quality has the potential to lead to increased domestic and international instability in at least two ways: (1) domestic unrest caused by the inability of governments to meet the food, industrial, and municipal needs of its citizens, and (2) hostility between two or more countries possibly leading to greater insecurity or conflict, caused by one party disrupting the water supply of another.

In 2008, for the first time in history, more than half of the world's population lived in urban areas, and approximately sixty percent of humans are expected to live in urban areas by 2030. Currently, there are an estimated 23 megacities worldwide (populations over 10 million). By 2015, the number of megacities is expected to grow to 36. The world's megacities take up just 2 percent of the Earth's land surface, yet they account for roughly 75 percent of industrial wood use, 60 percent of human water use, and nearly 80 percent of all human produced carbon emissions. Growth in urban areas has serious implications for freshwater ecosystems as human consumptive needs for freshwater overwhelm these systems. Water withdrawals, wastewater and storm water inputs, and loss of natural vegetation all impact the health of freshwater ecosystems. Typical impacts to watersheds in urban areas include diminished water quality, excessive erosion and sedimentation, proliferation of nuisance aquatic and riparian vegetation, and loss of aquatic species. The ecological footprint of cities can be intensely concentrated, as in the case of wastewater discharge and storm water runoff, or broadly distributed when urban water supply systems reach far beyond urban geographies to tap distant freshwater supplies.

The health of freshwater ecosystems and human wellbeing are inextricably linked. Freshwater provides the basic drivers of human development – drinking water, sanitation, energy, food and transport – yet as the population grows, insufficient action is being taken to protect the freshwater systems that sustain us. The global human population is expected to grow to approximately 9 billion in the next 50 years, and the growing demands for water to support cities, food production, and energy generation present daunting challenges for water planners and governments.

Participants will note overlap in issues across the Topics in Theme 3. For example, Topic 3.1 addresses groundwater resources in the trans-boundary/basin context, while Topic 3.4 is specifically tasked to cover managing groundwater (in addition to surface, soil and rain water). Topic 3.2 includes a session that examines how to consider environmental flows in infrastructure development, while Topic 3.3 is charged with evaluating the benefits of environmental flows. There are other examples throughout the Theme. This highlights the inter-linked nature of issues in managing our limited freshwater for humans and the environment.

Theme 3 involves a difficult set of issues as it touches upon people's core values and economic interests. In the two years of planning for the Fifth World Water Forum, Theme 3 Coordinators, Topic Coordinators and Session Coordinators and stakeholders have worked to design a set of sessions that will encourage open and honest debate on how to meet the needs of the expected 9 billion humans while at the same time not undermining our freshwater systems.

Basin Management and Trans-boundary Cooperation

River basins cross political boundaries (whether national or sub-national) and cut across many users with competing demands for the precious resource of water. River basin management is a key challenge and opportunity for sustainable water resource management. Countries are establishing river basin organizations as a tool for improved water management, moving toward Integrated River Basin Management and Integrated Water Resource Management. While some river basin organizations have been functioning for some time, many are just being established or function only on paper. Plans and institutions will only succeed, however, if the policies and programs exist to bring about real changes in ensuring water and development needs are met at local levels.

Topic 3.1 was developed in consultation with a long list of organizations and other stakeholders. The focus of the sessions will be on practical application of IWRM at the basin

level, in groundwater management and for trans-boundary cooperation, trans-boundary surface and groundwater resources management, the participation of stakeholders in both trans-boundary basin cooperation and groundwater management, and existing operational tools for basin and aquifer management as well as trans-boundary cooperation.

One of the expected conclusions/recommendations out of the sessions is the need to focus on hydrosolidarity as a means to improve trans-boundary basin cooperation. Hydrosolidarity describes an increasingly integrated approach to managing water resources that relies heavily on participation and coordination among community stakeholders, water-related management agencies, and local, state, and national governments. A fundamental goal of hydrosolidarity is the cooperative, unified management of shared water resources, whether at the national or the international level.

There is no one set of mechanisms and tools (e.g., international conventions, regional treaties, diplomacy, politics) that support the achievement of cooperation (including protection against floods and droughts, preventing pollution, water sharing and maximizing benefits for all countries and populations living in the same basin) while nurturing genuine cooperation. International commissions, arbitration commissions, transboundary basin authorities all offer lessons learned for improved river basin management. For example, the size, shape and structure of river basin organizations depend on the needs of the river basin and the ideas of the participants and members of the organization—there is not one size and form that fits all. There are many types of river basin organizations, including: watershed management RBOs, river basin management RBOs, international boundaries and water commissions, bi-national or tri-national river basin commissions, and regional corporations, among others. They also evolve over time as lessons are learned as to what works and does not work. Studies have shown the river basin organizations are most effective if they are tailored to the physical, social and economic circumstances of the basin.

For basin management and trans-boundary cooperation to be effective, it is important to develop indicators that can be used to monitor and assess the quality of cooperation at any level (e.g., local, national, trans-boundary). This is particularly important for the range of stakeholders to assess progress. Experience shows that creating a sense of ownership among stakeholders is a key to the success of a project on the ground. However, determining the appropriate ways for developing wide and effective stakeholder participation in particular situations is still a challenge, especially in transboundary contexts and situation of scarcity.

This is true in all cases, however, particularly in large river basins. Improved management of rivers which span thousands of kilometers and changing political and cultural boundaries – from headwaters to their estuaries – is incredibly challenging and is not be possible without tremendous collaboration among partners from government, academic institutions, the corporate sector, communities and NGOs.

Operational tools are crucial for the improvement of water management (surface and groundwater) at the basin level, as well as for the reinforcement of transboundary cooperation. These may be related to risk management, flood and drought prevention, funding mechanisms, integrated information systems, planning methods, training and capacity development. For application of these tools and approaches, however, it is critical to have adequate and realistic financing mechanisms and tools (e.g., national budget, tariff strategy, water taxes, and financial transfers).

Managing and Protecting Water Resources and their Supply Systems to Meet Human and Environmental Needs: Ensuring adequate water resources and storage infrastructure to meet agricultural, energy and urban needs

Topic 3.2 cuts at the core of very difficult issues of how to allocate water among many different and often conflicting purposes: agriculture, water supply, sanitation, energy, navigation, etc. In addition, water is required for ecosystem functionality, and this is often considered as after thought in development projects, if at all.

There is a strong relationship between water infrastructure and human economic and social development. Socio-economic analyses show that the stock of infrastructure (e.g., water supply, sanitation, dams, reservoirs and storage, electricity, and hydropower) that a country possesses is generally closely linked to its socio-economic development and that these infrastructures are essential for a country's development. The developed countries have a large and varied inventory of water infrastructures. Thus, it is important for the socio-economic development of emergent and developing countries to develop water infrastructure in order to have available sufficient supplies of water, food and energy. Developing countries without appropriate infrastructure have a limited ability to provide water services and water security and to protect against the risk of water-related disasters.

However, in the haste to develop new infrastructure, it is critical that it not be developed in a manner that degrades freshwater systems. If the health of ecosystems are undermined so too are the health of humans and overall chances for real socio-economic well being. This is particularly true for poor communities that are the ones most often dependent on their ecosystems.

With increasing competition over limited water resources, governments have begun over the last few decades to accept the concept of integrated resource management as a fundamental approach to resource allocation issues, steering away from traditional sectoral approaches. Integrated water resources management (IWRM) is grounded on the understanding that water resources are a part of a linked system, involving upstream and downstream users, terrestrial and aquatic systems, surface and underground water sources, as well as the river basin and adjacent coastal and marine environments. It provides a framework in which the competing and conflicting needs of multiple users and stakeholders can be explicitly analyzed and addressed, in a transparent, systematic and participatory way.

However, IWRM needs to be practiced at different scales in order for it to be helpful in enabling governments and all stakeholders to determine how to allocate water among increasing energy, agricultural and urban demands. A sustainable management policy requires socio-economic, technical and institutional Issues to be considered together and not separately—this can prove challenging as the energy, agriculture and urban sectors "compete" against each other for water resources. In addition, global evidence of climate change and its impacts on droughts in some places and flooding in others must be considered if IWRM plans are to be effective in the longer term.

In tackling issues of climate change, many water managers and others are pointing to the need for increased storage capacity. While the total storage of reservoirs amounts to approximately 30% of the world's available water resources, this security does not come without costs and impacts. Experience in infrastructure development during the last century has revealed that large water and energy projects, including dams and reservoirs, can have major social and environmental impacts. Future scenarios of storage needs need to consider all alternatives to storage (e.g, water saving, reuse of wastewater, tank irrigation, desalination). Planning must consider how best to adapt storage options to their purposes in

size (from small to large scale), and type (e.g, water harvesting, small dams, large dams, surface and groundwater management, etc.) in light of global changes and climate change. Alternatives to storage (e.g., water saving, reuse of wastewater, tank irrigation, desalination) must also be considered.

It is necessary to bridge dividing positions, to break down the dilemma and the antagonisms between the structural actions of water resources management and conservation measures in order for countries to develop while not undermining the health of their ecosystems. In response to the increasing loss of freshwater ecosystems, in a broad array of countries in every continent, increasing attention is now being paid to the ecological benefits of restoring natural flow conditions with their seasonal variability. This work is, in effect, defining the environmental water demands for these systems. Equally important are efforts to devise innovative water management techniques to restore these environmental flows on a permanent basis while retaining the economic benefits for which the dams and other structures were initially developed. Ultimately, infrastructure needs to be designed, constructed and operated to mitigate its social and environmental impacts. Regional energy and water planning through Strategic Environmental Assessments and other means offers governments and all stakeholders a vehicle through which to design and plan infrastructure to meet human needs for energy, water, food, etc. while finding ways to avoid, reduce and mitigate the social and environmental costs.

Preserving Natural Ecosystems: Ecosystems for Water and Life

Topic 3.3 is focused on the key question of how can the preservation of natural ecosystems become a principal objective of land and water management. It was developed with the concept of involving as many stakeholders as possible in an interactive format at the Forum to allow innovative ideas to come forward.

Ecosystem services are defined as a variety of culturally and socially-valued goods and services that human society derives from natural ecosystems. Freshwater ecosystems provide a wealth of food and fiber, water purification, fish and wildlife habitat, tourism and recreational opportunities, shipping routes, employment, and opportunities for cultural and

spiritual renewal. For example, people across the globe depend on fishes as their primary source of protein, with some regions particularly reliant on fish due to the fundamental social and economic role of fisheries. Moreover, the genetic and chemical components of aquatic species may offer humans invaluable pharmaceutical and other benefits. However, to provide the range of services on which humans depend, freshwater systems themselves depend on the cycling of water and on functioning ecological processes and species assemblages.

Topic 3.3 acknowledges the human benefits derived from preserving natural ecosystems in an attempt to bridge divides between sectors with differing objectives for ecosystems. Water management has traditionally focused on meeting the needs and desires of a growing and changing human population without due consideration to the needs and limits of our freshwater systems. As a result, freshwater and related ecosystems have felt the impacts of mismanagement, with some rivers such as the Rio Grande in the US and Mexico now failing to reach the sea in many years or during droughts. Globally, it is estimated that the world has already lost half of its wetlands with most of the destruction having taken place in the last 50 years during the period of rapid population growth and industrialization. The destruction of aquatic habitat from development and urban sprawl, the construction of dams, excessive surface and groundwater withdrawals, and pervasive pollution have decimated natural freshwater systems. It is not only freshwater species that are rapidly disappearing, but also saltwater and terrestrial species that depend on healthy freshwater ecosystems for their survival.

Water is often viewed as having competing uses—agriculture, industry, or domestic (drinking and sanitation). Historically, environment was lumped in with these competing uses. This view of environment being equal to agriculture or industry ignores the fact that water is the basis of ecosystems and habitat for humans and wildlife. There is a strong interdependence between people and freshwater ecosystems. Part of Topic 3.3 will highlight the shifting paradigm from “water for nature” to “nature for water.”

In shifting to the paradigm of “nature for water,” water managers and others must grapple with which policies will best support ecosystem protection. This includes the challenge of how to link IWRM plans with forest programs, biodiversity strategies (including

governmental commitments under the Convention on Biological Diversity), and land use planning to bring about the greatest protection of ecosystem services for all. This is particularly challenging as it involves many agencies that traditionally have not worked together. To move toward this paradigm becoming a reality, it will be critical for agencies (e.g., water, forestry, mining, energy, agriculture, finance) to overcome differences and make the commitment to work together on ecosystem security.

One of the challenges in moving toward ecosystem security is convincing policymakers that protecting ecosystem goods and services will promote social and economic development. The Millennium Ecosystem Assessment gave an in-depth look at the range of ecosystem goods and services and their current state, but it did not provide the economic data for national leaders to commit to "investing" in ecosystem conservation. As the United Nations Economic Commission for Europe has noted, the degradation of ecosystem services represents loss of a capital asset. There is a lack of data on the costs and benefits of clean water provided by watersheds. A report by the World Health Organization (WHO) made the case that for every dollar invested in meeting the water and sanitation targets, the returns could range from US$3-34, and that interventions targeted at the poor (such as improved household water treatment and storage) can bring returns of up to US$60 per US$1 invested. Reaching the targets will require greater investments by countries as well as improved laws and regulatory systems. The equitable sharing of benefits will also need to be addressed.

Economic instruments offer one means to help conserve ecosystems. Payment for environmental services (PES) in the water sector, in essence, promotes the conservation of upstream areas, and thus ultimately entire watersheds, through compensation for ecosystem friendly land use practices. Environmental service fee have been established in a number of places across the globe. These systems offer valid lessons learned on how to create new mechanisms that encourage individuals and businesses to recognize the *value* of ecosystem services.

Environmental flow science has advanced considerably. Ecosystems vary, but aquatic species depend on an appropriate sequence and timing of minimum flows, normal flows, and peak flows for their survival. The productivity levels of deltas and estuaries, which arguably rival

that of wetlands, also depend on the timing and volume of freshwater inflows to support critical habitats such as mangroves as well as fishery stocks. Despite improved methods for scientifically defining a river ecosystem's flow needs, water management processes continue to fail to account for scientific understanding of freshwater ecosystems. Topic 3.3 will help examine how maintenance of environmental flows benefits agriculture, industry, energy and the domestic supply sectors.

Managing and Protecting Surface, Ground, Soil and Rain Water

Topic 3.4 is designed to cover all of the important key questions and possible solutions for sustainable water management. Although all forms of water have distinct and special behaviours, they are part of the hydrological cycle and thus should be considered together. However, Topic 3.4 calls out a special session on groundwater as due to its nature, groundwater requires specific strategies and approaches to be successfully managed.

Although there are disparities in infrastructure and water consumption patterns across sectors and regions and even some positive signs of water conservation, decades of rapid population growth and increasing water withdrawals for agriculture, industry and municipalities have strained the world's freshwater resources. Human modifications in the form of industrial and agricultural development and urban sprawl impact the hydrological cycle, disconnecting rivers, streams, floodplains and wetlands.

Freshwater ecosystems are disappearing as a result of the over-pumping of groundwater for agricultural and other uses. Each year on a global basis, 150-200 cubic kilometers more groundwater is pumped out of aquifers than is recharged naturally. Over the last few decades, a marked decline in water tables worldwide is occurring as a result of groundwater overexploitation. Declines of 10-50 meters have been registered in cities across the globe. Groundwater and surface waters are interlinked; thus, degradation or diminution of groundwater may affect surface waters and the associated ecosystems.

Water pollution is a particularly difficult problem in countries where population is growing rapidly, development demands are great and governments have limited resources for

investment in water management and pollution control. Both agricultural and industrial pollution is undermining natural systems. In developing countries, on average, 90-95% of all domestic sewage and 75% of all industrial waste are discharged into surface waters without any treatment whatsoever. The environment and human health are impacted as a result of this, particularly as the amounts overwhelm the assimilative capacity of waterways.

A strategic framework for effective water resources management can assist particularly developing countries while they are struggling to overcome problems originating from water related conflicts in a cost-effective and sustainable way. Effective water resource management is the only answer to this situation. Optimal usage of each and every drop of water requires that every corner of the life will have to participate in water resource conservation and effective management. Water management should be intra-sectoral and water saved by one sector should not be wasted by other sector. Public awareness and participation will be the key to achieving these objectives. Conjunctive use and integrated protection of waters may be the best way to handle this precious natural resource. In addition to the technical aspects of sustainable water management, the legal, institutional, social, economical, political and participatory frameworks may be of even greater importance.

In the short term, groundwater management needs to be incorporated into IWRM and effective practices must be shared. There also needs to be capacity building and awareness-raising on how to manage aquifers and the consequences of overexploitation and contamination. In the short and medium term, policies need to be created and implemented that enable more systematic approaches to groundwater management. In the medium and long term, the impacts of climate change, population growth and land use change need to be incorporated into planning and management to ensure a sustainable supply for the future.

OVERALL THEMATIC CONCLUSIONS AND RECOMMENDATIONS

The sessions are designed to generate discussion as to the best solutions for managing and protecting water resources and their supply systems to meet human and environmental

needs. Therefore, the points raised below are a starting point and conclusions/recommendations will be drawn throughout the sessions, Topic wrap-ups, and Theme 3 Synthesis.

- River basin management is a key challenge and opportunity for sustainable water resource management, with hydrosolidarity a means to improve cooperation particularly in a trans-boundary context. All mechanisms and tools (e.g., international conventions, regional treaties, diplomacy, politics) should be adopted to the extent they are able to support the achievement of cooperation (including protection against floods and droughts, preventing pollution, water sharing and maximizing benefits for all countries and populations living in the same basin) while nurturing genuine cooperation.

- River basin organizations offer a vehicle through which a range of partners can work together reconcile the short-term emphasis on development with the long-term view of creating compatible conservation and sustainable human use within a river basin and different river cultures.

- IWRM needs to be practiced at different scales in order for it to be helpful in enabling governments and all stakeholders to determine how to allocate water among increasing energy, agricultural and urban demands. IWRM plans need to adequately take into account projections for increased demand for food, energy, housing, water, etc. in the coming decades, particularly in face of climate change. In addition, groundwater management needs to be incorporated into IWRM.

- Strategic Environmental Assessments and other forms of region-based efforts in planning for infrastructure development at broader scales can help avoid, reduce and mitigate social and environmental impacts of projects and ensure long-term sustainability of freshwater resources.

- Countries need to adopt integrated policy packages that preclude development in certain areas, maximize the social and environmental compatibility of development where it occurs, and compensate local communities for ecosystem services lost due to infrastructure development.

- Governmental agencies must do a better job of working across sectoral lines (e.g., energy, agriculture, planning, and finance) toward integrated planning to address current

and future infrastructure development needs and make use of effective tools for inter-sectoral, inter-agency cooperation. Governmental agencies need to work trasnversally across many departments to developed harmonized policies for infrastructure development and sustainable water management.

- Strategies for the sustainable development of water resources should be based on a participatory process, engaging stakeholders in the earliest stages. The role of the poor should be especially considered so that the voices of those most dependent on ecosystem services are heard in managing freshwater resources.

- In both the science and engineering associated with water resource planning and river management, there has been remarkable progress in the recent decade. Environmental flow science to support river management has taken some giant leaps forward and the integration of environmental flows in infrastructure development and re-operation can help reduce the environmental impacts. Innovative engineering and water management techniques to restore environmental flows should be integrated in infrastructure development to strike the right balance between the human needs for which river systems were initially developed and ecological needs.

- Water management decisions should be taken and implemented in an equitable manner, maintaining transparency through cooperation with not only the water sector but also other sectors critical for improving water management (e.g., agriculture, energy, finance).

- Plans and institutions will only succeed, however, if the policies, programs and funding are put in place to bring about real changes in ensuring both development needs *and* water management and conservation needs are met.

- A sustainable management policy requires socio-economic, technical and institutional issues to be considered together and not separately. An integrated management system can help ensure the preservation and evaluation of a given water source for beneficial utilization for human and environmental needs.

- Policies, approaches and tools that support the protection of ecosystem services should be adopted and replicated. Payment for environmental services (PES), water funds, and similar approaches offer financially sustainable means of protecting the health of watersheds, particularly those supplying expanding cities with water.

- Water management should be intra-sectoral and water saved by one sector should not be wasted by other sector. Public awareness and participation will be the key to achieving these objectives. Conjunctive use and integrated protection of waters may be the best way to handle this precious natural resource.

- Strengthening legal, regulatory and institutional systems is critical for the sustainable management of water.

Water security must be embedded into national development plans, such as poverty reduction strategies and comprehensive development frameworks. IWRM plans should be linked with forest programs, biodiversity strategies (including governmental commitments under the Convention on Biological Diversity), and land use planning to bring about the greatest protection of ecosystem services for all. To do so, it is important to recognise the need to bring together fragmented institutional responsibilities and interests in water such as finance, planning, agriculture, energy, tourism, industry, education, health. Water and basin managers will need to engage with and influence those ministries, businesses, civil society actors and those from other sectors that use water to achieve their development goals.