

Mainstreaming Environmental Flow Requirements into Water Resources Investment Decision Making and Policy Reforms

Concept Note

November 17, 2006

I BACKGROUND AND RATIONALE

1. *High social and economic costs of under investing in water resources management and development.* Investments in water supply, sanitation and sewerage systems, irrigation, hydropower, flood control, and river and lake basins, wetlands and aquifer management have contributed enormously to improving the quality of life, reducing vulnerability of fragile economies to economic and social disruptions of extreme climate variability, and providing essential services to many urban populations and rural communities. The costs of under investing in water resources development and management were demonstrated in a 2005 study¹ of climate variability and water resource degradation in Kenya and the Country Water Resources Assistance Strategy for Ethiopia². The Kenya study estimates, conservatively, that climate variability and water resources degradation costs the country at least three percent of GDP annually. The 1997/98 El Nino floods cost the nation 11 percent of the GDP, and the La Nina Drought cost the nation 16 percent of the GDP in each of the following two years. The Ethiopian study underscores the high vulnerability of that country's economy to floods and droughts, which are exacerbated by insufficient infrastructure to both allow for productive uses of water and to buffer against too much water or too little water. Man-made storage (dams) and natural storage (lakes, wetlands, groundwater aquifers), inter - basin water transfer schemes, conjunctive use of surface and groundwater, desalination, and demand management can provide the necessary buffering capacity against the uncertainties of climate variability and provide sources of power, irrigation, domestic, industrial and livestock water for many developing countries. It is difficult to imagine how development can be achieved or poverty alleviated, especially in regions with highly variable climates such as Africa and Asia and with limited or degraded natural and man made buffering capacities, without restoring and managing natural assets and building water resources infrastructure.

2. *Re-engaging in water resources infrastructure in an environmentally responsible way.* The World Bank has decided to re-engage in water resources infrastructure investments, including single and multipurpose small, medium and large dams, inter-basin transfer schemes, and conjunctive use of surface and groundwater for water supply, irrigation, hydropower and flood control works, to address these vulnerabilities³. The under-investment in water resources infrastructure and water resources management institutions and systems in developing countries has also been recognized by other bi-lateral and multi-lateral development agencies. However, it has also been recognized that past investments in large dams have not always been planned, designed or implemented responsibly. Large numbers of people have been displaced without adequate resettlement or compensation, and economically and ecologically important habitats have been damaged or destroyed both

¹ "Climate Variability and Water Resources Degradation in Kenya: *Improving Water Resources Development and Management*", Mogaka, H., S. Gichere, R. Davis, and R. Hirji, World Bank Working Paper No. 69, 2005.

² *Managing Water Resources to Maximize Sustainable Growth: A Country Water Resources Assistance Strategy for Ethiopia.* World Bank. 2006.

³ "Water Resources Sector Strategy: Strategic Directions for World Bank Engagement", World Bank. 2004.

upstream and downstream of the dams, intakes, abstraction and diversion structures⁴. Future investments in water resources infrastructure will have to be made in an environmentally and socially responsible manner that avoids these impacts where possible, mitigates them when avoidance is not possible and fairly compensates when mitigation is not possible. The recent Bank report “Water for Growth and Development”, released at the 4th World Water Forum, makes the case for a minimum platform of investments to achieve water security so as to ensure that water underpins, rather than undermines, economic growth. It calls for a right balance in investments for infrastructure and institutions and mandates that the new investments in water management and development be sustainable, achieving a balance between water security and social and environmental protection.⁵

3. *Limited experience in addressing downstream environmental and social issues and impacts.* Development agencies, including the World Bank, have gained considerable experience in systematically addressing the upstream social and environmental aspects of dams and other water resources infrastructure, but have much less experience in addressing the downstream impacts. Typical impacts upstream of an impoundment would be related to the conversion of a terrestrial into an aquatic habitat, and could entail relocation, resettlement or compensation of land and assets to be inundated or impacted by inundation. Downstream impacts – biophysical and social - arise primarily from changes in the flow – quantity, timing and quality – patterns of rivers⁶. In some cases, significant quantities of water have been exported to other nations or total quantities of water have been affected as flows have been diverted from the rivers to support extensive irrigation, hydropower production, and urban water demands; in other cases, such as in hydropower development and flood control or multi-purpose structures, it is the seasonality of flows and the size and frequency of floods that have been modified.

4. *Defining environmental flows.* The flows that provide environmental services (fisheries, trees and vegetation, biodiversity, dilution capacity, river morphological benefits and habitat integrity, etc.) and associated social services (such as water supplies during dry periods and livelihoods for farmers, pastoralists, fishing and other river dependent communities) are termed environmental flows. These are neither constant flows nor are they statistically derived flows on the basis of hydrological considerations alone, but are based on a clear understanding of the downstream ecological needs and the needs of the society that depend on the ecological resources and services. A globally accepted definition of environmental flows is based on the following two aspects:

- The quality, quantity and timing of water flows required to maintain the components, functions, processes and resilience of aquatic ecosystems which provides goods and services to the people,⁷ and,
- The foundation from which socially-valued resources are derived and supported, and without which no sustainable uses are possible – not as a user of water in competition with other users⁸

⁴ World Commission on Dams. (2000). Dams and Development: A new Framework for Decision Making. Earthscan Publications.

⁵ Grey, D. and C. Sadoff (2006) “Water for Growth and Development: A Theme Document for the Fourth World Water Forum.”

⁶ Water quality can also be affected downstream of a dam or other infrastructure, through changes in water temperature and changes in water chemistry or reduced dilution capacity resulting from changes in river flows.

⁷ The definition of environmental flows here also captures practices described by other terminology common to particular countries or specific geographies such as ecological flows (China), ecological reserve or reserve (in parts of Africa, including RSA, Tanzania and Kenya), instream flow protection (USA).

5. *Absence of a clear planning and management decision making framework.* The process of determining environmental flows and integrating them into the operations of infrastructure is highly complex. Even though it is a key aspect of integrated water resources management, it is not fully understood or appreciated by water resources planners and managers as well as environmental specialists. Even social scientists have not developed a clear framework for determining the downstream social impacts as well as the necessary mitigation and compensation programs associated with resource loss resulting from reduced or altered river flows as they have for upstream impacts. The process of determining and integrating environmental flows into infrastructure operations is also a highly contested area of water resources development, partly because of the absence of an agreed metric to define environmentally sustainable water use, partly because of the absence of a uniformly agreed set of methodology for carrying out environmental flow assessments, and partly because of the continuing difficulty in implementing environmental flows in the face of operational and political pressures. The central deficiency is the absence of a clear analytical framework for systematically integrating environmental flows into water resources planning and management decision making and policy development and implementation. In fact, the determination and implementation of environmental flows is still evolving even in the developed world with Australia, the United States, the European Union and South Africa providing cutting-edge experience. Even these experiences have limitations⁹.

6. *Environmental flows are important in many different contexts.* Although large dams are the most prominent cause of disruption to riverine flows, major land conversions in the catchments of rivers, diversions of water for off-stream use, inflows of drainage waters, groundwater pumping, and inter-basin water transfers have also modified the flows of many of the world's rivers. Whereas, the detrimental effects from modifications to flow patterns from dams is now increasingly recognized, the modifications resulting from these other development activities is less well recognized by development agencies.

7. *Environmental flows are essential for livelihoods of downstream communities.* People, especially in the developing world, are dependent on the services provided by environmental flows. For example, Chilika Lake downstream of the Naraj Barrage on the Mahanadi River supports the livelihoods of over a 100,000 fisherfolk and its spectacular biodiversity makes it an important recreation area and Ramsar site. Flood recession agriculture on the Senegal River below Manantali Dam is important for thousands of downstream farmers, and flood waters also support pastoral and fishing communities and groundwater recharge. The fish catch (41,000 tonnes per annum) at Tonle Sap in Cambodia, depends critically on seasonal flows from the Mekong which are under threat from proposed upstream development. The release of water from Tonle Sap augments flows in the Mekong River during the dry season, allowing a second crop of rice to be grown in the Mekong Delta.

8. *Lack of uniform understanding of environmental flows.* Recent surveys have shown that environmental flow concepts have been emerging and used in at least 71 countries. Respondents have also indicated that there wasn't a uniform understanding of the concept of

⁸ The process of assessing environmental flow needs and developing environmental flow recommendations for environmental water allocations, requires societal judgement about the state in which an ecosystem should be maintained. The quality, quantity and distribution of water required for any aquatic ecosystem will depend on the environmental objectives for that system.

⁹ In Australia, the United States and EU nations, the focus has been on biophysical issues. In South Africa, although the science of determining EF is still new, but innovative, implementation is significantly lagging.

environmental flow. In a number of cases the application of environmental flow concept has been driven by the need to conform with development agency requirements; in others, policies, laws and strategies have been produced that include environmental flow requirements but there is little implementation. All but one (South Africa) of the 11 countries with well-established environmental flows procedures are located in the developed world.

9. *Environmental flows in World Bank operations.* The World Bank promotes the incorporation of environmental flows into the water resources management of borrowing countries in three potential ways:

- Use of safeguard policies to ensure that environmental and social considerations are fully incorporated in investment projects;
- Promotion of environmental flows in Bank support for country-level water resources policy reforms;
- Promotion of provision for environmental flows in Bank support for integrated river basin management and integrated lake basin management.

10. *Ad hoc practices and grey areas in safeguard policies.* In most cases, however, the incorporation of environmental flows in World Bank project planning and design has been carried out on an ad hoc basis. The Bank's policies and procedures do not *explicitly* recognize the need to provide for environmental flows and do not mandate the use of specific approaches or methods to quantify and integrate it in the water allocation decision making. Environmental flow requirements represent a *grey area* in the Bank's safeguard policies. Consequently, it is not surprising that there is considerable leeway in the attention given to environmental flows in the Bank's infrastructure projects. Even when provisions for environmental flows are included in the planning and development of infrastructure projects, these provisions are not always put into practice because of pressures to use stored water for income generating activities. Environmental flows need to be effectively mainstreamed (institutionalized) into water resources and environment policies, programs and procedures, built into integrated water resources management, and supported through monitoring, scientific studies and capacity building programs.

11. *Absence of an established operational framework for implementing the Bank's Water related Environment Strategies.* The Bank's 1993 Water Resources Management Policy (p. 12) stipulated that "The water supply needs of rivers, wetlands, and fisheries will be considered in decisions concerning the operations of reservoirs and the allocation of water." The Bank's Environment Strategy acknowledges that environmental considerations have yet to be effectively mainstreamed into both Bank and its client country procedures. The Bank's Water Resources Sector Strategy identifies maintenance of environmental flows as an important component of Bank re-engagement in water resources infrastructure but like the WRMP and the Environment Strategy, provides no explicit guidance on how this should be achieved. The EA Sourcebook makes passing mention of environmental flow issues (Energy Chapter) but there is no explicit guidance on the inclusion of environmental flow issues in EIAs, there is no EA Update dealing with environmental flows. The major guidance is provided through various informal publications, especially three Water Resources and Environment Technical Notes¹⁰ and through funding support provided by the Bank

¹⁰ Water Resources and Environment Technical Notes C1-3.

Netherlands Water Program Partnership (BNWPP) Environmental Flows window¹¹. These informal guidance notes and BNWPP support have been useful but have limitations. They do not address the key analytical gap - a clear operational and decision making framework for systematically integrating environmental flows into water resources planning, design, operations and management decision making.

12. Most development agencies have tended to follow the World Bank lead in the incorporation of environmental considerations in development assistance and so they too do not systematically make explicit the need to provide for environmental flows in their project and policy work.

II OBJECTIVES

13. Given the Bank's recommitment to scaling up investments in high as well as low risk water resources infrastructure, it is timely to review the lessons that have emerged from both the Bank and non-Bank experience to support development of a clear analytical framework for systematically incorporating environmental flows into its lending and sectoral support operations. These lessons will guide the development of an analytical framework for decision making that will better inform future operations, identify potential changes in the operational policies and procedures of development agencies and support development of good practices to effectively incorporate environmental flow considerations into their operations.

14. This ESW concept note has been developed following discussions with TTLs who have accessed BNWPP Environmental Flows Window funds, QACU staff and other Bank staff with experience in environmental flows.

15. This ESW has the following four objectives:

- Documenting the changing understanding of environmental flows, both by water resources practitioners and environmental experts within the Bank and in borrowing countries;
- Drawing lessons from the experience in implementing environmental flows by the Bank, other agencies with experience in this area (IUCN and IWMI) and a small number of developed countries (Australia, Canada, United States and European Union) and developing countries (South Africa and Tanzania).
- Developing an analytical framework to support more effective integration of environmental flow considerations for informing and guiding:
 - The planning, design and operations decision making of water resources infrastructure projects,
 - The legal, policy, institutional and capacity development related to EFs, and
 - Restoration programs.
- Providing recommendations for explicit improvements in policies and procedures to better incorporate environmental flow considerations into their lending operations.

¹¹ A forthcoming Technical Note summarizes experiences and lessons from assistance provided by the BNWPP Window to Bank projects. A forthcoming Bank publication – Directions in Development – summarizes lessons from the World Bank's pioneering work on the Lesotho Highlands Water Project.

III AUDIENCE

16. The primary audiences for the ESW are water resources and environmental policy makers and water resources and environmental specialists. This includes audiences inside and outside the World Bank, including from other development agencies, NGOs and client countries engaged in water resources policies and investment programs.

IV METHODOLOGY

17. The evolving emphasis given to incorporation of downstream issues in dam-related projects will be documented by analyzing project documents (PADs, EAs, BTO reports, ICRs) for about 60 water resources projects which involve environmental flows issues; these will include 30 dam and other water resources projects reviewed under the 1996 OED study (pre-1996 cases) and 30 recent water resources projects (post 1996 cases). In addition to a general review, emphasis will also be placed on an in-depth analysis of 10-12 detailed case study projects and programs. Detailed case study projects will be selected on the basis of:

- Variety of dam purposes (hydropower, multipurpose, flood control, etc)
- Regional spread
- Availability of documents

Examples of case studies to be considered include the Aral Sea Project, the Tarim Basin, the Lesotho Highlands Water Project, Chilika Lake work, Mekong River Basin, Tanzania experience, BC Hydro, selected case studies from Australia, South Africa, United States and the European Union, and others. These case studies will be supplemented by a 2002 review paper¹² that looks at the evolution of the World Bank's policies concerning the integration of environmental flow considerations through selected case studies.

18. *Broad Based Lessons will be drawn.* Lessons from recent Bank experience in implementing environmental flows supported by the BNWPP have been preliminarily summarized and these lessons will be supplemented by interviews with consultants working for the BNWPP Environmental Flows Window and Bank TTLs and information in the recent report on Water for Growth and Development. The extent to which downstream issues have been incorporated into non-dam related projects will also be assessed using 30 large scale forestry projects supplemented by the findings in the recent ARD draft report on watershed management¹³. The experiences of IUCN, IWMI, TNC and NHI in promoting environmental flows will be captured through supporting papers to be written by an experienced specialist.

19. *Benchmarks.* Benchmarks from those developed countries with greatest experiences in implementing environmental flows (Australia, Canada, United States and European Union) as well as evolving experiences from developing nations (South Africa and Tanzania) will be obtained through specialist papers being written by consultants familiar with progress in those countries. It is hypothesized that these countries have been successful because of the existence and application of a combination of judicial, procedural, evaluative, instrumental, professional and public controls. This will be examined in the specialist papers.

¹² Hirji, R. and T. Panella. Evolving Policy Reforms and Experiences for Addressing Downstream Impacts in World Bank Water Resources Projects. This paper was originally presented at *Environmental Flow Assessments for Rivers: An International Working Conference on Methods and Case Histories*, Cape Town, South Africa, on March 3-8, 2002.

¹³ Watershed Management Operations: Approaches and Emerging Lessons (Draft). April 3, 2006.

20. *Scope of the Analysis.* These analyses will include:
- Policy development, river basin planning, development and management, and project lending
 - Dam and non-dam lending projects
 - New single and multi-purpose dams, rehabilitation and re-operation amongst dam projects
 - Methods and procedures for determination of downstream environmental and social impacts and associated mitigation and compensation programs
 - Environmental policy and procedures for guiding dam and reservoir operations
 - Costs of environmental flow provisions
 - Stakeholder involvement and decision processes
 - Infrastructure design considerations for building flexibility for environmental flow releases.
21. *Outputs of the ESW.* The out puts will include :
- More explicit recommendations for inclusion of environmental flow considerations in the policies of the World Bank;
 - An analytical framework to support more effective integration of environmental flow considerations for informing and guiding (a) the planning, design and operations decisions making in water resources projects, (b) the legal, policy, institutional and capacity development related to EFs, and (c) restoration programs; and,
 - Material for inclusion in training courses.

A proposed outline of the ESW Report is attached as Annex 1.

V TIMETABLE

Concept Review: April 18, 2006
 First Draft Report: July 15, 2007
 Decision Meeting: Nov 30, 2007

VI BUDGET

Staff Time and Travel	\$ 85,000	(BB)
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PROPOSED OUTLINE OF THE ESW REPORT

The ESW will be organized in five parts:

1. Introduction (short)
 - a. Water Resources Management and Development
 - i. Investments in water resources
 - ii. Principles of sound water resources management
 - b. Environment and water resources management linkages
 - i. Upstream and downstream issues
 - ii. Biophysical and social issues
 - iii. Mainstreaming challenge
 - c. Objectives of the ESW
 - d. Audience
 - e. Methodology
 - f. Organization of the ESW
2. Understanding Environmental Flows
 - a. Biophysical issues and ecosystem services delivered by flows
 - b. Basin-level water allocation
 - i. Direct use of water
 - ii. Indirect use through environmental services
 - c. Modifying flows through:
 - i. Infrastructure (dams, weirs, etc)
 - ii. Large scale land use changes affecting runoff
 - iii. Abstractions (including inter-basin transfers) and discharges
 - d. Socio-economic impacts of modifications to flows
 - i. Benefits (primarily flood control) and costs
 - ii. Differences between developing and developed countries
 - iii. Participation, negotiation, modifications and compensation
 - e. International recognition of environmental flows in both developing and developed countries, including policies and implementation approaches in selected countries (overview of South Africa, Canada, Australia, USA, EU and Tanzania)
 - i. Mainstreaming environmental flow considerations into policy and integrated water resources management.
 - ii. Need to integrate biophysical, hydrological, ecological and socio-economic expertise
 - iii. Technical capacity for flow assessments
 - iv. Institutional acceptance of flow-related issues
 - v. Evolving procedures for flow assessments and incorporation into flow allocation decisions
3. Experiences from Bank projects
 - a. Changing acceptance of environmental flows within Bank dam-related projects
 - b. Incorporation of environmental flow considerations in non-dam projects
 - i. Large scale forestry and other land use conversion
 - ii. Integrated river basin management projects and inter-basin water transfers

- iii. Water resources policy reform and environmental water provisions
 - c. Issues affecting acceptance of environmental flows
 - i. Costs of undertaking flow assessments
 - ii. Difficulties of coordinating hydrological, ecological, social and economic assessments
 - iii. Effect of environmental flows on project viability and financing options
 - iv. Limited policy and legal backing
 - v. Enforcement of environmental flow agreements
 - vi. Monitoring of predicted impacts and benefits of flows (participatory approaches)
 - vii. Limited knowledge, changes in understanding, experimentation, adaptive management
 - d. Lessons from recent Bank projects involving changes in flow regimes
 - e. Emerging issues
 - i. Incorporating estuarine and near-shore flow requirements
 - ii. Environmental water allocations in the face of climate change
 - iii. Linking environmental dependence on both surface and groundwater resources
 - iv. Environmental flows and water quality
- 4. Recommendations
 - a. More explicit inclusion of environmental flow considerations in the policies of lending institutions
 - b. Framework for sustainable inclusion of environmental flow considerations in water resources management in developing countries. This will include guidelines for informing:
 - The planning, design and operations of infrastructure projects,
 - The legal, policy, institutional and capacity aspects related to EFs, and
 - Restoration programs.
 - c. Material for training courses
- 5. Appendices
 - a. Summary of EF Methods
 - b. Case Studies illustrating experiences
 - i. Infrastructure projects and flows, (both BNWPP assisted examples and non-BNWPP examples)
 - ii. National policy development assistance
 - iii. Integrated river basin management projects
 - c. Details of approaches to planning water allocation, including environmental allocations, in South Africa, Australia, Canada, USA, EU and Tanzania
 - d. Infrastructure design features for releasing environmental flows
 - e. Downstream social issues related to riverine biophysical changes and losses