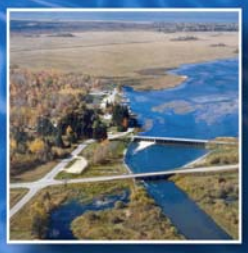
Visiting Scholar Program

August 2006

Key Performance Indicators of River Basin Organizations

2006-VSP-01



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Visiting Scholar Program

Throughout its history, the Institute for Water Resources (IWR) has invited preeminent water resources academicians and practitioners to take up residence at the Institute to foster scholarly exchange. At any given time, IWR frequently has faculty from universities spending time in residence at the Institute. Both IWR and the Corps benefit from such faculty engaging in ongoing water resources studies and research on a reimbursable basis. Visiting scholars are expected to help infuse new energy and ideas to the IWR program, while the practical work environment at IWR and/or the Hydrologic Engineering Center (HEC) provides a stimulating context for mutual exploration of potential advances in hydrologic engineering and planning analysis. Such experiences have proven to be intellectually invigorating for both the Institute staff and the visitors themselves.

American Association for the Advancement of Science Science and Technology Policy Fellows Program

Through the American Association for the Advancement of Science (AAAS) Science and Technology Policy Fellows Program, IWR sponsors post-doctoral and senior fellows to work on water resource policy issues such as analyzing the linkages between water resources development and water resources problems (e.g. drought, floods) and the economies of developing nations. Individuals with a systems engineering, economics, public participation or water resources background are especially encouraged to apply. This highly selective fellowship program gives scientists and engineers a real-world introduction to how science interacts with policy in Washington.

Leo R. Beard Visiting Scholar Program

For many years, the Hydrologic Engineering Center (HEC) has invited prominent hydrologic and hydraulic professionals to take up residence at HEC in Davis, CA to foster scholarly exchange. Faculty from a number of universities have spent some of their sabbatical with HEC and on occasion HEC has also had prominent engineers from other agencies join the Center in the same capacity. The experience and the exchange of ideas that these scholars bring to HEC have proven to be intellectually satisfying and productive for both HEC staff and the visitors themselves. Such scholars in residence are known as "Leo R. Beard Visiting Scholars."

Maass-White Visiting Scholar Fellowship

The Maass-White Visiting Scholar Fellowship is designed to ensure that today's water resources challenges benefit from innovative thinking of the nation's top academics, and to promote a deeper understanding of real-world water resource problems by those in academia. The fellowship honors the late Arthur Maass and Gilbert F. White–two scholars who had a revolutionary impact on the practice of water resources planning and management.

National Research Council Research Associateship Program

Through the National Research Council (NRC) Research Associateship Program, IWR sponsors postdoctoral and senior research awards to conduct relevant research for one to two years at one of IWR's locations. Fellowships are given for the purpose of conducting research (chosen by the doctoral level scientists and engineers) to apply their special knowledge and research talents to areas that are of interest to them and to the host laboratories and centers.

UCOWR Water Resources Fellowship

The Universities Council on Water Resources (UCOWR) and IWR developed a visiting scholar program in 2003. The program invites academicians to the Institute to focus on emerging water resource issues of relevance to the civil works mission. While on sabbatical these scholars are expected to perform applied, policy-relevant research to extend the Corps of Engineers knowledge of and thinking about emerging water resources needs and issues. UCOWR Fellows, chosen via a UCOWR/Corps panel, are university professors who have substantial applied experience in water resources planning and management, as well as strong teaching credentials.

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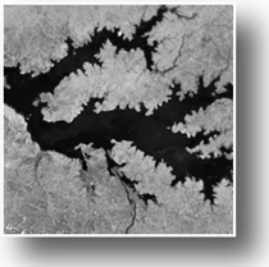

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Disclaimer

The opinions contained in this document are those solely of the author and do not represent the opinions of the above mentioned people or organizations.

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Executive Summary

This report discusses the results of a study undertaken in a Universities Council on Water Resources Fellowship with the Institute for Water Resources, US Army Corps of Engineers to measure the effectiveness of river basin organizations. The aims of the study were to:

- Develop general performance indicators of river basin management organizations' ability to undertake integrated river basin management (IRBM) which is taken to mean implementing integrated water resources management at the basin scale, and
- Apply the general indicators to selected US river basins and recommend their application there and elsewhere.

Based on the concepts of integrated water resources management, integrated river basin management and performance assessment, this report discusses the development and application of a method to identify Key Performance Indicators (KPIs) for river basin organizations (RBOs). The performance indicators were developed from a suite of good governance factors, assembled from the reviews of consultants' practical experiences in river basin management, peer-reviewed literature, government reports and policy statements, and reports of river basin management practice. Applications of the general performance indicators were undertaken at different levels, including river basin commissions; a Corps of Engineers district project and a UNESCO HELP basin project; Corps of Engineers strategic directions such as in the Civil Works Strategic Plan 2004-2009; and treaty/compact basins. The outcome of the study was a template of general performance indicators for measuring the ability of river basin organizations to implement integrated water resources management. The study provides 115 indicators for mature/auto-adaptive RBOs. These were grouped into ten categories:

- coordinated decision-making
- responsive decision-making
- goals, goal shift and goal completion
- financial sustainability
- organizational design
- role of law
- training and capacity building
- information and research
- accountability and monitoring
- private and public sector roles

The report also includes a method to self-identify the stage of auto-adaptiveness of a river basin organization, a method for river basin commissions to apply the key performance indicators to their own organization, and so develop their own Key Performance Indicators, and a scorecard for individual projects. This report discusses policy issues related to integrated water resources management and river basin management in the USA, the need to strengthen the role of the Corps of Engineers to become the nation's IWRM/basin management leader and next steps in the use of the indicators developed in the study.

Keywords: river basin organization, integrated river basin management, performance indicator

1.0 Introduction and aims of the study

River basin organizations have been promoted internationally as an institution to implement integrated water resources management. Basin organizations have been in place since at least the 1930's in many places. From an historical perspective, development-oriented basin organizations probably reached their zenith in the 1940's-1970's dam building era, when emphasis was on resource development for hydro-electric power, irrigation, flood control and the provision of potable water supplies (Jaspers 2003). Today, new and reformed basin organizations, such as the Mekong River Basin Commission, the Murray-Darling Basin Commission and the Delaware River Basin Commission have emerged, motivated by sustainable development imperatives. These 'new' entities often derived from former basin organizations or national water agencies and international water organizations, and they continually 'retool' their business towards a broader mandate of social and ecological sustainability. This activity is becoming more widespread, especially with the emergence of the European Water Framework which recommends basin organizations as an implementation tool in that continent. Critical questions to ask of this emerging experience include: how effective can these basin organizations be in the current era of integrated water resources management? How effective is the governance capability of basin organizations? Are they adaptive to new economic, social and ecological conditions in their basins? How do they respond to new knowledge regarding natural resources management?

The results of river basin management will be reflected, at varying times and at spatial scales, in the biophysical and social and economic indicators of that basin. They are often presented in 'State of the Environment Reports' or 'Report Cards of Basin Health'. However, this is complicated by the impacts of economic activities which are tangential to or separate from natural resources management decisions, for example, the construction of highway infrastructure, urban sprawl, de-industrialization or new industrial developments. The challenge is to demonstrate the degree and extent to which economic, social and ecological conditions change as a result of actions undertaken by an RBO, specifically through its river basin management plans, strategies and programs. This issue was recently taken up by an international workshop of water resources accounting in Morocco which stated, inter alia, that integrated water resource accounts are needed – information systems which present a coherent framework of the economic, ecological and social information related to water, using standardized concepts, definitions and classifications consistent with hydrological laws and conventional national accounts (Anonymous 2004). The workshop called for "a capacity building program and a special study analyzing the institutional, technical and organizational issues for establishing water accounts by river basin in the whole country" (page 1).

The thesis on which this report is written is that the economic, social and ecological conditions of a river basin landscape are the result of changing land use activities. The effectiveness of the discrete activities of basin management is probably impossible to separate from other activities – what we see in terms of environmental quality is the sum result of many activities. A way to clarify effectiveness of basin management, is to examine the management processes themselves, and to identify whether 'best practice' is used and achieved, decision process by decision process. This does not mean avoiding the use of state of the environment reporting, rather adding governance performance attributes as a separate set of performance measures. This will add value to basin organizations and allow them to identify their strengths and weaknesses and make the necessary adaptations to improve governance. The focus of this study, therefore, is on measuring the effectiveness of decision processes.

Knowledge of ways to measure the governance performance of RBOs is limited, but growing. Some of the most promising work has occurred in basin programs in Southeast Asia (Makin, Parks, and Arriens 2004), national catchment management programs in South Africa (Walmsley et al. 2001; Catchment Management

Directorate 2002) and Australia (Murray-Darling Basin Ministerial Council 2005), projects resulting from the European Framework Directive (Videira et al. 2006) and worldwide (World Bank 2006; GWP Technical Committee 2006). The purpose of this report is to extend knowledge about the measurement of governance performance of US basin organizations, using performance indicators as measurement tools.

The aims of the study reported here are to:

- Develop general performance indicators of river basin management organizations' ability to undertake integrated river basin management (IRBM is taken to mean implementing IWRM at the basin scale), and
- Apply the general indicators to selected US river basins and recommend their application there and elsewhere.

The work reported here is exploratory, and is a work in progress. It assumes that there is no template which will fit all river basin settings. This report provides:

- A discussion of the paradigms on which the study is based: integrated water resources management, integrated river basin management, organizational performance indicators (Section 2)
- A typology of river basin organizations (Section 3)
- The methods used to develop basin organization performance indicators and the results of this task (Section 4)
- Results of a preliminary application of the indicators to different US settings (Section 5)
- A policy discussion of the issues in applying the general indicators to US basins (Section 6)
- Suggestions for further use (Section 7).

2.0 River Basin Governance

The development of the indicators reported here was based on several paradigms. The first is the use of an Integrated Water Resources Management (IWRM) paradigm, an emerging approach to water resources management. The focus of IWRM is coordinated decision-making about natural resources management and involves taking a cross-sectoral, participatory and adaptive approach to resource use and management. This approach is strategic, focusing on what needs to be done first, rather than all-embracing efforts and uses collaboration between stakeholders in government, the general public, non-government organizations and the private sector, to maximize the outcomes of shared objectives about natural resources management. Much has been said, done and written about IWRM, a selection of which is reported in this document, but the key action is collaboration.

For the purposes of this study, integrated river basin management (IRBM), the second paradigm, is taken to be a subset of IWRM: the implementation of IWRM at the basin scale. River basins and groundwater provinces are logical applications of IWRM over large regions due to the dependencies of water availability to provide for human needs and ecosystem functioning.

The third paradigm used in this study is organizational performance indicators. Indicators refer to a single data (a variable) or an output value from a set of data (aggregation of variables) (United Nations Economic Commission for Europe (UN-ECE) 2003). These data describe system functioning and refer to, in the case of this study, the social decision system of a river basin as revealed in the decisions of river basin organizations. Indicators are distinguished from indices, the latter being an aggregation of variables or indicators. Indicators can be used to identify the strengths and weaknesses of management. Indicators

are 'signposts' to assist decision-makers improve organizational behavior. In the context of this study, such signposts flag where effort can be made for continuous improvement in the management systems of river basins. They are also valuable diagnostics of the behavior of the institutional arrangements for basin-scale natural resources management.

Taken together, these three paradigms offer a framework for river basin governance, where the term '**governance**' is taken to be the decision-making processes across all sectors and scales.

2.1 Integrated Water Resources Management

International perspectives

There is increasing recognition and use of an integrated approach to water resources management (IWRM). Much has been written about IWRM and the following section seeks to capture the breadth of the international experience. This material is drawn heavily from (Hooper 2005).

In 1992, the UN Conference on Environment and Development (Earth Summit, Rio de Janeiro) underlined in Agenda 21 (Chapter 18) that

> "Integrated water resources management, including the integration of land and water-related aspects, should be carried out at the level of the catchment basin or sub-basin. Four principal objectives should be pursued, as follows:
>
> (a) To promote a dynamic, interactive, iterative and multisectoral approach to water resources management, including the identification and protection of potential sources of freshwater supply, that integrates technological, socio-economic, environmental and human health considerations;
>
> (b) To plan for the sustainable and rational utilization, protection, conservation and management of water resources based on community needs and priorities within the framework of national economic development policy;
>
> (c) To design, implement and evaluate projects and programs that are both economically efficient and socially appropriate within clearly defined strategies, based on an approach of full public participation, including that of women, youth, indigenous people and local communities in water management policy-making and decision-making;
>
> (d) To identify and strengthen or develop, as required, in particular in developing countries, the appropriate institutional, legal and financial mechanisms to ensure that water policy and its implementation are a catalyst for sustainable social progress and economic growth."

IWRM has been defined in many ways; most definitions emphasize collaboration and coordination:

"Integrated Water Resources Management is a process which promotes the co-ordinated 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" (Global Water Partnership Technical Advisory Committee 2000)

"A more comprehensive or inclusive approach that takes into account the scope and scale of environmental and human issues and their interconnections….. a strategic and interactive process is used to identify the key elements or goals at which to direct attention. These critical elements or goals then become the focus of an inter-organizational or coordinated approach to reforming environmental decision-making." (Queensland Department of Natural Resources 1991)

The integrated approach is the foundation for international and global environmental management initiatives aimed at more sustainable management, as developed at the World Commission on Environment and Development 1987, and the United Nations Conference on Environment and Development Agenda 21, 1992 (Born and Sonzogni 1995). The Dublin principles on water resources management (Table 1) stimulated the water sector to consider the interconnections between development and ecosystem management and the significance of participation of all stakeholders. These became core elements of an integrated approach.

Table 1 Dublin Statement and Principles

In commending this Dublin Statement to the world leaders assembled at the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro in June 1992, the Conference participants urge all governments to study carefully the specific activities and means of implementation recommended in the Conference Report, and to translate those recommendations into urgent action programmes for water and sustainable development.

GUIDING PRINCIPLES
Concerted action is needed to reverse the present trends of overconsumption, pollution, and rising threats from drought and floods. The Conference Report sets out recommendations for action at local, national and international levels, based on four guiding principles.

Principle No. 1 - Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment
Since water sustains life, effective management of water resources demands a holistic approach, linking social and economic development with protection of natural ecosystems. Effective management links land and water uses across the whole of a catchment area or groundwater aquifer.

Principle No. 2 - Water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels
The participatory approach involves raising awareness of the importance of water among policy-makers and the general public. It means that decisions are taken at the lowest appropriate level, with full public consultation and involvement of users in the planning and implementation of water projects.

Principle No. 3 - Women play a central part in the provision, management and safeguarding of water
This pivotal role of women as providers and users of water and guardians of the living environment has seldom been reflected in institutional arrangements for the development and management of water resources. Acceptance and implementation of this principle requires positive policies to address women's specific needs and to equip and empower women to participate at all levels in water resources programmes, including decision-making and implementation, in ways defined by them.

Principle No. 4 - Water has an economic value in all its competing uses and should be recognized as an economic good
Within this principle, it is vital to recognize first the basic right of all human beings to have access to clean water and sanitation at an affordable price. Past failure to recognize the economic value of water has led to wasteful and environmentally damaging uses of the resource. Managing water as an economic good is an important way of achieving efficient and equitable use, and of encouraging conservation and protection of water resources.

Source: http://www.gwpforum.org/servlet/PSP?iNodeID=1345&iFromNodeID=2408

IWRM involves cross-sectoral collaboration and adaptive management rather than single sector, 'line' management and planning of land and water resources (Hooper 2005). The move towards an integrated approach became apparent in the 1980's. There were concerns about traditional single sector resource management for several reasons. First, it had been largely reactive, disjointed and based on narrow or limited purposes, with many organizations unable to deal with inter-linkages or interrelationships. Second, many environmental problems have been called "wicked" problems, which arise from interrelationships between the biophysical, human and economic systems, and therefore can rarely be treated in isolation. As well, increasing resource demands have led to conflicts over environmental management. Governments are finding it increasingly difficult to make environmental management decisions without incurring conflict. The solution lies in finding management processes which incorporate a range of values from the affected stakeholders and work towards solutions which maximize social, economic and environmental benefits. IWRM offers an opportunity to do this, but is not a foolproof method.

Many conceptualizations of the integrated approach have been articulated and they focus on collaborative, interactive processes amongst stakeholders for strategic decision-making (Mitchell 1987; Born and Genskow 1999; Margerum and Born 2000; Global Water Partnership Technical Advisory Committee 2000; Born and Genskow 2001b;). IWRM rose to international prominence thanks to the water organizations such as the Global Water Partnership, the World Water Council and the UNESCO HELP program. International efforts in the 1990's and 2000's resulted in IWRM being placed on national political agendas through the World Water Forums organized by the World Water Council.

The integrated approach evolved from seminal work in flood management (White 1970), catchment (watershed) management (Burton 1984), river basin management (Priscoli 2005) and river management (Shih and Meier 1972; Allee, Apener, and Andrews 1975; Mitchell 1980; Lang 1986). Several building blocks were initially recognized as forming the basis of the integrated approach (Table 2), an approach which was later strengthened and expanded by international support and promotion (Global Water

Partnership Technical Advisory Committee 2000; Jonch-Clausen and Fugl 2001; Catley-Carlson 2002; Hooper 2002; GWP Technical Committee 2006).

Table 2 Building Blocks of IRBM

Use of:
1. A Systems Approach in which attention is directed towards both natural and human systems, their component parts, and the interrelationships among those parts.
2. A Strategic Approach in which attention is directed to key, not all, issues and variables identified through consultation with stakeholders and to linkages among the key issues and variables.
3. A Participatory Approach in which it is recognized that governments, citizens and non-government groups should be able to participate in decisions – they have a role, requiring common objective setting, definition of roles and responsibilities, and be involved in conflict resolution mechanisms.
4. A Balanced Approach in which concerns for economic development are weighed against ecosystem protection, and satisfying social norms and values.
Modified from (Mitchell and Hollick 1993)

The IWRM approach is practiced in both developed and developing counties and derives from the improved understanding in recent years. This is apparent in the implementation of the World Water Council's World Water Vision 2000, which strongly endorsed an integrated approach to water management. This initiative follows a sequence of major international meetings which led not only to greater global awareness of the water issues by the WWC, but formed the foundation for broader acceptance on an integrated approach. The meetings included:

- International Conference on Water (Mar del Plata, Argentina, 1977)
- World Consultation on Drinking Water and Sanitation (New Delhi, India, 1990)
- Dublin Conference on Water and Environment (1992)
- Rio Summit (Chapter 18 of Agenda 21) (1992)
- Ministerial Conference on Drinking Water and Sanitation (Noordwijk, Netherlands, 1994)
- First World Water Forum (Marrakech, Morocco, 1997)
- Ministerial Conference on Water and Sustainable Development (Paris, 1998)
- Sixth Session of the United Nations Commission on Sustainable Development (1998)
- Workshops and publications leading up to the Second World Water Forum (The Hague, 2000)
- Outcomes of the Third World Water Forum (Kyoto, 2003).

As these dates suggest, IWRM emerged at the international level as the new paradigm in the 1990s. It brought with it concerns for social impacts of declining water quality and access to water resources, the ecological health of rivers, the importance of the interdependence of floodplains and rivers, the need to manage water resources on a river basin basis, the role of water supplies from rivers and groundwater resources, the key role of rainwater harvesting, the need for irrigation efficiency and the impacts of resource use on the ecosystem health in watersheds.

(Bellamy et al. 1999) captured the coordinating nature of IWRM by recognizing it involves the integration of community involvement, technical knowledge, organizational structures and policy objectives. The integrated approach is not all inclusive, rather it is focused and strategic, striving to coordinate critical components of the water sector to achieve agreed societal goals and increase the likelihood of more practical outputs with respect to resolving conflicts between poverty reduction, economic development and ecosystem maintenance and conservation. It is a response to past narrow and disjointed approaches to natural resources management, and aims to overcome the dysfunctional mechanisms between and within government and communities in the management of water resources.

Much of the conceptual development and experience with integrated approaches relates to integrating land

and water resources management on a catchment basis (Burton 1986; Burton 1988; OECD 1989; Downs, Gregory, and Brookes 1991; Asmal 1995; Versfeld 1995). Such efforts include inter-relating the management of water quality and quantity, ground and surface waters, the land-water interface, biologic concerns, and the objectives of the user community. The Murray Darling Basin Commission in Australia captures this watershed orientation in its Integrated Catchment Management Policy statement:

> Integrated Catchment management (ICM) is a process through which people can develop a vision, agree on shared values and behaviours, make informed decisions and act together to manage the natural resources of their catchment.

The IWRM approach uses stakeholder participation, cross agency coordination and a wide range of innovative tools to improve water management. These tools are now documented (such as in the Global Water Partnership's Toolbox www.gwpforum.org). This participatory approach seeks involvement through negotiation and building partnership agreements. It seeks to avoid marginalizing resource user groups or agencies. It builds bridges and partnerships to achieve commonly accepted resource management goals, and has been widely used in many international water sectors (Table 3).

Table 3 Examples of IWRM used by selected international water organizations and institutions

The **World Bank** developed an approach to water sector management using IWRM principles and Briefing Notes on integrated river basin management.
The **World Water Council** endorsed an integrated approach to water resources management in the World Water Vision, 2025, and used an expert panel to promote sustainable river basin management based on integration. The report provides a five stage framework for IRBM at the river basin scale: assessment of the institutional framework, co-operation strategies, formation of a river basin management authority and management plan, implementation of the management plan, evaluation and compliance monitoring ((Anonymous 2000);
The **Global Water Partnership** developed a Framework for Action to implement IWRM and an IWRM Toolbox containing over 50 methods to implement the IWRM approach (See http://www.hrwallingford.co.uk/projects/gwp.fau/toolbox/ ;
The **International Network of Basin Organizations** (INBO), based in France, established and promoted IWRM at the level of river basins and facilitated implementation of tools suitable for the integrated management of water resources at this scale;
The **International Riversymposium and Riverprize** based in Brisbane, Australia, which rewards demonstrated achievement in river management with an annual prize of A$100,000 and a symposium of latest river management practices, undertaken within an IRBM approach. The 2000 winner was the Grand River Conservation Authority, Canada (http://www.riverfestival.com.au/2001/symposium/riverprize_2000winner.asp)
The **Stockholm Water Symposium and The World Water Prize** which have demonstrated and showcased advances in IWRM
The **International Water Resources Association** and the **Canadian Water Resources Association** who promote and continue to enhance knowledge of IWRM, and international collaboration between, professional experts and practitioners in IRBM, in countries both of the south and north.

American perspectives

IWRM has been widely practiced and promoted in the US water sector, led by Federal and State agencies and by many academics and research institutes. Research and intellectual endeavor amongst agencies, institutes and academicians has strengthened considerably the definition and conceptualization of IWRM (Table 4) based on many reviews of practical experiences. This in turn has led to clearer understandings of what constrains implementation and the opportunities for improved efforts.

Table 4 Selected U.S. definitions of IWRM

"A process of formulating and implementing a course of action involving natural and human resources in an ecosystem, taking into account the social, political, economic, and institutional factors operating within the ecosystem in order to achieve specific societal objectives" Dixon and Easter, 1986

"The co-ordinated control, direction or influence of all human activities in a defined environmental system to achieve and balance the broadest possible range of short- and long-term objectives." Cairns, 1991

Proactive or preventative measures that maintain the environment in good condition for a variety of long-term sustainable uses. Alternatively .... co-ordinated control, direction, or influence of all human activities in a defined environmental system .... to achieve and balance the broadest possible range of short- and long-term objectives. Scherer, 1994

[all quotes referenced from (Born and Sonzogni 1995)]

There is an ongoing debate about what constitutes IWRM, its perceived origin in Western Europe, how new the concept really is and how it evolved in the United States. This is encapsulated by DelliPriscoli,

> "When anyone considers substance in IWRM they are rapidly confronted with the issue of storage and dams and multi purpose water use and MOP planning. Indeed, there is an unwritten assumption that IWRM is new (announced by GWP (Global Water Partnership) in 1998) and this seems to mean that it is new because of participation and environment. If IWRM, as expressed by GWP means environment, then they should say so more clearly. I have asked questions, such as … . Is TVA an example of IWRM? Is the Columbia an example of IWRM? Are the 308 MOP (Master Operating Plan) reports authorized in the 1920s and done on every major river in the U.S over 60 years in the U.S. - IWRM? What is the relation between IWRM and MOP? Can you talk of IWRM without talking about dams and storage? Can you talk of IWRM and its contribution to development, wealth generation and growth, without talking about dams and structures?
>
> "In addition, behind any of the U.S cases …, which I think are IWRM, and behind what I think successful IWRM would be, is the reality of serious political change. It does little good for the technical expert to say, "...here is the best way to do things, the RBO or watershed.." and then criticize the politician for being either corrupt or stupid for not adopting these marvelously rational approaches. The politicians can see the unsaid political dimensions of the IWRM proposals - everywhere, rich and poor countries. Thus we need to be far more explicit with these dimensions and find far better ways to discuss them, as they are a gray area between political and technical water, but they are also central.
>
> "The great contribution of IWRM and GWP in my view is that it is trying to say to the world that the water situation is more than service delivery - it is about the management of the whole resource. And that is a function of the public or commons or legitimate authority.
>
> J. Delli Priscoli, pers.com. 1 August, 2006

The debate in the US is ongoing on these matters, with much of the effort in the past two decades focused on whole of resource system management , about the social decision system in any water resources setting and how to improve those decisions, what is the role of research, how to influence watershed management with science, and who really are the stakeholders who make decisions in response to new water policies. This experience is difficult to encapsulate across a myriad of US experiences, but there is a common focus on how to improve watershed governance, the role of research and what are the conflicting agendas for water resources management:

> "Suppose we characterized and diagnosed the problem [of watershed management], arrayed your options, told you that if you exercise any of those options what will happen and assign some confidence limits to it. Now you say the social decision system does not absorb this, doesn't take action on this. Maybe you need some more research. If the problem has been accurately diagnosed and we have prescriptions, and we have costed out and assessed the efficacy of these different prescriptions, why are these not being adopted? What is the disconnect here? That [then] focuses another area of research for this kind of incorporation. It's not that you have to develop the biophysical snake oil kit. It's not that you have to gather more information to characterize the problem. … Until we can get some testing, until we can get some interventions, we cannot take this much further, and to do that we need to understand what does it take before these targets are receptive to these types of testing. Does it take fear? Incentive structures? Simply sharing in a belief structure about the future of [location mentioned]?
>
> This seems to me an iterative research approach, that is policy driven. A lot of your research is then focused on implementation research. What are the barriers and impediments to implementation? Is it institutional? Is it organisational and the sets of rules

involved? Is it that there is widespread disbelief in the diagnostics of the problem? Is it that THESE people don't like THOSE people in some central research location telling them what ought to be done? … You get questions about: what do we have to do to get some acceptance of this, and to get if not a full scale management program at the whole watershed level, how can we have a set of selective interventions that we can do mutual learning with? And that's what the research enterprise is attempting to grapple with. It's not just a question of how much information do I have to transfer.... what type of system do I have to have to transfer it... it is this whole participatory interaction with these folks who ultimately have implementation authority, and this is invariably a highly dispersed, multi-nucleated system... different needs and very difficult to gather. You cant' conscript a result.

The problem is too nebulous if we just focus on research adoption, and if we talk about redesigning the whole institutional system. I am not sure that's exactly what's called for. People want to make all these changes to institutions. Some times they are unwilling to do all those other things that will do the job.

S. Born, pers.comm. 3 Nov, 1997.

With much of the effort focused on watershed management, rather than larger scale whole of river basin management, the US experience has provided rich insights into such facets of integrated management as roles and responsibilities, coordination and collaboration mechanisms, impediments to the integrated approach and lessons learned from practice. Much of the research is transdisciplinary, built on various constructs such as collaborative planning theory, the geographical traditions of people–environment interactions and natural hazards, natural resources management, political science and institutional analysis and, more recently, learning theory and ecosystem management theory.

The following literature is a sample of that experience but in no way attempts to summarize this rich tapestry of knowledge. The practice of IWRM in the USA has focused on coordinated action at the local watershed level, delivering science to local decision-makers and coordinating efforts between agencies and the general public. Much of this work has been led by Federal agencies watershed efforts (EPA) and numerous reviews suggest much has been achieved while considerable challenges remain (Environmental Protection Agency 1992; Environmental Protection Agency 1994a; Environmental Protection Agency 1994b; Kenney 1997; Imperial 2004; Cole, Feather, and Munch 2005; Bruins, Heberling, and Maddock 2005a; Bruins, Heberling, and Maddock 2005b).

(Born and Margerum 1993), for example, showed how practical organizational factors such as funding and staffing, personnel policies, and the role of the project manager were influential in facilitating integration in natural resources management in Wisconsin. (Margerum and Born 2000) developed a systematic, descriptive framework for examining co-ordination practice. The framework was a diagnostic tool which can be used to examine the range of formal and informal rules that define stakeholder interaction. They argued that clearly specified arrangements are a prerequisite for developing an effective integrated approach. Their co-ordination diagnostic can be used to analyze co-ordination settings and, when combined with evaluation criteria and participant knowledge, it can be used to develop options for improving co-ordination arrangements. (Michaels 2001) examined initiatives in the Neponset, Ipswich, and Sudbury-Assabet-Concord watersheds and showed how watershed-scale innovation in engaging nongovernment participants was influenced, but not dominated, by the statewide program, the Massachusetts Watershed Initiative. The presence or absence of three elements - external support, process, and issue - and the order in which they occur, shaped the viability of collaborative watershed-scale management initiatives. They emphasized how external support (providing personnel or funding from outside an initiative) is most apparent when outside assistance is provided after an issue has crystallized into clear problem needs that can be addressed through specific research projects or implementation activities. Process is central in shaping issues, utilizing external support, and generating management results. The outcomes of voluntary processes in the three watershed initiatives highlighted how the evolution of the Massachusetts Watershed initiative leads to, and depends upon, the development of watershed-scale initiatives.

(Imperial and Hennessey 1996) found that traditional coastal resource management programs tended to be fragmented and focused on a limited subset of problems. Many scholars, government practitioners, and academics argued that an ecosystem-based approach is more appropriate. They investigated the promising ecosystem-based approach to managing estuaries in the United States under the National Estuary Program (NEP). They examined the strategy, structure, and process of the NEP and showed that the strengths and weaknesses of the NEP's management lay in its adaptive capacity. The weaknesses of the program were the high costs of problem characterization and modeling and lateness of evaluation (Hennessey 1994).

(Kenney 1997) examined twelve US western watershed efforts and his purview of experience and knowledge says much of what integrated efforts have achieved:

1. Managing water (and related resources) at a regional scale is an idea with a long history and sound theoretical basis, but it has never been so widely implemented as at the present time.

2. The watershed initiatives of the West show tremendous variety in structures and functions, although successful initiatives tend to exhibit common qualities: leadership, participation, focus, trust, resources, and process.

3. A lack of formal authority for a watershed initiative usually does not hinder the functioning of the initiative; to the contrary, a reliance on “moral authority” is generally seen as a key asset.

4. Most watershed initiatives are not closely linked to management programs at the larger river basin scale.

5. The watershed movement has some serious critics who raise legitimate issues about the goals, focus, decision making procedures, representativeness, and effectiveness if certain watershed initiatives or watershed initiatives in general.

6. The performance of most watershed initiatives is sufficiently positive to merit guarded optimism and to justify greater support from all levels of government and the private sector.

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He characterized the context of US water management as one of interagency and intra-agency competition, with functional specialization dominating the Federal and State institutional landscape. Despite the support for collaborative, adaptive or integrated water resources management, putting theory into practice remained a formidable challenge. In this context, he called for an enhanced federal role in watershed management: in regional conflict resolution, in more flexibility in the allocation and use of Federal funds and in exercising Federal authorities though implementations such as the Clean Water Act and the Endangered Species Act.

The issues of coordination, communication, motivation and cooperation were also taken up in a second review highlighting Federal roles in watershed management (Cole, Feather, and Letting 2002). This report provided a skeleton integrated watershed planning framework based on what they called the most advanced framework, the Federal Water Resources Project Planning framework. They identified the limitations of current watershed planning processes: how they limit impact assessment to projects within their boundaries and scope, while focusing on meeting environmental standards and improving local welfare. This study points to the need for cumulative impact assessment and specification of interagency definition of criteria to build a complete watershed planning framework. This emphasis on standards suggests a target driven approach could add much value to present watershed management efforts and they call for effort in five areas:

- Using Federal agencies' experiences in adaptive management and applying them to specific areas, e.g., Corps of Engineers watershed efforts

- Using Federal agencies' experiences in environmental sustainability policy and linking them to local watershed efforts
- Using watershed science and modeling methods in watershed planning processes more effectively, so as to provide a more technical basis for decisions and project level planning
- Identifying and integrating local, State and Federal hierarchy of public interests in watershed planning; there are too few, if any, processes to link watershed planning processes to other watershed efforts or larger river basin planning processes
- Develop a Corps of Engineers watershed planning framework, through reviewing case studies, supplementing hydrologic modeling, environmental analysis and socioeconomic analysis; more efforts are needed to identify impediments in authorities and policies which mitigate against a watershed planning framework.

The US Army Corps of Engineers explored the use of IWRM (Cardwell, Cartwright, and Martin 2004)(unpublished). Table 5 lists the key findings of their work which spans a significant breath of experience, and is presented here as a snapshot summary of the American IWRM tradition.

Table 5 Findings on IWRM and its use in the Corps of Engineers Civil Works Program

1. IWRM is a goal-driven process – different goals for management can result in different management actions
2. Water resources management can be integrated – over time, institutions, objectives and space
3. The goal of IWRM as practiced by the Corps in sustainability
4. IWRM and the Corps is fully consistent - with Environmental Operating Principles, the Strategic Plan and the Watershed approach.
5. IWRM and the 'watershed approach" – IWRM is a better term to describe a participatory, broadly-scoped management philosophy that integrates objectives, time, space and institutions
6. Four principles for IWRM for the Corps' Civil Works Program are –
(a) define a common vision
(b) conduct a high quality technical analysis (using a systems approach)
(c) Collaborate with other governmental and no-governmental institutions and the public
(d) Modify decisions in a structured format based on new technical and value-oriented information (adaptive management)
7. Defining a common vision for management is a key factor for integrated management
8. The project emphasis of the Corps impedes integration in multiple ways – restricts long term management, larger scope of water resource systems, reduced likelihood of collaboration

Modified from (Cardwell, Cartwright, and Martin 2004)

Their study suggested that the Corps has started to embark on the IWRM approach in its Civil Works Program, its Strategic Plan and its Environmental Operating Principles. This augurs well for national leadership in IWRM, but they caution that this approach requires a shared understanding of the term within and between other agencies, non-governmental organizations and the public. They proposed new operating principles and provided a conceptual framework for IWRM. The latter involves a four dimensional interacting matrix of objectives, institutions and space, through time. They recognized the role of river basin organizations as an institutional integration mechanism and stress the incremental nature of building such procedures. They emphasized that IWRM is essentially a process, rather than a project, but is constrained by the Corps' operating procedures. Examining the CoE Civil Works Program, they pointed out that the lack of coordinating structures, effective representation, Corps-specific organizational structures and a means of tradeoffs between objectives restrict progress in implementing IWRM. They suggested coordinating structures such as river basin commissions, councils, and watershed management bodies to assist the implementation of IWRM. The findings of their study are relevant to this study, implying that internal institutional and cultural reform of the Corps is needed to advance its IWRM role in the US water sector. There is an opportunity for the Corps to emerge as the federal leader in promoting and implementing IWRM and this notion has been advocated by others outside the Corps (Loucks 2003; Tarlock 2004).

2.2 Integrated River Basin Management

International perspectives

Integrated river basin management (IRBM) is now recognized as the tool, perhaps the most appropriate tool, to deliver IWRM at the basin scale. This recognition is illustrated in an agreement reached at the 3rd World Water Forum in Kyoto, Japan. The Statement, "IWRM and the Basin Management Theme" was issued. This statement recognized, inter alia, that

> "the key issue confronting most countries today is that of effective governance, improved capacity and adequate financing to address the increasing challenge of satisfying human and environmental requirements for water. We face a governance crisis, rather than a water crisis. Water governance is about putting IWRM with river and lake basin management and public participation as critically important elements, into practice. "

The statement called for action in

> "new policies, strategies and laws for water resources development and management… in a large number of countries, using the principles of IWRM. Such plans have often led to restructuring of the institutional framework as a result, including river and lake basin organizations as the basic institutional entities for implementing IWRM. "

The importance of the river basin as the 'place'[1] to implement water resources management is recognized in the Helsinki convention on transboundary watercourses and international lakes (Council of the European Union 1995) and the European Water Framework Directive[2]. Both approaches embed the integrated approach in national programs of natural resources management.

(Naiman 1992) characterized the meta-complexity of watershed management as a multi-dimensional problem (Table 6). This suggests new concepts, new methods and an adaptive approach are needed in basin management, using collaborative management in local watersheds.

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[1] Place – in the **geographical sense**, as a noun to denote location with which people live and with which they relate (Hooper 2005). For instance, a "sense of place" can be an area of the earth's surface, a location, river or lake with which people strongly identify – they were "lower Mississippi people", "the Delaware River community", "the people of the Tigris-Euphrates marshes", "they were ranchers of the Upper Rio Grande".

Also "place" in the **hydrological sense** - "the land is situated in the Missouri basin", which receives runoff from several tributaries across the Upper Mid-west of the USA; as a **drainage basin** (also known in North America as a **watershed**, or in Australia, UK and South Africa as a **catchment**) is a region of land where water from rain or snowmelt drains downhill into a body of water, such as a river, lake, dam, estuary, wetland, sea or ocean. The drainage basin includes both the streams and rivers that convey the water as well as the land surfaces from which water drains into those channels. Together they form a hydrological unity and are managed accordingly (Bhowmik 1998).

Also "place" in the sense of **hydro-solidarity** (Falkenmark and Folke 2002), in which ethics of socio-ecohydrological catchment management are addressed in water use, including human rights to water, international conventions, upstream and downstream water sharing issues, instream flow requirements to ensure ecological sustainability.

Also 'place' in the **hydro-ecological sense**, as a noun to locate a regional ecosystem, a water-dependent (either precipitation-fed or groundwater-fed) **biome**, in which ecosystem processes reflect the prevailing hydrological and climatic conditions of that place. Land surfaces across a drainage basin or groundwater province can contain several biomes. Examples include large-scale wetlands and estuaries (Imperial and Hennessey 1996).

[2] See http://europa.eu.int, accessed November 2005.

Table 6 Characterizing meta-complexity in integrated watershed management

- The scope of issues demands unparalleled cooperation between industry, governmental agencies, private institutions, and academic organizations
- The increasing tendency to resort to technical solutions (e.g. hatcheries, silviculture) must be augmented with increased habitat protection and preservation of fundamental components of long-term watershed vitality.
- The complexity of information management and the scope of experimental manipulations needed often exceed the capacity of individual institutions.
- The current tendency to seek conceptual solutions at the expense of data-driven decisions must be reversed.
- Intra- and inter-agency inconsistencies in environmental regulations must be corrected.
- Human activities are a key element of ecosystem vitality and must be integrated with environmental considerations before long-term sustainability of the biosphere can be achieved.

Modified from (Naiman 1992)

While definitions of IRBM vary, one that captures the common focus of collaborative management is:

> 'an integrated and coordinated approach to the planning and management of natural resources of a river basin, one that encourages stakeholders to consider a wide array of social and environmental interconnections, in a catchment/watershed context' (Hooper 2005)

IRBM works by bringing together stakeholders, people who have a "stake" (a bargaining position) in a river basin, in processes to manage collaboratively the activities and impacts or resource use. Stakeholders include government entities, community organizations, business and industry organizations, and other organizations and individuals with a particular concern or interest. However, in many societies, people are frequently marginalized by their economic status, race and location; they are powerless to claim a bargaining position. In such cases, which are very common amongst poor communities in developing, emerging, as well as highly developed economies, the challenge is to provide marginalized and disenfranchised groups a stake. Mechanisms are needed to ensure not only their voice is heard but the solutions for resource management problems, development issues, access to freshwater and larger scale management issues, are heard and acted upon. These people have a valid claim in participating in the design of basin scale water management systems.

American perspectives

There is a concern that increasing demands on water resources are now pressing in many US basins. Consequently, there is the need to use basin management to provide resolution to current and predicted conflicts in water resources utilization. New societal goals for rivers are emerging, including environmental flows, increased access to freshwater supplies and refurbishment of aging infrastructure and shifting water use from agricultural to urban consumers. The Missouri River Basin, for example, is one basin where these conflicts are apparent, and there are increasing calls for an adaptive approach to river basins management be used (National Science Council 2002). The challenge is to use an adaptive-integrated approach, one that tests management options, refines those options based on practical learnings of experience, or seeks new alternatives (Sabatier et al. 2005). This has been articulated strongly at the highest levels (American Water Resources Association 2005).

Despite a broad acceptance of the adapted-integrated approach in the USA, implementation remains a challenge. River basin management techniques developed in the early and mid-twentieth century in the USA have had considerable success in delivering water supplies, navigable rivers, hydro-electricity and recreation benefits. But the motivations and issues have changed, economically, socially and environmentally. Also, understandings of natural resources management have improved. The critical issues precluding implementation are known (Hooper, McDonald, and Mitchell 1999; Sabatier et al. 2005; Hooper 2005) and a sample includes:

- the need for strengthened coordination mechanisms
- role specification

- clarity in the divesting of government powers and responsibilities
- financing IRBM (who pays?)
- sustained community involvement
- defining the need and scope of integration
- leadership skills
- providing information access and exchange
- improving links with regional and local planning
- overcoming bureaucratic resistance, and property rights problems.

Some of these problems are encapsulated in Table 7. They act as constraining factors at a local watershed scale and preclude even larger scale basin planning and management. If local watershed management falters, how much more difficult is basin management where the degree of complexity escalates? The above litany of constraints is merely a catalogue; the critical issue is to know which are the most important in a specific context. Some suggest that there has not been enough empirical research to catalogue representative observations of each limiting factor and this precludes identifying critical causal factors, to create the regression equations that speak causality (Sabatier et al. 2005). However, others found that conflict resolution mechanisms in the water sector are strongly influenced by legal, policy and administrative aspects of their setting (Saleth and Dinar 2004). These include user participation policy, functional specialization, information adequacy and the extensiveness of science and technology application. They also found that intersectoral and water transfer policy is similarly related to policy and administration variables. These results indicate the significance of the institutional framework for water resources management and have been used to set the foundations for effective integrated river basin management practice (World Bank 2006).

Table 7 Key Factors that Influence Watershed Management Initiatives

Exogenous Factors	Endogenous Factors
Nature of the ecological setting and related use problems Demographic and socio-economic setting Situational history Issue salience Regulatory/programmatic context	Partnership initiation Composition Statement/clarity of purpose Leadership Staffing Governmental commitment and support Funding Watershed plans

Source: (Born and Genskow 2001b)

These results are not surprising as they illustrate the fundamental role of government which sets the scene for effective water governance (Rogers and Hall 2003). Such international studies of water sector institutions suggest that the creation of effective water policy regimes are a precursor to effective river basin management. In the USA, there are critical water policy and water leadership issues which preclude ongoing use of IWRM, at the basin scale. These issues are discussed later in this document (Section 6).

Driven by the immediacy to find workable solutions, common principles and functions can be developed to improve implementation. This immediacy is seen in the work of several consultancy organizations and international aid agencies, documented in (Hooper 2005). The following discussion in 2.3 and 2.4 draws largely from that source. This approach is a generic design of IRBM principles for RBOs and should be

used cautiously - it will require adaptation to the specific context where it is applied.

Table 8 Summary of international experiences in relation to river basin management and how IRBM offers solutions to these problems

The problems	The solutions IRBM offers
Institutions and legislation	
Sector-based approaches Historically governments and societies have failed to appreciate the intrinsic linkages between economic growth, societal wellbeing and environmental sustainability, and have established decision-making, legal and administrative systems that serve to isolate, rather than integrate these pillars of sustainable development.	IRBM fosters a change in the way governments do business; moving away from sector- based institutions, policies and laws, to more integrated approaches.
Institutional weaknesses and lack of integration and coordination Sector-based management and decision-making is a product of sector-based institutions, policies and laws. Without addressing these fundamentals, the implementation of IRBM cannot succeed. Poor coordination among Ministries is a strong signal of this form of institutional failure. Allied to this are laws and policies that promote sector-based management.	IRBM is as much about social and economic policy reform as it is about moving to manage the environment for long-term sustainability. For this reason the implementation of IRBM must be mandated by the highest level of Government and be supported by appropriate legal and administrative coordination tools.
Inappropriate management scale River basins provide a convenient and appropriate management scale; yet historically management has been allowed to operate at small scale without due consideration for downstream and broader impacts.	The paradigm shift to IRBM needs to draw into river basin level planning and management ALL government Ministries and stakeholders, at all levels; national, provincial and local. Decentralisation of management responsibility to river basin commissions, provincial and local governments is the key to successful IRBM.
Stakeholder and public participation	
Unsustainable land and water uses fostered by ignorance Unless the principles of IRBM and sustainability are understood by both the government sector and civil society, and then applied at the local, provincial and river basin levels, the capacity of ecosystems to support livelihoods will continue to decline.	Stakeholder and public participation can enhance the quality of IRBM decisions and help implementation by reducing costs and delays. In order to empower local stakeholders it is necessary to invest in education and public awareness programs and activities that target all sectors of society.
Lack of transparency and consultation in decision making The failure of governments to inform and consult local people about development and river/water resource management proposals that may impact on them is strongly counter-productive to the ethos of IRBM, breeding conflict and resentment among stakeholders.	Opportunities to participate in decision-making and providing access to management-related data are key aspects of gaining the support, involvement and commitment of stakeholders for implementing IRBM.
Economic measures and financial incentives	
Failure to consider all costs (economic, environmental and social) of development activities Where economic cost and benefits are the primary consideration of impact assessment processes, then unsustainable land and water use practices are promoted when external costs – both environmental and social – are excluded from resource allocation decisions.	The global trend in impact assessment is to consider the full range of environmental, social and economic cost and benefits, and this is now supported by robust methods for valuing the services provided by ecosystems within these assessment processes.
Failure to provide economic incentives and remove disincentives to sustainability Not valuing the full range of services provided by ecosystems has contributed strongly to their widespread degradation. Unsustainable land and water management practices have unwittingly been encouraged and even subsidized by governments, both through their ignorance of the broader social and environmental costs , and through the promotion of an economic development agenda as a priority.	There is now a vast array of economic measures and financial incentive options being applied in China and internationally that are proving highly successful in transforming land and water management into sustainable development enterprises. Two of several keys to their successful application in a Chinese context are to tailor the measures to fit local situations and to combine measures together in creative ways.
Applying IRBM-related technologies	
River management problems not being addressed through available technologies Typical river management problems are flooding, pollution, water scarcity and loss of biodiversity. Associated with these are escalating human health costs, damage to urban, rural and industrial infrastructure, food and water shortages, and lost opportunities for economic development and poverty reduction.	An IRBM approach helps to mobilize these technologies in a strategic and carefully planned way. This leads to a reduction in these impacts, while not compromising development and social betterment aspirations.

* Source: China Council for International Cooperation on Environment and Development [CCICED] Task Force on Integrated River Basin Management http://www.harbour.sfu.ca/dlam/04riverbasin%20rpt.htm

2.3 IRBM principles

The above discussion illustrates the complexity of river basin management today. There is a danger that promoters of IRBM lapse into high levels of conceptualization, rather than recognizing the realities of this complexity. This is particularly the case with naïve advocates of sustainable development who frequently rely on doctrinaire statements, rather than workable solutions. In this regard, the following principles are provided to offer some reality to river basin management. The principles were derived by the author's review of material published on current IRBM, reviews of past practices and the literature on evaluation of river basin management, and interviews and his own professional experience in the field. The published material is documented in Table 14 of this report.

Principle 1: Engagement of and ownership by relevant decision-makers. River basin management design is enhanced if relevant river basin decision-makers own the process and participate under a formal, contractual arrangement, rather than ad-hoc, voluntary arrangements. The issue of multiple players and distant participants can be addressed by the use of Internet-based river basin information systems, with supportive local meetings and face-to-face contacts.

Principle 2 : Improved river basin management design. Sound scientific information guides effective integrated river basin management. It should describe resource condition and trend, the causes of resource degradation and the likely impacts of resource management options. Economic analysis and social impact assessment should be used to provide ex-ante and ex-post evaluations of river basin management plans. This is supported by accurate modeling of river basin management options.

Principle 3: Application of diverse institutional arrangements. There are many institutional arrangements to enact IRBM. These include cost-sharing programs, tradable discharge permits and voluntary actions, as well as more regulatory practices such as environmental regulation, zoning laws and environmental standards for best practice. Developing countries require different approaches to institutional strengthening for river basin management than those of developed countries, relating to their difference in hydrology, administrative capacity and vast numbers of stakeholders (Table 9).

Principle 4: Clear definition of the role and structure of the river basin organization (RBO). An RBO requires a clear management role and jurisdiction which involves:

- A skills-based, independent membership of its board of directors/oversight group
- A democratic process - members elected by the regional community
- An accountability procedure of its management departments - reporting to an independent board of directors
- Being linked to high levels of government for political influence and support
- Responsible for the core basin management business of social and economic inventories of the river basin, management of river basin information, provision of resource management planning guidelines to Local Government, implementation of plans of action and co-ordination of other agencies' actions in the river basin.

Table 9 Differences between developing countries and developed countries basin realities

Developed Countries	Developing Countries
Temperate climates, humid, higher river-stream density	Rainfall low, climate extreme, higher mean temperatures, lower stream density, water scarcity an emerging constraint
Population concentrated in the valleys, downstream	Densely populated in both valleys and catchment areas; population high both upstream and downstream of dams
Water rights based on riparian doctrine and prior appropriation	Water rights based on rights to rainfall or ground-water; people's notions of ownership relate more easily to rain than to large-scale public diversions
Focus on blue surface water: water found in rivers, and lakes	Focus on green water: water stored in the soil profile or blue water stored in aquifers
Most water users get water from 'service providers'; most water provision is in the formal sector-making water resources governance feasible	Most water users get their water directly from rain and from private or community storage without any significant mediation from public agencies or organized service providers. Because the bulk of water provision takes place in the informal sector, it is difficult to pass enforceable water legislation
Small numbers of large-scale stakeholders	Vast numbers of small-scale stakeholders
Low transaction costs for monitoring water use and collecting water charges	High transaction costs for monitoring water use and collecting water charges

Source: Modified from (Shah, Makin, and Sakthivadivel 2004) and http://www.iwmi.cgiar.org/home/integrated_river_basin.htm, accessed November 2004; as reproduced in (Hooper 2005)

Principle 5: Strong river basin advocacy. Successful river basin management is driven by strong leadership. Individual advocates and organizations with a strong river basin advocacy are needed to engage both willing and recalcitrant resource managers.

Principle 6: Prioritizing actions. River basin management will be more likely to succeed when short-term actions (say within three years) are implemented, visible results change the landscape, and water quality improves. This requires clear identification of these actions and immediate commitment to action by river basin managers. These actions need to be specified within a River Basin Management Plan. It is unlikely that this Plan will develop within a short time period, so interim river basin management actions should be designed and implemented immediately. Longer term river basin management planning can commence simultaneously with a goal of developing an agreed, cost-shared plan of action in three year's time.

Principle 7: Accountability. A process of accountability is required to monitor the effectiveness of a river basin management plan and the organization responsible for its implementation. This task can be implemented at the commencement of a river basin management plan and be linked to a river basin-based State of the Environment report. In this way regular reports (say every 2 years) chart the progress of river basin health, using critical water quality and ecosystem indicators. Similar organizational performance indicators can be developed and used to analyze the effectiveness of an RBO (hence the purpose of this paper).

Principle 8: Local Government partnerships for effective implementation. Local government has a key role to play in local governance - decisions which can have a more immediate impact on resource conditions. Planning and local zoning mechanisms are useful tools which to implement broader river basin management goals.

Principle 9: Integrating functions for collaboration. Lack of coordination between and within government agencies, NGOs, the general public and locally and regionally significant water stakeholders is a constant problem in IRBM. The solution lies in identifying collaboration mechanisms and driving collaboration throughout the RBO and with and between its strategic stakeholders. Collaboration and coordination mechanisms are listed in Table 3 but the starting point is to establish a joint vision for the basin and an ethic of willingness to cooperate, coordinate and jointly manage. This requires clear

specification of the roles and responsibilities of partners in any joint action. Frequently, coordination stops at the level of agreed values whereas what is needed, once an agreed vision is achieved, are actual collaborative plans of action and a monitoring and review program to account for and report to the collaborators on progress and pitfalls.

2.4 IRBM functions

There are several RBO functions at both the international and national levels, depending on the context of natural resources management and environmental planning. There are three broad functional basin organizations: monitoring, investigating and co-ordinating river basin committees; planning and management commissions; and development and regulation organizations (World Bank 2006). The following is a list of possible functions for this range of organizations:

1. Regional natural resources management planning. This includes policies and plans for management of land and water resources across the river basin. The plans set out the strategic approach to natural resources management required in the river basin, including:

- an appraisal and evaluation of natural resources and their condition and trends
- an analysis of community needs
- subcatchment goals
- subcatchment implementation guidelines
- details of cost-sharing programs for on-ground works and other actions
- details of a monitoring program
- appendices which describe special catchment management issues, areas, management techniques

2. Coordination mechanisms. RBOs have a fundamental role to coordinate decision-making about natural resources management. Table 10 lists integration mechanism tools which can be used by river basin managers at different levels. These include planning, conflict resolution and communication tools.

3. Social data and information. An RBO requires data on the demography, social networks and human resources of the basin, which are best presented in a basin atlas. The data provides information to assist basin management decision-making, information such as the capacity of resource managers to change, the trends and causes of demographic change in the basin, and the adoption rates by resource users of best management options. Effective basin organizations develop *ex-ante* and *ex-post* social impact assessment procedures for implementing basin management plans and will require data sets to monitor the condition and trend of the social decision environment. There is also a need for data sets which describe information management behavior of resource users and the types of delivery mechanisms of basin management plans.

Table 10 Mechanisms for improving coordination in IRBM

Tools for joint planning and management	Tools for resolving conflict	Tools for communicating
Joint forecasting or scenarios Joint models or jointly used geographic information systems Co-location of personnel or creation of common jurisdictional boundaries Joint review of plans or environmental impact statements Formal review of clearance procedures Supervisory oversight Joint budgeting process Co-ordination committees Joint staffing or joint staff work groups Joint permit reviews or common standards for review Joint planning process (including environmental impact assessments) Cost-sharing arrangements for financing river basin management works Joint plans of action (projects, program, policy, other)	Additional research or analysis Interpersonal or inter-group communication Appeal to higher authority Special meetings of committees or other groups Negotiation/bargaining within the group Appeal to outside party or third party (facilitation, mediation etc.) Use of community advisory committees International water agreements Village level meetings and use of tribal customary law	Information and data sharing procedures Common database or data gathering Regular communication mechanisms (e. g. newsletters, e-mail) Scheduled meetings Intranet for joint development of plans, papers Informal communication, social occasions, word of mouth networks

Adapted from (Margerum and Born 2000)

4. Natural resources inventory. The description of condition, trend and spatial location and variability of natural resources is a fundamental information tool for integrated river basin management. These data, information and knowledge provide an understanding of the condition of natural resources, and knowledge on which sound judgments can be made about prioritizing river basin management options. The resource inventory is also used to monitor the state of the environment through time in the river basin, to identify the changes in resource conditions resulting in river basin management plans. This forms a feedback loop to the decision process. These data sets are ideally developed in a geographic information system, ideally owned and operated by the RBO in partnership with government agencies, NGOs and other leading basin management stakeholders.

5. Legislative instruments and policy review. RBOs do not exist in an institutional vacuum. They exist in an often turbulent institutional environment. RBOs can have a powerful function in identifying and reviewing (or calling for the review of) current relevant legislation including local planning and natural resources management and environmental legislation, relevant to the river basin. This includes international agreements which impact on legislation if it is an international RBO. This procedure may result in the identification of needed legislative reforms, and the need for new policies and high level (perhaps Cabinet-level) initiatives between ministers of participating governments and departments. A policy instruments database is useful in cataloging current legislation and policy instruments relevant to river basin management within and between countries.

6. Decision support infrastructure. The application of decision support systems, information management systems and models to evaluate resource management options is a fundamental task in river basin management. Stakeholders can be used to develop resource use scenarios, criteria, and variables in models and decision support systems. These tools, if used appropriately, can enhance the knowledge level of the RBO, be used as a mechanism to engage stakeholders and provide a mechanism for prioritizing natural resources management goals.

7. Regional economy inventory. In many countries, RBOs have the opportunity and functionality to develop basin level indicators of economic performance. While they do not have to be the collector of such data, their added value role is to assemble these data, interpret the data and provide information about how proposed natural resources management goals will impact on the basin's economy. Such information should be stored in a regional atlas as a web-based geographic information system. The RBO's role is to facilitate the analysis of drivers of land use change and water resources developments, and provide a scenario-building capability for the basin community and relevant national and international governments.

8. Information Management System (IMS) Infrastructure. Allied to function 6 and 7, there is the need for a basin wide information system (Figure 1). A river basin information system is a generic term and focuses on exchanging information on best management practices at the sub-basin scale for different land types and land uses, congruent with an overall basin management strategy and plan.

This approach, items 1 to 8, is similar to the World Bank approach to IRBM. This was developed as briefing notes for World Bank staff to assist their roles in developing policy, river basin management plans and the establishment of river basin management organizations (Table 11, (World Bank 2006)). The notes were developed for both within-state (national and provincial) and international river basin settings, and drew on his experiences in the Mekong River Commission (South-east Asia), the Murray-Darling Basin Commission (Australia), the Tarim Basin Water Resources Commission (China) and others. This IRBM framework establishes policy, basin planning and procedural measures for river basin management.

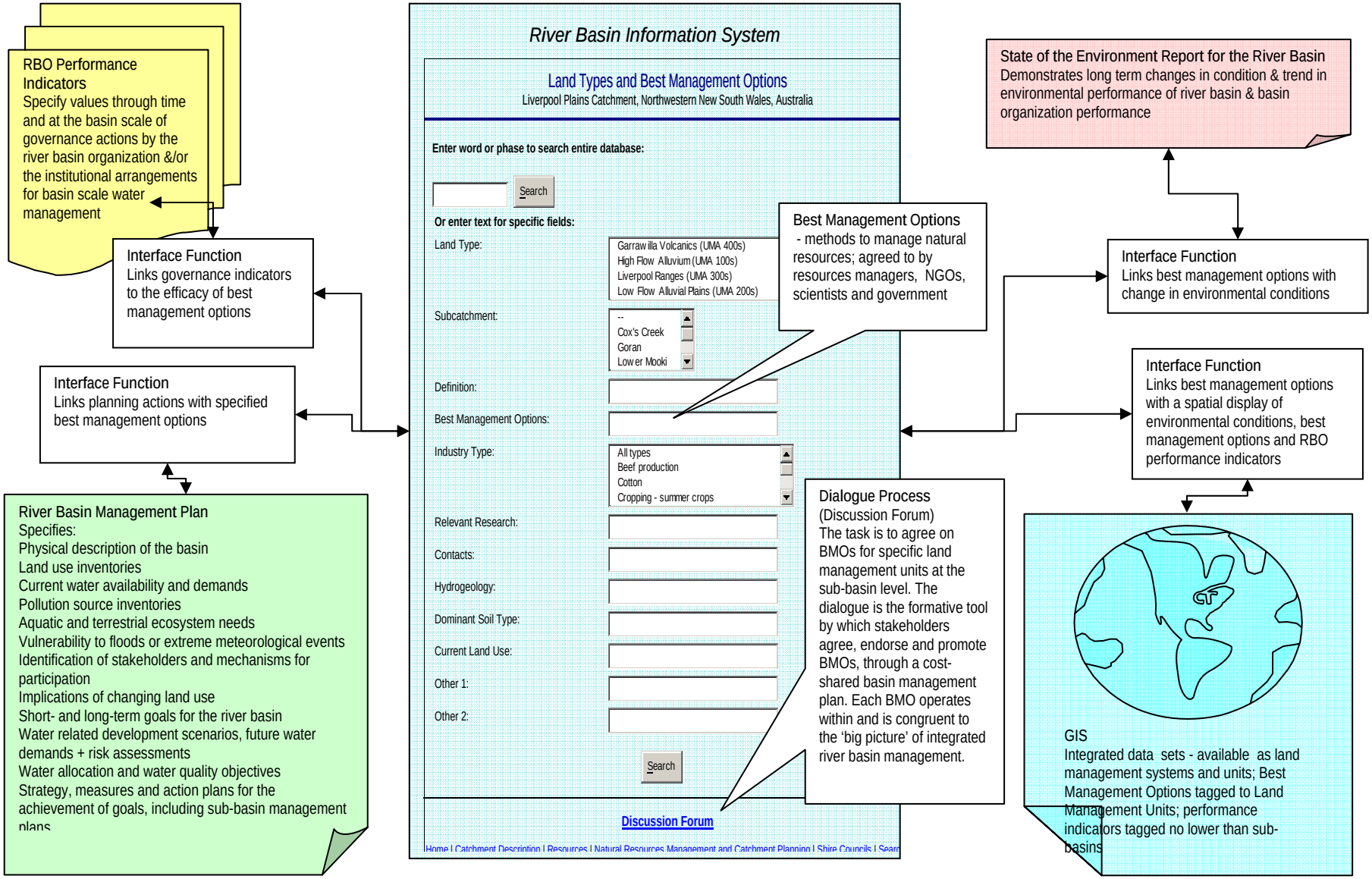


Figure 1 Relationship between basin organization performance indicators, information systems, plans and GIS - an Australian example

Table 11 Components of Integrated River Basin Management *

A: Concepts and Institutional Issues
Chapter 1. Background, which scopes the need for integrated river basin management; types of river basin organizations; the need to separate roles and functions (of resource managers, from those of pollution monitors and regulators, and from service providers) for the clarification of responsibilities in basin management.
Chapter 2. Creating and Empowering a Basin Organization, which focuses on the role of 'mutual benefit' and 'doing the right thing' by customary law to establish international basin organizations.
Chapter 3. Organizational Strategic Planning for a River Basin Organization, which sets the direction, defining the priorities, planning the actions, monitoring the results.

B: Data and Information
Chapter 4. Water Related Data and Information Management, in which transparent, open information exchange is advocated.
Chapter 5. Water Related Resource Inventory, which includes good data and information on the condition of the natural resources base, a well developed set of simulation models for testing policies, development options and projects, and a set of decision support tools to present the modeling information in a way which helps decision makers.
Chapter 6. Systems Modeling, which simulates the behavior of the basin's resources in response to new policies and development options; modeling uses of a package of decision support tools by working groups; continuous staff training is used to maintain decision support capability.
Chapter 7. Notification and Evaluation of Projects, which outlines requirements to establish notification of new projects to all basin stakeholders, and evaluation techniques, including environmental impact assessment.

C: Policies and Strategies
Chapter 8. Sharing and Managing a Basin's Water Resources, which outlines methods of reasonable and equitable water allocation drawing on case study experiences, the use of water accounting mechanisms, quotas, transfers and audits.
Chapter 9. Licensing/permitting of Water Diversions and Use, which involves setting the rules for water licensing, issuing the licenses, monitoring who uses how much water and how efficiently.
Chapter 10. Modern Approaches to River Basin Planning and Management, which focuses on engaging basin communities, the role of bottom-up planning and participation in local land and water management plans
Chapter 11. Pricing and Charging for Water Resource Management, which outlines the role of efficient water pricing structures for both supply and distribution, and for managing and monitoring the resource base itself, and the role of independent pricing tribunals.

D: Partnerships and Awareness
Chapter 12. Stakeholder Partnerships, Participation and Funding, which outlines partnership building methods with peak bodies and at lower levels.
Chapter 13. Raising the Awareness of the Basin Community, which outlines the contents of a basin package of communication initiatives spanning education on IRBM for schools, villages, towns and the community in general.

E: Monitoring and Capacity Building
Chapter 14. Setting and Managing Basin Sustainability Performance Indicators which outline the need for sustainability benchmarks and performance indicators of river basin management, and the contents of a river basin 'status report'.
Chapter 15. Setting directions, informing and motivating staff, crafting a vibrant, respectful organization, which outlines the project management cycle for river basin management, organizational performance enhancement, marketing river basin management to stakeholders, and the role of leadership.
* Source: (World Bank 2006)

2.5 Organizational performance Indicators

Indicators are a tool to aid decision-making. They provide insight into the performance of natural resources management systems. The discussion below follows closely the work of (United Nations Economic Commission for Europe (UN-ECE) 2003) and is strongly influenced by the work of (Lorenz 1999; Lorenz, Gilbert, and Cofino 2001). Indicators reflect both quantitative and qualitative information; they can be either descriptive or normative. They essentially enlighten the user regarding a specific feature.

Context is very important to indicators – they tell different stories according to different settings. For example, the performance of the private sector in delivering water in very poor countries will be different to that in highly developed economies. Indicators are not entirely objective: they are built around the beliefs and assumptions (whether explicit or implicit) of the user or system of evaluation being used. They are often highly linked to the vocabulary and thinking of a specific discipline and in the case of the water sector: the language, assumptions and technologies of the core 'water disciplines': engineering, ecology, economics and planning.

Table 12 summarizes different definitions of 'indicator' and 'index'. Indicators have three core functions:

- to provide system information to inform the public and policy
- to evaluate the effect of policy actions and plans; and
- to translate data into policy relevant information. That is, they describe, show trends and communicate the results of implementing objectives.

Table 12 Terms and definitions of indicator and index.

An **indicator**, comprising a single data (a variable) or an output value from a set of data (aggregation of variables), describes a system or process such that it has significance beyond the face value of its components. It aims to communicate information on the system or process. The dominant criterion behind an indicator's specification is scientific knowledge and judgment.

An **index** is a mathematical aggregation of variables or indicators, often across different measurement units so that the result is dimensionless. An index aims to provide compact and targeted information for management and policy development. The problem of combining the individual components is overcome by scaling and weighting processes, which will reflect societal preferences.

The aggregation of variables into an indicator may be likened to combining the annual withdrawal of surface and groundwater into the total annual withdrawal. An index combines for example, the withdrawal with the availability of water to indicate water stress. The emphasis in an index is not on scientific justification, but on responding to the societal needs.

A **variable** is an observed datum derived by using basic statistics or monitoring, such as amount of rainfall or runoff, or number of diarrhoeal cases. Indicators are derived when the basic variables or observed data are aggregated using objective and scientific methods; for example mathematical aggregation of evaporation and transpiration data provide an indicator on evapotranspiration. When such core indicators are lumped together we get an index, for example, the aridity index of an area, which can be constructed by aggregating different indicators on water availability and use

Source: (United Nations Economic Commission for Europe (UN-ECE) 2003) p. 33.

Indicators of the effectiveness of river basin management organizations have been developed through several means. In the past, these were done through ex-ante basin planning assessments and post audits. There is an extensive history of basin planning evaluation, with some of the earliest material relying on audits of plan objectives (Kindsvater 1964; Arthur D Little P/L 1973). Recent work, however, focuses on the use of biophysical data and compliance program data to construct indicator sets. For example, (Smith 2004) summarizes a national attempt to coordinate water resources indicators into sets, arranged according to the outcomes of various national meetings.

Similar work in South Africa highlights the need for a cross-sectoral approach, selecting a range of indicators for sustainable development for catchment management. (Walmsley et al. 2001) analyzed indicators used in the Fraser Basin Council (Canada), the Murray-Darling Basin Commission (Australia), the Tennessee Valley Authority (USA), the United States Environmental Protection Agency and the World Resources Institute. They found that these indicator sets were developed using an issues-based approach, with common themes of biodiversity and ecosystem integrity, land-use change, water quality, waste production, water availability and resource use. These issues required information at the catchment level, and included indicators such as population growth; community involvement; water availability; water use; water quality trends; soil contamination; non-compliance; species at risk; key species assessment; change in vegetation; agricultural impact; access to recreational opportunities, and ecosystem health.

The Murray-Darling Basin Commission used Key Result Areas to evaluate program objectives ex-post (Murray-Darling Basin Ministerial Council 2005). This procedure requires evidence to be found for specific program area objectives. Using this approach, I developed for this report a sample of indicator sets for use in an Australian context and they are provided here for illustrative purposes (Table 13). Other indicator sets occur, including those of (van der Zaag, Seyam, and Savenije 2002) who developed an indicator set based on six criteria and water allocation algorithms that operationalize equity, using the concepts of 'blue' and 'green' water in basin water accounts.

Table 13 Examples of indicators linked to program objectives

Key Result Area	Sub-program of Basin Sustainability Plan								
	Irrigated Regions Management			Dryland Regions Management			Riverine Environment Management		
Sustainable Agricultural Activity	Objectives	Indicators	Data sets	Objectives	Indicators	Data sets	Objectives	Indicators	Data sets
	Continuously improving the efficiency and effectiveness of irrigated water use	Water use efficiency	Water use data	Matching new and current land use and land management practices to land suitability and capability	Land use compatibility	Land use change data matched with land capability/suitability mapping	Improving planning support for sustainable use of floodplains, wetlands and rivers	Extent and effective use of planning mechanisms	Local and State Government planning instruments
	Matching new and current land use and land management practices to land suitability and capability	Land use compatibility	Land use change data matched with land capability/suitability mapping	Maintaining and enhancing the sustainable productive capacity of the land resource base by reducing land degradation	Extent of salinized land	Salinity maps	Maintaining and enhancing the use of floodplain, wetland and riverine flora and fauna	Health of vegetation indicators	Land use data
	Maintaining and enhancing the sustainable productive capacity of the land resource base by reducing land degradation	Extent of salinized land	Salinity maps	Maintaining and expanding perennial vegetation cover	Extent and degree of land cover	Land cover maps	- -		

Modified from (Murray-Darling Basin Ministerial Council 2005)

3.0 River Basin Organizations

The intent of this report is to develop performance indicators for river basin organizations (RBOs), but there are many types of RBOs throughout the world. They are not a new phenomenon and have been established as a response to different needs at different times. They were originally formed in the early twentieth century for development purposes but more recently their goal has switched to sustainable development (Jaspers 2003). RBOs have had a checkered career both in the United States (Rogers 1996) and many parts of the world (Cassar 2003). The reasons for this vary and include many enabling environment factors (laws, investments and policies), individual and organizational capacities and management factors (Hooper 2005).

The river basin is the logical area of management in all these initiatives. Over 261 major river basins shared by two or more sovereign states can be identified (Turton et al. 2001), and even more river basins that cross local, state, or provincial boundaries within individual countries. The World Resources Institute recognizes 106 major basins in the world (Figure 2), suggesting a different measuring system. In the continental USA, there are also many interstate basins, the largest being the Missouri-Mississippi (3226300 km^2). In 2005, the International Network of Basin Organizations reported 133 member organizations in 50 countries, a number of which excludes RBOs at the local and state levels (www.inbo.org, accessed 6/2005). These numbers suggest a large number of basins in the world with some type of basin management procedures, but not necessarily all basins have constituted RBOs.

An RBO is defined in this report as a societal entity created to manage, develop or monitor natural water resources in a large watershed. The minimum size of a "basin" is quite arbitrary, but a suggested size is the macro-scale - at least 100,000 km^2. At this scale, strategic management decisions are made to allocate natural resources, primarily by governments.

RBOs vary considerably in form and function and there many types of basin organizations in the world today. The following classification of nine RBOs is from earlier work and draws from a selection of international experiences (Hooper 2005). Not all types of basin organizations listed here have embraced the integrated approach. This is not because of organizational style, rather the purpose of their formation.

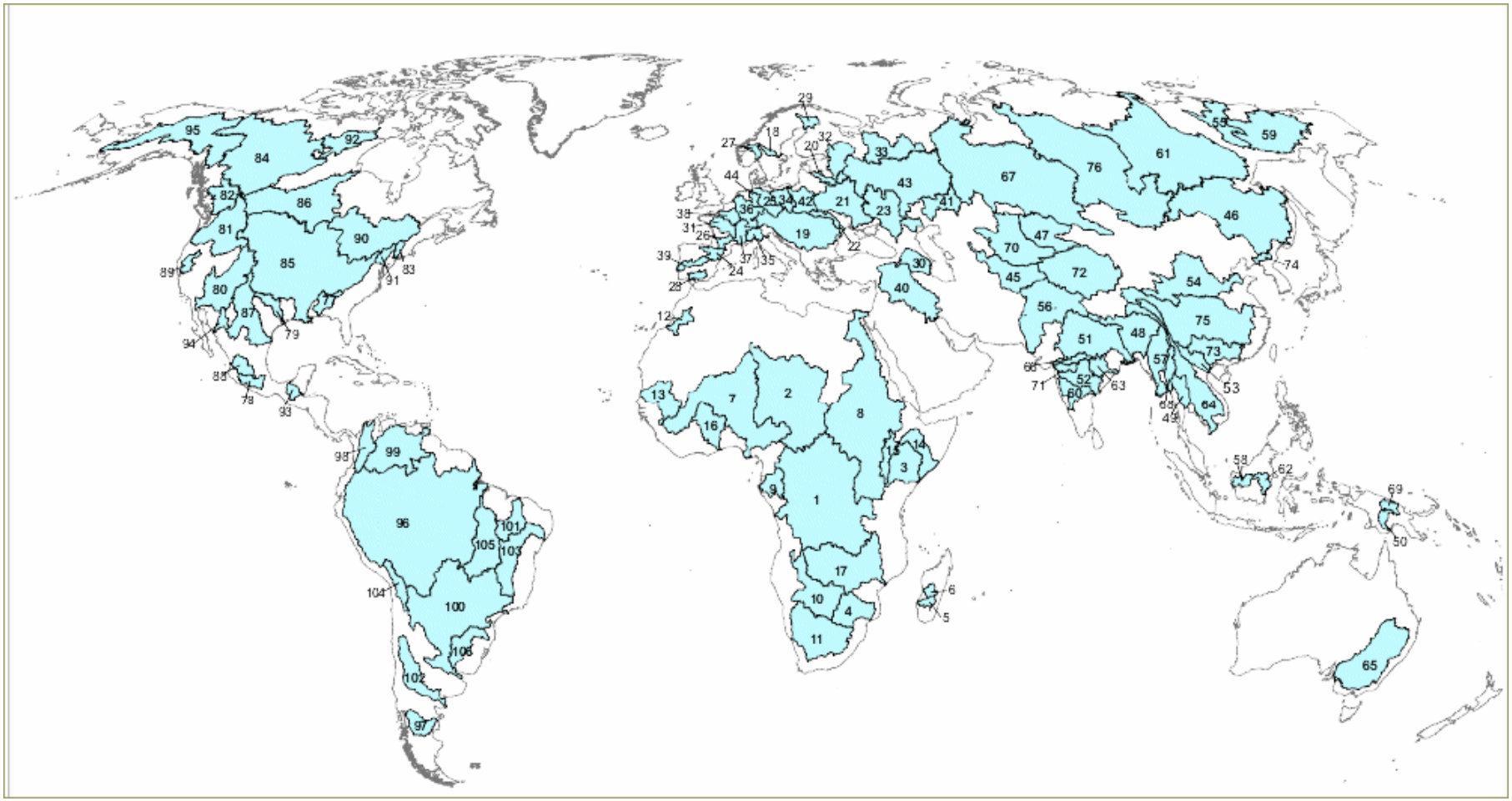
3.1 Types of river basin organizations

Type 1: Advisory Committee ~ A formalized or quasi-formal organization in which individuals take responsibility for undertaking action planning and provide advice; governments 'hand over' strategic planning to such organizations; they frequently have no or limited legal jurisdiction. Examples include:

- Fitzroy Basin Association, Eastern Australia
- Verde Watershed Association, South-western USA

Type 2: Authority ~ An organization which makes planning decisions at a central or regional government level; may set and enact regulations, or have development consent authority; authorities are founded on democratic principles and a framework of law to which all relevant individuals and institutions are subject in a basin setting. Examples include:

Figure 2 Transboundary river basins of the world



Africa

1 Congo
2 Lake Chad
3 Jubba
4 Limpopo
5 Mangoky
6 Mania
7 Niger
8 Nile
9 Ogooue
10 Okavango Swamp
11 Orange
12 Oued Draa
13 Senegal
14 Shaballe
15 Turkana
16 Volta
17 Zambezi

Europe

18 Dalalven
19 Danube
20 Daugava
21 Dnieper
22 Dniester
23 Don
24 Ebro
25 Elbe
26 Garonne
27 Glama
28 Guadalquivir
29 Kemijoki
30 Kura-Araks
31 Loire
32 Neva
33 North Dvina
34 Oder
35 Po
36 Rhine & Meuse
37 Rhone
38 Seine
39 Tagus
40 Tigris & Euphrates
41 Ural
42 Vistula
43 Volga
44 Weser

Asia & Oceania

45 Amu Darya
46 Amur
47 Lake Balkhash
48 Brahmaputra
49 Chao Phrya
50 Fly
51 Ganges
52 Godavari
53 Hong (Red River)
54 Hwang He
55 Indigirka
56 Indus
57 Irrawaddy
58 Kapuas
59 Kolyma
60 Krishna
61 Lena
62 Mahakam
63 Mahanadi
64 Mekong
65 Murray-Darling
66 Narmada
67 Ob
68 Salween
69 Sepik
70 Syr Darya
71 Tapti
72 Tarim
73 Xi Jiang
74 Yalu Jiang
75 Yangtze
76 Yenisey

North & Central America

77 Alabama & Tombigbee
78 Balsas
79 Brazos
80 Colorado
81 Columbia
82 Fraser
83 Hudson
84 Mackenzie
85 Mississippi
86 Nelson
87 Rio Grande
88 Rio Grande de Santiago
89 Sacramento
90 St. Lawrence
91 Susquehanna
92 Thelon
93 Usumacinta
94 Yaqui
95 Yukon

South America

96 Amazon
97 Chubut
98 Magdalena
99 Orinoco
100 Paraná
101 Parnaiba
102 Rio Colorado
103 São Francisco
104 Lake Titicaca
105 Tocantins
106 Uruguay

Sources:

- Environmental Systems Research Institute. 1992, *ArcWorld 1:3M. Continental Coverage*. Redlands, CA:ESRI.
- US Army Corps of Engineers Construction Engineering Research Laboratories (CERL). *Major Watersheds of the World*.

Source: http://earthtrends.wri.org/maps_spatial/maps_detail_static.php?map_select=274&theme=2

Accessed: May, 2006

- Grand River Conservation Authority, South-eastern Canada
- Niger Basin Authority, West Africa
- Tennessee Valley Authority, Central-eastern USA

Type 3: Association ~ Similar to an Advisory Committee, this is an organization of like-minded individuals and groups with a common interest. In a river basin they have varying roles: providing advice, stimulating basin awareness, education and ownership of basin natural resources management issues; educational functions and information exchange. An example is the Missouri River Basin Association, Midwest USA

Type 4: Commission ~ An organization which is delegated to consider natural resources management matters and/or take action on those matters. A basin commission's powers vary, and include advisory/education roles, monitoring roles, undertaking works, fulfilling goals of a specific government's charter or an international agreement. Commissions normally are instituted by a formal statement of a command or injunction by government to manage land and water resources; commissions may also have regulatory powers. Examples include:

- Delaware Basin Commission, North-eastern USA
- Great Lakes Commission, North America
- International Commission for the Protection of the Danube River, Central & Eastern Europe
- International Commission for the Protection of the Rhine , Western Europe
- International Joint Commission, North America
- Lake Chad Basin Commission, Central Africa
- Mekong River Commission, South-east Asia
- Murray-Darling Basin Commission, South-eastern Australia
- North Carolina Environmental Management Commission, South-eastern USA
- Ohio River Water Sanitation Commission, Central- northern USA
- Tarim Basin Water Resources Commission, Western China

Type 5: Council ~ A formal group of experts, government ministers, politicians, NGOs and lay people brought together on a regular basis to debate matters within their sphere of basin management expertise, and with advisory powers to government. A council is contrasted with a commission which, although also a body of experts, is typically given regulatory powers in addition to a role as advisor to the government. An example is the Fraser Basin Council, western Canada - North-western USA

Type 6: Corporation ~ A legal entity, created by legislation, which permits a group of people, as shareholders (for-profit companies) or members (non-profit companies), to create an organization, which can then focus on pursuing set objectives, and empowered with legal rights which are usually only reserved for individuals, such as to sue and be sued, own property, hire employees or loan and borrow money. Also known as a "company". The primary advantage of a for-profit corporation is that it provides its shareholders with a right to participate in the profits (by dividends) without any personal liability because the company absorbs the entire liability of the organization. Examples include:

- Damodar Valley Corporation, Northern India
- The former Snowy Mountains Engineering Corporation (now Snowy Hydro), South-eastern Australia

Type 7: Tribunal ~ A basin entity which has formalized procedures and quasi-judicial powers; a heavy emphasis on bureaucratic decision making; stakeholders may formally participate through hearings; major decisions are taken by independent bodies, like a water pricing tribunal. A Tribunal acts as a special court outside the civil and criminal judicial system that examines special problems and makes judgments, for example, a water tribunal, which resolves disputes between water users. Very few such entities exist purely for river basins management purposes but rather for special purposes, for example, government pricing tribunals. Some tribunals have specific water functions which are a component of a broader river basin's management process, where an RBO may or may not exist. These entities have limited traditional powers of civil government and do not report to other government agencies, except where a local government body may oversee entities such as 'country' drainage districts, which charges for water. They play an important role in developed countries and many developing countries. An example is the Valencia Water Court, Spain.

Type 8: Trust ~ A trust is legal device used to set aside money or property of one person for the benefit of one or more persons or organizations. It is an organization which undertakes river basin works; develops and implements a strategic plan; its mandate is to be the river basin 'advocate'; it co-ordinates local programs through Memoranda of Understanding or other agreements; it raises local levies (funds) for its works and programs. A Trust keeps monies raised in 'trust' for the benefits of its citizens. An example is the former Hawkesbury-Nepean Catchment Management Trust (now part of the Sydney Catchment Authority), South-eastern Australia.

Type 9: Federations ~ A collaboration of organizations or departments within one government or between state and national governments to establish and undertake actions for river basin management. Local government groupings have emerged in some locations in the USA for regional natural resources governance. Governance actions at various levels (national, state and local) include: agreements on water sharing and water quality management, shared statements of intent; shared policy development; information exchange; joint actions for management of ecosystem degradation. Collaboration is expressed in terms of framework directives, cost-sharing arrangements, joint statements of intent, partnerships, joint programs and agreed policy. Examples include:

- International Network of Basin Organizations; Global, based in France
- Chesapeake Bay Commission and the Chesapeake Bay Agreement, Eastern USA
- Council of Great Lakes Governors and the Great Lakes Basin Water Resources Compact, North America
- European Commission – Water Framework Directive (Directive on River Basin Management)

4.0 Derivation of General Performance Indicators for River Basin Organizations

The variety of river basin management settings and river basin organizations described in Sections 2 and 3 present formidable challenges to this study. This section provides a method to identify general performance indicators of river basin organizations, suitable to this complex array of basin organizations. No single indicator template will suit all conditions and the following procedure uses a broad range of indicators. The result is a number of indicators from which basin organizations can select, according to

their own conditions. This selection procedure is discussed in more detail in Section 5.

4.1 Methods

This study utilized an action-research approach with basin practitioners to develop RBO general performance indicators. It involved two stages. The first stage was the collection of known best practices in integrated river basin management from a number of sources:

(a) A review of the literature of the period 1970 to present using databases. The literature provided only a limited number of analytical experiences in the development of RBO performance indicators. The majority of the literature was concerned with implementation constraints (Kenney 1997; Born and Genskow 1999; Hooper, McDonald, and Mitchell 1999; Margerum and Whitall 2004; Imperial 2004; Sabatier et al. 2005);

(b) A review of experiences of practitioners, consultants, basin managers and water resources managers in the field. These practitioners published material in a variety of forms, including web-based documentation, agency reports and professional journals. This material was supplemented by discussions with colleagues in basin management consultancy projects. Most of the practitioner experiences included practical methods for implementing IRBM and the development of performance indicators for catchment management. These are documented in Table 14. The most relevant of these reports was the work of the World Bank in developing internal briefing notes on IRBM, which the author of this report reviewed prior to the Fellowship period, and which were later published as (World Bank 2006).

(c) A review of previous experiences in developing evaluation frameworks for Australian catchment management by the Australian Commonwealth Scientific and Industrial Research Organisation (CSIRO) (Syme and Butterworth 1999; Bellamy et al. 2001)

(d) Lessons learned from large scale restoration projects and current basin management programs in North America, including the Delaware River Basin Commission, the Susquehanna Basin Commission, the International Joint Commission and the Chesapeake Bay Program. These are documented in Table 14.

(e) Structured and unstructured discussions with UNESCO HELP program staff in Paris (May 2005) and at a water policy conference in Dundee, Scotland (September, 2004) regarding the efficacy of the then proposed study. This input continued in the project from US members of the UNESCO HELP program using teleconferences throughout 2005.

(f) Comments solicited from Corps of Engineers staff not listed in Table 14, and noted in the Acknowledgments section of this document, while the author was in residence at the CoE Institute for Water Resources, Virginia in 2005.

The second stage involved the synthesis of best practices to create a suite of general performance indicators. ‘Best Practice’ is used here as an embracing term. It refers to what is considered by basin practitioners as the range of management practices which will most likely result in the implementation of integrated water resources management. Best practices can also be identified as ‘what not to do’ – obstacles to implementation of best practices. The synthesis involved looking for common meanings or understandings in terms used to describe ‘best practice’ from the above sources. This synthesis simplified the vast array of information, captured the essence of the meaning of each term and provided a diverse array of indicators. The choice of each indicator kept in mind the following criteria for selection. Is the indicator:

- Relevant and observable – does it actually exist? Can evidence be collected about it? Is it applicable to basin management?
- Controllable – is it able to be managed as a discrete, identifiable item? Can practitioners change its value through progressive actions?
- Realistic - does it address important basin RBO functions? Does the indicator refer to feasible functions for this RBO's stage of development?
- Understandable - can it be interpreted by three groups: RBO internal staff, RBO stakeholders, those to whom the RBO reports (usually government agencies)
- Subjective and objective data sets – can subjective values and objective documentary evidence measure the value of each indicator?
- Achievement – can the indicator measure achievement of the mission goals of the RBO? Many different measures e.g. change of attitudes, voting patterns in RBO meetings, projects completed, innovative actions taken, greater ownership of processes etc. can be used.

Table 14 Sources of river basin organization general performance indicators

Reference	Authors' Organization Type	Locations of case studies/approaches (countries or basins etc)
(AACM International and Centre for Water Policy Research 1995)	Consultancy Academician	Australia
(Alaerts 2001)	International Financial Agency (World Bank)	Latin American, Africa
(Anonymous 1997)	Academician	USA
(Anonymous 1998)	National aid agency (MFA)	South Africa, European Union
(Barrow 1998)	Academician, Aid Agency	Developing countries
(Bellamy et al. 1999)	National research organization (CSIRO) Academician	Australia
(Born and Genskow 1999; Born and Genskow 2001a)	Academicians	USA
Bourget, P.; Cardwell, H.; Stakhiv, E.; (focus discussions, May-Sept. 2005).	Basin management experts (Army Corps of Engineers)	Worldwide
(Priscoli 2005)	Basin management expert (Army Corps of Engineers)	Worldwide
(Dourojeanni 2005)	International agency (UNESCO)	Latin American and Caribbean countries
(Global Water Partnership 2003)	International agency (GWP)	Worldwide
(Global Water Partnership Technical Advisory Committee 2000)	International agency (GWP)	Worldwide
(Hooper 2005)	Academician Consultancy	Australia, Canada, India
(Hooper, McDonald, and Mitchell 1999)	Academicians Consultants	Australia, Canada, USA
(Imperial 2004)	Academician Non-government / not for profit organization	USA
(Jaspers 2003)	National research organization (IHE-Delft)	Zimbabwe, South Africa, Tanzania, Turkey, Indonesia, France and The Netherlands
(Jones 2001)	Non-government / not for profit organization	European Union
(Kemper, Dinar, and Blomquist 2005)	International Financial Agency (World Bank)	Case studies in: Tárcoles (Costa Rica), Fraser (Canada), Alto Tietê and Jaguaribe (Brazil), Guadalquivir (Spain), Murray Darling (Australia), Brantas (Indonesia), Warta (Poland) and 83 river basin organizations worldwide
(Kenney 1997)	Academician	USA
(Le Moigne et al. 1994)	International Financial Agency (World Bank)	Worldwide
(Makin, Parks, and Arriens 2004)	International Funding Agency (ADB)	Application mainly for developing countries
(Margerum and Born 2002; Margerum and	Academician	USA

Whitall 2004)		
(World Bank 2006)	International Financial Agency (World Bank)	Tarim (China); Rhine (Western Europe); Mekong (SE Asia) Murray-Darling Basin (Australia)
(Rogers and Hall 2003)	International agency (GWP)	Worldwide
(Saleth and Dinar 1999; Saleth and Dinar 2004)	International Financial Agency (World Bank)	Worldwide
(Shah, Makin, and Sakthivadivel 2004)	International Research Organization (IWMI)	Developing contrasted with developed countries
(Syme, Butterworth, and Nancarrow 1994; Syme 1995; Bellamy et al. 1999; Syme and Butterworth 1999; Bellamy et al. 2001)	National research organization (CSIRO)	Australia
(Savenije and van der Zaag 2000; van der Zaag and Savenije 2000; van der Zaag, Seyam, and Savenije 2002)	National research organization	South Africa, European Union
(Walmsley et al. 2001; Walmsley 2002; Vigmostad et al. 2005)	Non-government / not for profit organization	USA basins: Chesapeake Bay, Coastal Louisiana, Columbia River, Great Lakes, San Francisco Bay-Delta, South Florida Everglades, Upper Mississippi River
(Walmsley and Hasnip 1997)	National aid agency (UK Department for international Development)	Worldwide

4.2 Results

The synthesis resulted in the identification of 115 indicators of best practice integrated river basin management, shown in Table 15. These were grouped into ten categories:

(1) coordinated decision-making – the use of coordination mechanisms between and within agencies and basin organizations; consensus based decision-making; links between local water institutions and a basin organization; how relevant sectoral interests are engaged
(2) responsive decision-making – decision processes which adapt to new knowledge and new conditions; promote efficiency; value cross-sectoral dialogue; promote best practices
(3) goals, goal shift and goal completion – achievement of goals using an integrated approach
(4) financial sustainability – evidence of ongoing financial support, cost-sharing, transparency, innovative water pricing and demand management
(5) organizational design – the use of democratic processes; evidence of stable international agreements and evidence of national water policy conducive to river basin management; use of organizational structures which fit basin needs and avoid fragmentation
(6) role of law – the existence of laws which support river basin management; laws characterized by strong & flexible arrangements
(7) training and capacity building – the use of ongoing training and capacity building of staff relevant to basin needs
(8) information and research – the existence of a knowledge system to aid decision-making, protocols to share information, and a culture of research-knowledge links
(9) accountability and monitoring – evidence that basin organizations are accountable to constituent governments & citizens; use of transparent reporting mechanisms
(10) private and public sector roles – evidence of stakeholder participation; clear specification of roles of private and public sector

Each of these groupings has several sub groups. Each subgroup is described in terms of good governance factors. Group 1 for example, Coordinated Decision-making, has seven sub groups. Acronyms for each sub-group of indicators are included (Column 1, Table 15), for coding purposes use in future field applications.

The performance indicators listed in Table 15 are those for a mature RBO, that is, a basin organization

which has evolved over time and shows a high degree of adaptiveness to new information, government policy, economic conditions in the basin and the results of project completion. Adaptable RBOs are dynamic organizations, able to respond to these changing conditions and are reflexive: able to learn from past experiences and capable of implementing change. Such RBOs would be considered by their peers as 'high achievers' in integrated water resources management. The difference between mature RBOs and less developed RBOs is discussed in the following section.

Table 15 General Performance Indicators for River Basin Organizations

Acronym	Good Governance Factor		Indicator
COORDINATED DECISION-MAKING			
CROSS-SEC	Cross-sectoral linkages for coordination of natural resources management: there is integrated action used across all natural resource issues, which means agencies do not find singular solutions but look at impacts and improvements across the spectrum of natural resources, and the development of regional (basin scale) natural resources management policies.	1	Existence of high level, cross-sectoral policy links between natural resources management, health, population and economic development portfolios of government
		2	Existence of national and/or international coordination arrangements (dialogues, memoranda of understanding, joint programs of action) between states for river basin management
		3	Existence of natural resources management policies which provide solutions by across the spectrum of natural resources, and the development of regional (basin scale) natural resources management policies
		4	Evidence of international, cross-portfolio arrangements between agencies with similar roles in neighboring countries which address natural resources management, health, population and economic development
COORDINATION	Evidence of coordination mechanisms to enact integrated management	5	Existence of quality control mechanisms to avoid bias in monitoring, planning and management through coordination of a range of state, federal, commercial and private NGO bodies
		6	Use of multiple agency approach with overarching coordination body
CONSENSUS	Consensus based agreements	7	Use of consensus-based decision-making in basin-wide planning and management to balance all user needs for water resources and to provide protection from water related hazards
		8	Evidence of use of consensus methods to broker agreements on commitments within the basin, coupled with evidence of mechanisms to monitor those agreements
INFORMAL-WATER	Jurisdiction over an informal water sector is critical: regulation is meaningless if there is ineffective management of water use when there are vast numbers of small-scale users and ground water pumpers who are not linked with public institutions	9	Existence of small-scale local public water management institutions and results are recorded which demonstrate improvements made
		10	Evidence of links between macro-level institutions and grassroots user organizations
PROTOAUTH	Protocols governing the use of coordination authority: protocols are defined and used for the array of coordination activities (who is involved), how binding or permissive is the coordination (what can be done) and on what basis is the involvement (law, policy, informal agreement)	11	Evidence of authority given to the RBO to coordinate actions and programs across the basin
		12	Existence of a business plan for the RBO which specifies coordination mechanisms between entities
		13	Existence of laws which specify authority of river basin organization to coordinate entities

LOCALTOOL	RBO guidance to local governments: local governance (by local governments, locally acting NGOs, water user associations and other local entities) provide a vital role in enacting natural resources management	14	Existence of guidelines produced by the RBO to enact natural resources management by local governments
		15	Evidence that local government zoning mechanisms are congruent with river basin management goals and strategies
		16	Evidence that local government and state agency pollution laws and regulations are congruent with river basin management plans and goals
PUBSECTOOL	Public sector role in IRBM ~ Water, as a common-pool natural resource, will more likely be managed by the public sector, than the private sector; the state (both provincial and local agencies) will take the lead role to develop, implement and manage river basin management activities	17	Existence of national government guidelines for the establishment of basin organizations within national goals and priorities for natural resources management
		18	Existence of national government guidelines for priority action areas in natural resources management which can be implemented by basin organizations and are supported by national funding mechanisms
		19	Evidence of services delivered by national government to specific basins using State budget mechanisms
RESPONSIVE DECISION-MAKING			
ADAPTOOL	Adaptive management the ability of the decision system to use flexible, adaptive methods, reacting to new research and understandings and deciding on better ways to manage natural resources	20	Use of a "learn by doing" approach by the basin organization
BESTPRACTOOL	The role of sectoral 'best practices' promoted by RBO	21	Evidence that the basin organization promotes local best management options to industry, urban planning, forestry, agriculture and other resource use organizations & individuals
DIALOGTOOL	Dialogue	22	Evidence of dialogue being used as a tool to make decisions on preferred management options – as in open meetings, tribunals, forums
EFFICIENCY	Focus of efforts towards maximizing water use efficiency by using groundwater and soil water resources: capturing water where it falls and mitigating flood and drought risk; and the use of risk management to address critical water shortages (climatic drought, river drought);	23	Evidence that the basin management decision processes address critical problems first: e.g. water scarcity, flooding, droughts for very large and rapidly growing populations through risk assessment;
		24	Evidence of programs which promote more efficient water management techniques in agriculture to achieve more crop, cash and jobs for each drop
		25	Evidence of programs which capture water more effectively in the soil profile (capture water where it falls) rather than increased river diversions

		26	Evidence of programs to raise local productivity through village-led/local government initiatives in water harvesting
VERTICALINKS	Vertical management linkages	27	Evidence of methods to integrate decision-making vertically though organizations: linking local management to Cabinet-levels of government
		28	Evidence of measures to link RBO to high levels of government decision-making
		29	Evidence of stakeholders' access to governments through RBO about natural resources management issues
GOALS, GOAL SHIFT AND GOAL COMPLETION			
GOALSHIFT	The river basin management process has moved from a purely resource exploitation ethic to incorporate environmental management, social impact assessment, sustainability goals and other region specific priorities; resource development forms part of a long-term IRBM Plan; prioritization of natural resources management issues occurs	30	Evidence of an IWRM approach used as the basis for land and water resources management
		31	Use of impact assessment procedures – including Strategic Environmental Assessment
		32	Use of environmental management systems and eco-audits, voluntary regulation of practices and international standards e.g. ISO14001 (International Organization for Standardization, 14000 series on management quality) and ISO 224 [self assessment with all stakeholders pf service performances of water and sanitation utilities), EMAS (Environmental Management and Audit Scheme, the European Union's voluntary, eco-auditing and management system)
GOALSPEC/PLANNING/COMPLETE	Specificity of the problem domain and completion of work to address that problem domain	33	Existence and use of water and natural resources planning: well-defined objectives, mutually beneficial and desirable goals, and resource development priorities in a long-term integrated basin management plan
		34	Evidence of an awareness of resource availability constraints on and options for development in river basin management plans
		35	Evidence of completion of river basin management plans
		36	Evidence of clear specification of the roles, responsibilities and functions of river basin organization and roles are distinguished from those of other entities
FINANCIAL SUSTAINABILITY			
COSTSHARETOOL	Cost-sharing arrangements, joint ventures and agreements on sharing the cost of common projects are used to finance IRBM	37	Evidence of cost-sharing arrangements
		38	Evidence of joint ventures
FINANCE-AVAILABLE	Financing river basin management processes, finance to support a river basin organization; And training in integrated management	39	Existence of ongoing funding for river basin management

		40	Funding exists and is adequate to address at least priority natural resources management issues
		41	Funding appropriations established and operating within National and State resources management investment
		42	Funding exists for staff training in coordination practices
FINANCETOOL	The quality of tools to finance IRBM are assessed regarding their longevity and ability to providing ongoing natural resources management and of a quality and quantity to make a difference	43	Evidence of transparency mechanisms to declare all revenue streams are transparent, to stakeholders
		44	Availability of adequate financial resources
PRICINGTOOL	Water pricing and demand management ~ pricing mechanisms are applied to situations where water charges are able to be collected; the price of water retains a poverty clause to provide water as a fundamental human right; alternative demand management technologies are used with pricing, where possible.	45	Evidence of economic assessment of water management options
		46	Evidence of cost-recovery mechanisms used in water management plans
		47	Evidence of water pricing used to recover some or all of development costs
		48	Evidence of alternative demand management technologies to manage water use
ORGANIZATIONAL DESIGN			
DEMOCRACY	Stable, democratic conventions: there is a relatively stable set of institutions of government which provide the ability of the public sector to establish a system of policies, laws and financing arrangements, which are unhindered by civil unrest	49	Existence of democratically elected governments
		50	Evidence that government officials appointed between administrations without civil unrest
		51	Evidence that national water policy functions through successive administrations
		52	Evidence that a system of water laws remains through successive administrations
INTERNATNL	International reciprocity and goodwill. For international basins, there will be international agreements which precede the establishment of joint basin organizations; stability of these international relationships will be the hallmark of preconditions to establish cooperative governance	53	Existence of international agreements /partnerships for other sectors (trade, health for example) between basin member nations pre-exist, which facilitate development of international (transboundary) water sharing agreements
		54	Evidence of lack of conflict over resources use between basin member nations
POLICY	National land and water policy sets the framework for the development of integrated river basin management; policy which is recognized as a tool for effective implementation of IWRM	55	Existence of national land and water policies
		56	Demonstrated use of national land and water policies in water planning documents and practices
		57	National land and water policies stipulate use of river basin as a management unit for natural resources management
BOUNDARIES	Protocols governing position and boundaries	58	Evidence of institutional arrangements for basin management which specify roles and responsibilities of different entities and stakeholders

		59	Evidence that 'rules' of participation specify membership representation and exiting decision settings
REALISM	Realistic functions ~ RBOs make decisions aware of the reality of existing conditions; often compromise on the best management options is required; a stage implementation procedure is needed - addressing the most pressing resource management issues first, and recognizing what is possible in the short term; this process must be backed up by long-term planning	60	Degree to which RBO roles, responsibilities and functions reflect realities of existing conditions
		61	Evidence of strategic planning and implementation process based on communications, coordination and cooperation within a river basin organization
		62	Use of a stepped approach to decision-making is used - do what is achievable first
ORGANIZSTYLE	Characteristics of organizational structure - degree to which they address the needs of the basin's context: a choice of organizational structure is required according to: the degree of RBO development: for cross-sectoral planning and management? For coordination and advisory roles? For regulation and development authorization	63	Evidence that organization type reflects prevailing needs for river basin management
		64	Use of flatter organizational structures to improve coordination rather than steeply hierarchical structures
		65	Methods in place to deal with multilateral donor agencies and/or funding sources
		66	Evidence that RBO structures avoid dominance of one sectoral interest group
STABLEINST	Institutional stability: a stable institutional framework exists which overcomes fragmentation and overlap of responsibilities	67	The specification of organizational responsibilities is clear and determined by policy and law
		68	Mechanisms exist in government to reduce jurisdictional overlap and reduce duplication (such as regulatory tribunals)
ROLE OF LAW			
LAW	IRBM is supported by strong and comprehensive, but flexible legislation, regulations, decrees etc which ensure "fairness" in basin-wide decisions, a process of accountability identifies RBO functions, structure and financial base and whose administration and operation is based upon a decision-making process of authority, responsibility and accountability	69	Existence of legislation to enact natural resources management
		70	Legislation specifies functions, structure, financial base & accountability mechanisms for river basin management
LEGALACTION	Legal actions	71	Existence of an appropriate and enforceable legal and jurisdictional system in land and water management
		72	Evidence that the RBO has the mandate to ensure they take the 'big picture' in river basin management
		73	Existence of legally trained staff in the RBO
TRAINING AND CAPACITY BUILDING			
BUILDCAPAC	Capacity building mechanisms relevant to their cultural, political and administrative setting and level of economic development of the country within which they operate	74	Evidence of training programs to improve the skill levels of river basin managers and stakeholders, specific to their situation
		75	Evidence that the RBO provides the leading voice on basin wide land and water issues
		76	Evidence of the RBO informing its constituencies and decision-makers of basin issues and management solutions
		77	Evidence that the RBO leadership is well-trained, articulate, responsible and has 'listening skills'

TRAINING	Human resources capacity building	78	Existence of well-trained staff with capacity to work in teams and plan across sectors and disciplines
		79	Evidence of training programs in the concept of IWRM and the tools of coordinated management
INFORMATION AND RESEARCH			
INFOEXCHANGE	Protocols information exchange	80	Evidence of a method to specify type of information, how it is presented and timing of information exchange in the RBO's information systems
INFOPROTOOL	Protocols which ensure best use of available data, information, knowledge and wisdom and presented in a river basin IMS (information management system) and the use of GIS (Geographic Information Systems)	81	Evidence that information is accessible to relevant stakeholders
		82	Evidence that information is appropriate to relevant stakeholders
		83	Evidence that information system is affordable for relevant stakeholders
		84	Evidence of protocols in place to ensure information is equitable in addressing gender, race and poverty issues related to natural resources management
		85	Evidence of integration of the information on a spatial scale: provides a resource management atlas in GIS at the sub-basin scale specifying environmental conditions and best management options
		86	Evidence of 'wisdom' [best understandings derived from research and practice over decades] being incorporated into local, regional and basin-wide information and mapped in a basin IMS
		87	Evidence that two-way vertical information exchange mechanisms are made a priority
INFOTOOLS	Knowledge system ~ RBOs require a high quality, reliable, uniform and comprehensive data network, available to all stakeholders in ways which suit their needs; systems and models for analysis which allow "knowledgeable" natural resources/water management policies and strategies to be developed and implemented.	88	Evidence that data and information are quality controlled; including strong systems of field measurements and of data collection
		89	Evidence of high reliability of information system – evidence of lack of breakdowns
		90	Evidence of sharing of data in the information system by stakeholders
		91	Evidence of uniformity of information system for entire basin
		92	Evidence that information management systems and models are used for analysis and prioritizing resource management options
RESEARCHTOOL	Culture of research-knowledge links	93	Existence of a well designed research program which identifies and tests with stakeholders best management options for land types in sub-basin catchments

		94	Existence of data providers who understand the basin's structure, management functions and resource use activities.
		95	Existence of a GIS which describes research programs (and outputs) for specific sub-basin locations
		96	Use of joint assessment tools like multi-objectives decision support systems, Policy Delphi techniques and others, to manage research output and use it to inform the basin's strategic natural resources management decisions
		97	Evidence of research collaboration between RBO, research community, government agencies and NGOs
ACCOUNTABILITY & MONITORING			
ACCOUNTABILITY	Accountability mechanisms	98	Existence of an accountability mechanism for the RBO to higher authorities and citizens
		99	Existence of a "policing" entity on RBO activities: e.g. an independent body (or bodies) with enough authority to insist on improvements
		100	Reporting mechanisms in place between RBO and high levels of government
MONITORTOOL	Monitoring	101	Existence of a monitoring and information system including a permanent, reliable and optimized system of meteorological, water resources, water use measurements linked to basin decision-making
		102	Use of a monitoring system that derives from an accurate, uniform and comprehensive data network, systems and models for analysis
		103	Use of a monitoring system and that facilitates the use of "knowledgeable" natural resources/water management policies and strategies and is linked to the basin decision systems
private and public sector roles			
PARTICIPTOOL	Community participation ~ strong community awareness and participation processes exist to enhance greater ownership of basin scale plans of action; the emphasis is placed on wide public and stakeholder participation in decision-making at all levels; local empowerment is facilitated if participation is a high priority	104	Strong community awareness and participation processes exist to enhance greater ownership of basin scale plans of action
		105	Existence of workable methods in the RBO to manage public involvement and avoid stalemates
		106	Existence of actions to empower local organizations and individuals, if participation is a high priority
		107	Evidence of local awareness of river basin management issues in basin community and high levels of government
		108	Evidence of the capacity of local agencies, NGOs and water user organizations to implement resource management activities [labor supply, funding, assessment techniques to ensure best management options are relevant to the setting]
		109	Use of impact assessment to ensure that local ownership of resource management processes occur when BOOT (Build, Own, Operate, Transfer) resource development methods are in place
		110	Evidence that river basin management plan is driven by bottom up water sector initiatives with strong NGO and

			village level management
		111	Evidence of institutional reform through high level ownership of water management & using 'water champions' in government
		112	Evidence that donor agencies are sensitive to these approaches in water planning
		113	Use of a common language despite ethnic differences
PRIVSECTOOL	Private sector participation in IRBM - There are ample opportunities for the private sector to enact IRBM at the local level	114	Evidence of clear specification of private sector involvement and links to basin decision systems
		115	Evidence of joint ventures, funding and exploiting resources

5.0 Application of General Performance Indicators to US Conditions

This section reports the application of the general performance indicators in Table 15 to different river basin management contexts in the United States. The first section discusses how to calibrate the indicators to river basin organizations of different levels of auto-adaptiveness. The remaining sections report applications to four settings:

- River basin commissions
- A CoE valley-scale (sub-basin) project and a UNESCO HELP Basin
- The CoE Civil Works Program, and
- Treaty/compact basins in general.

5.1 Selecting context dependent performance indicators

The application of general indicators to specific conditions depends on the institutional context of the basin setting where they will be applied. The characteristics of the basin management context are the result of a long period of many competing and complementary political, administrative, economic and cultural forces. That is, the context reflects previous and contemporary water resources development, planning and management policies, strategies, programs and initiatives. Thus, no basin is a 'greenfield' setting for performance indicator application.

It is problematic to suggest that a simple comparison of basin management experiences will provide a performance indicator template suitable everywhere, even within one country. Conditions are dynamic over time and space in river basins. There are differences in the physical features, levels of economic development, institutional arrangements and natural resources management arrangements. These influence how RBO performance indicators can be applied. Highly developed water institutions and wealthy economies have more capacity to develop RBOs, than those with less capacity. As well, new RBOs are more likely to succeed if grafted onto or emerge from reforming existing water organizations (World Bank 2006). There are differences in the stage of organizational development and management style so different indicators will be more relevant at different periods in the evolution of river basin management. A further dimension is the degree of political and legal complexity of different institutional arrangements for river basin management, especially in transboundary settings. Recent work suggests there is a continuum of increasing complexity in the water sector: in a sequence of basins with strong centralized governments (top-down, directive), to basins within federal nations with strong state governments (transboundary waters, similar to the USA), to basins shared by nations (international transboundary waters) (World Bank 2006).

So the creation of a *generic* 'Basin Organization Performance Report Card' on how RBOs have achieved IWRM is fanciful. Rather, RBOs should be recognized for their stage of organizational development, and evaluated in that context. This suggests some indicators will be irrelevant, for example, for basin organizations which are at the initial stage of implementing IWRM. As they mature, other indicators will be become more relevant. Three stages of development can be recognized (Table16), Initial/Functionary, Emerging Auto-adaptive, and Mature Auto-adaptive. Each stage has specific functions. There is a sequence of development implied by this pattern and functions will overlap through time.

The peak stage, the mature auto-adaptive RBO, has clearly identified roles and responsibilities; implements river basin management plans in response to changing conditions; operates effectively within established institutional arrangements; uses transparent reporting mechanisms; and uses an IWRM approach. A

mature RBO undertakes all Group 1-5 activities in Table 16 with the ability to adapt to new conditions in its basin, commences new projects and modifies past river basin management plans in response to changing conditions (e.g. new science, improved modeling and data, changing community demands, political imperatives). In this way the RBO operates as a learning organization. There has been a transition from a focus on efficiency and effectiveness towards 'learning by doing'. This stage will take many years to accomplish. The 115 general indicators in Table 15 are designed to illustrate a mature auto-adaptive RBO. In this setting, the majority of indicators will be present and will 'score' reasonably well on maturity ratings. That is, they will reflect 'best practice'.

Table 16 Functional stages in the evolution of an adaptive river basin organization

Functions	Initial RBO	Emerging Auto-adaptive RBO	Mature Auto-adaptive RBO
Group 1: Water (and natural resource) data collection and processing, systems modeling, water and natural resources planning, stakeholder consultation & issue clarification	X	X	X
Group 2: Project feasibility, design, implementation, operation and maintenance, raising funds, ongoing community consultation and awareness raising	X	X	X
Group 3: Allocating and monitoring water shares (quality and quantity and possible natural resources sharing), cost sharing principles		X	X
Group 4: Policy and strategy development for economic, social and environmental issues, community awareness and participation			X
Group 5: Monitoring water use and shares, monitoring pollution and environmental conditions, oversight and review role for projects promoted by RBO partners, monitoring and assessing the health of the basin's natural resources, monitoring the sustainability of resource management, review of strategic planning and implementation of modified plans			X

Source: Modified from (Comfort 1999; World Bank 2006)

The indicators listed in Table 15 imply that there is a sequential level of auto-adaptiveness in the governance capacity of the RBO as it matures through time. It is also implied that management in RBOs would accept intuitively that IWRM is the preferred approach in highly auto-adaptive systems. For example, the RBO would demonstrate classic IWRM features, e.g. coordinating action, engaging basin communities, seeking tradeoffs about options, cost-sharing projects, resolving conflicts in water allocation etc. But this is not always the case. RBOs do not always adopt the IWRM approach, and there is debate about what constitutes IWRM in many basin programs (Section 2). The indicators designed in this study are meant to showcase IWRM, according to the definition presented in this study (Section 2.1), and if an RBO has few IWRM characteristics, this will be reflected in little evidence and low scores. It will be unlikely to mature as an auto-adaptive RBO. It will not demonstrate evidence of an ability to auto-adapt to new science, new best management options, and other responsive mechanisms.

RBOs can act as a referent organization for natural resources management. Using the terminology of (Trist 1983), the referent RBO provides overarching, coordinating functions for its constituent organizations and gives it regional credibility, advocacy and leadership for basin scale natural resources management. A highly referent basin organization may take decades to establish. This classification is derived from similar work which identified degrees of auto-adaptability of disaster response organizations (Comfort 1999). This approach recognizes that social organizations display varying degrees of adaptiveness to their environment in response to changing conditions. They become learning rather than purely functionary organizations. Capable social organizations imbibe effective response systems and can incorporate new knowledge and

conditions as they arise. They evolve from stage to stage with a mature auto-adaptive organization having a highly advanced responsive capability.

Self assessment

RBO managers are the primary users of the indicators developed in this study. Their critical task is to identify which indicators are relevant to different stages of RBO development. In any basin setting, RBO managers can assess the effectiveness of their organization with the resources at hand, and can examine their own situation. They can assess and correct courses of action to stay on track to achieve societal goals. This involves:

- an assessment of basin management conditions: level of organization development, use of IWRM, staff resource availability to apply indicators;
- identification of current practices in basin management;
- identification and application of relevant indicators;
- comparison of current practices with known best practice, as reflected in indicators; and
- development of management responses.

This approach is best done by the RBO managers themselves and not by an external evaluator. Self-assessment has the following advantages. It creates:

- greater ownership of the state of best practice in the basin organization
- intimate knowledge of the basin and the basin organization strengths and weaknesses
- knowledge of the resources available to remedy faults and build on successes

However, it has the following disadvantages:

- easily manipulated by vested interests and thus prone to corruption
- cannot see the 'bigger picture' of national and state agendas in natural resources management, but captured by local interests
- depending on who is involved, may not represent all stakeholder interests.

To assist self evaluation, this report includes several tables of suggested performance indicators for different levels of RBO development other than the total list of general performance indicators in Table 15.

Scorecards

Table 17 is a classification scorecard which categorizes an RBO according to its level of auto-adaptiveness, using Table 16's functional categories. The second part of this spreadsheet is a hypothetical score card of functionality of an RBO. The scorecard provides a method for an RBO to identify its level of maturity – how far it is along the path to becoming a fully functioning, mature RBO. Finally, there is a summary statement about these RBO features and space for identifying areas of strengths and areas where improvements are warranted.

This score card is designed to be used as a tool to give a 'first cut' approximation of where the RBO is in the evolution towards auto-adaptiveness. It is recommended this be used prior to applying the indicator sets in the rest of this report.

Table 17 RBO Functional Classification, Initial Evaluation and Hypothetical Scores

Purpose: to classify and evaluate the stage of development of your basin organization

Name of River Basin Organization: The Hypothetical River Basin Commission

Step (1) CLASSIFICATION: What is the stage of river basin organization development?

What is the evidence for each of the following functions? Score each function according to the following rating scale.

Rating scale:	Score	Meaning
	0	NOT RELEVANT [We don't do this] OR TOO EARLY TO TELL [I can't score it yet]
	1	VERY LITTLE
	2	LITTLE
	3	NEITHER A LITTLE NOR A LOT - I'M NEUTRAL ON THAT ONE
	4	A LOT
	5	VERY MUCH
Group1 Functions		
Data collection and processing	2	[Note: Hypothetical data included for illustrative purposes only]
Systems modeling	3	
Water and natural resources planning	1	
Stakeholder consultation	5	
Issue clarification	3	
Group 1 mean scores:	2.8	
Group 2 Functions		
Project feasibility analysis	2	
Project implementation	3	
Operation and maintenance	1	
Raising funds	2	
Ongoing community consultation & awareness raising	4	
Group 2 mean scores:	2.4	
Group 3 Functions		
Allocating and monitoring water shares	0	
Cost sharing principles	0	
Group 3 mean scores:	0.0	

Group Functions	
Policy and strategy development for economic, social & environmental issues	0
Community awareness	4
Community participation	1
Group 4 mean scores:	1.7
Group 5 Functions	
Monitoring water use and shares	0
Monitoring pollution and environmental conditions	3
Oversight and review role for projects promoted by RBO partners	2
Monitoring and assessing the health of the basin's natural resources	0
Monitoring the sustainability of resource management	0
Review of strategic planning and implementation of modified plans	0
Group 5 mean scores:	0.8

Which groups rank highest?	1 and 2
Further comments:	This RBO has been operating for only 3 years

Step (2) INITIAL FUNCTIONAL EVALUATION: How effective are your basin organization's functions?

If the function exists, rate it according to effectiveness and importance to the basin organization. Score each function according to the following rating scale.

Rating scale:	Score	Meaning
	0	NOT RELEVANT [We don't do this] OR TOO EARLY TO TELL [I can't score it yet]
	1	VERY LITTLE
	2	LITTLE
	3	NEITHER A LITTLE NOR A LOT - I'M NEUTRAL ON THAT ONE
	4	A LOT
	5	VERY MUCH

[Note: Hypothetical data included for illustrative purposes only]	If function exists, how effective is its use?	If function exists, how important is it to the RBO?	SCORE (OUT OF 5)

Functions - Group 1			
Data collection and processing			
Systems modeling	4	5	4.5
Water and natural resources planning	5	5	5.0
Stakeholder consultation	4	4	4.0
Issue clarification	4	5	4.5
Group 1 mean scores:	4.3	4.8	4.5
Functions - Group 2			
Project feasibility analysis	1	4	2.5
Project implementation	2	4	3.0
Operation and maintenance	0	0	0.0
Raising funds	2	4	3.0
Ongoing community consultation & awareness raising	3	4	3.5
Group 2 mean scores:	1.6	3.2	2.4
Functions - Group 3			
Allocating and monitoring water shares	0	0	0.0
Cost sharing principles	1	3	2.0
Group 3 mean scores:	0.5	1.5	1.0
Functions - Group 4			
Policy and strategy development for economic, social & environmental issues	4	0	2
Community awareness	3	0	2
Community participation	2	0	1
Group 4 mean scores:	3.0	0.0	1.5
Functions - Group 5			
Monitoring water use and shares	3	5	4
Monitoring pollution and environmental conditions	4	5	5
Oversight and review role for projects promoted by RBO partners	3	5	4
Monitoring and assessing the health of the basin's natural resources	5	4	5
Monitoring the sustainability of resource management	3	4	4
Review of strategic planning and implementation of modified plans	3	4	4
Group 5 mean scores:			4.0

Step (3) YOUR RBO SUMMARY

Classification	Type:	Tick which one:	Notes:
Judged on the above results, my basin organization is more than likely to be:	Initial functioning/Set up		Groups 1 and 2 characterize an initial functioning basin organization
	Emerging, autoadaptive		Groups 1,2 and 3 characterize an emerging, auto-adaptive basin organization
	Mature, auto-adaptive		Groups 1 through 5 are found in a mature, auto-adaptive basin organization

Evaluation	Overall scores
Groups 1 and 2 functions	3.5
Groups 1,2 and 3 functions	2.0
Groups 1 to 5 functions	2.7

Remember: High scores in a group reflect the stage of development of the river basin organization

Final Comments

My RBO's areas of strengths are:	Add your comments here
	Add your comments here
My RBO's areas for improvement are:	Add your comments here
	Add your comments here
Further comments:	Add your comments here

Stepped development of RBOs

Having classified itself according to stage of evolution, the basin organization is now better placed to self assess its performance in IWRM. As RBOs become more mature and use more IWRM functions, the number of relevant indicators will increase. The indicators developed for mature auto-adaptive basin organizations do not necessarily apply to less developed basin organizations. As a result, two other sets of indicators were developed in the study. These were derived from matching functions with indicators related to those functions for each phase. The results are suggestive only and discernment should be used when applying them to any RBO.

Table 18 is a list of twenty one (21) general performance indicators of an Initial/Functionary RBO. This is the set up phase for a RBO and may last for perhaps five years, or longer if the RBO is unable to adapt to new conditions. It involves the establishment of the RBO within current laws and existing organizations.

Table 19 is a list of sixty one (61) general performance indicators of an Emerging Auto-adaptive RBO, after the startup phase of river basin organizations. This phase incorporates all functions of an initial/functionary RBO, as well as growing levels of capacity and a broader range of functions. The emphasis is on water resources allocation, assuming river basin management plans have been designed and allocation mechanisms reflect the results of systems modeling. Data collection and processing have been used to feed systems modeling to inform the water resource allocation procedures.

The choice of indicators listed in Tables 18, 19 is suggestive and an RBO should decide what is relevant, measurable and reportable in its own situation. However, discarding an indicator because of the inability to be measured or reported, may jeopardize that RBO's ability to enact IWRM, as the indicators were derived from known best practice. They thus act as a 'road map', suggesting functionality for each of three levels of auto-adaptiveness. So, it is recommended that practitioners provide their own subjective scores as a 'first cut' estimate of performance. This is particularly valuable when there are no quantitative, objective scores available nor data sets.

Who uses the scorecards? How are they used?

The scorecards can be used by three groups:

- The RBO's staff ~ the scorecard can be used internally as a quality assessment and performance monitoring tool. It provides the RBO with annual or biannual assessments of progress made against its organizational objectives. It also provides a 'road map' of preferred IWRM attributes – the directions to advance to implement IWRM;
- The RBO's stakeholders in the community ~ the scorecard can be used externally to provide outside interests with a mechanism to review the RBO's progress from the perspective of a stakeholder;
- Agencies to whom the RBO reports and with whom they work ~ the scorecard can be used by government agencies to give a second external review process and provide transparency in RBO reporting.

Simple measures of effectiveness – rating scores of 0 to 5 as used in Table 17 can be used by the three groups.

Thus the scorecards provide a three way performance evaluation approach which adds value to internal performance reviews undertaken solely by the RBO and give a broader perspective of achievements in IWRM.

Table 18 General Performance Indicators of Initial/Functionary River Basin Organizations

Indicator Group/Acronym	Good Governance Factor	#	Indicator
GOALS AND PLANNING			
GOALSPEC/PLANNING	Specificity of the problem domain: scope, scale and boundary identification and realistic goal formulation	33	Existence and use of water and natural resources planning: well-defined objectives, mutually beneficial and desirable goals, and resource development priorities in a long-term integrated basin management plan
		34	Evidence of an awareness of resource availability constraints on and options for development in river basin management plans
FINANCIAL SUSTAINABILITY			
FINANCE-AVAILABLE	Financing river basin management processes, finance to support a river basin organization; And training in integrated management	39	Existence of ongoing funding for river basin management
		40	Funding exists and is adequate to address at least priority natural resources management issues
		41	Funding appropriations established and operating within National and State resources management investment
FINANCETOOL	The quality of tools to finance IRBM are assessed regarding their longevity and ability to providing ongoing natural resources management and of a quality and quantity to make a difference	44	Availability of adequate financial resources
ORGANIZATIONAL DESIGN			
POLICY	National land and water policy sets the framework for the development of integrated river basin management; policy which is recognized as a tool for effective implementation of IWRM	57	National land and water policies stipulate use of river basin as a management unit for natural resources management
BOUNDARIES	Protocols governing position and boundaries	58	Evidence of institutional arrangements for basin management which specify roles and responsibilities of different entities and stakeholders
		59	Evidence that 'rules' of participation specify membership representation and exiting decision settings

REALISM	Realistic functions ~ RBOs make decisions aware of the reality of existing conditions; often compromise on the best management options is required; a stage implementation procedure is needed - addressing the most pressing resource management issues first, and recognizing what is possible in the short term; this process must be backed up by long-term planning	60	Degree to which RBO roles, responsibilities and functions reflect realities of existing conditions
		61	Evidence of strategic planning and implementation process based on communications, coordination and cooperation within a river basin organization
		62	Use of a stepped approach to decision-making is used - do what is achievable first
ORGANIZSTYLE	Characteristics of organizational structure - degree to which they address the needs of the basin's context: a choice of organizational structure is required according to: the degree of RBO development: for cross-sectoral planning and management? For coordination and advisory roles? For regulation and development authorization	63	Evidence that organization type reflects prevailing needs for river basin management
ROLE OF LAW			
LAW	IRBM is supported by strong and comprehensive, but flexible legislation, regulations, decrees etc which ensure "fairness" in basin-wide decisions, a process of accountability identifies RBO functions, structure and financial base and whose administration and operation is based upon a decision-making process of authority, responsibility and accountability	70	Legislation specifies functions, structure, financial base & accountability mechanisms for river basin management
INFORMATION AND RESEARCH			
INFOEXCHANGE	Protocols information exchange	80	Evidence of a method to specify type of information, how it is presented and timing of information exchange in the RBO's information systems
INFOPROTOOL	Protocols which ensure best use of available data, information, knowledge and wisdom and presented in a river basin IMS (information management system) and the use of GIS (Geographic Information Systems)	85	Evidence of integration of the information on a spatial scale: provides a resource management atlas in GIS at the sub-basin scale specifying environmental conditions and best management options

INFOTOOLS	Knowledge system ~ RBOs require a high quality, reliable, uniform and comprehensive data network, available to all stakeholders in ways which suit their needs; systems and models for analysis which allow "knowledgeable" natural resources/water management policies and strategies to be developed and implemented.	91	Evidence of uniformity of information system for entire basin
		92	Evidence that information management systems and models are used for analysis and prioritizing resource management options
RESEARCHTOOL	Culture of research-knowledge links	94	Existence of data providers who understand the basin's structure, management functions and resource use activities.
		95	Existence of a GIS which describes research programs (and outputs) for specific sub-basin locations
		96	Use of joint assessment tools like multi-objectives decision support systems, Policy Delphi techniques and others, to manage research output and use it to inform the basin's strategic natural resources management decisions

Table 19 General Performance Indicators of Emerging Auto-adaptive River Basin Organizations

Indicator Group/Acronym	Good Governance Factor		Indicator
COORDINATED DECISION-MAKING			
CROSS-SEC	Cross-sectoral linkages for coordination of natural resources management: there is integrated action used across all natural resource issues, which means agencies do not find singular solutions but look at impacts and improvements across the spectrum of natural resources, and the development of regional (basin scale) natural resources management policies.	2	Existence of national and/or international coordination arrangements (dialogues, MOUs, joint programs of action) between states for river basin management
CONSENSUS	Consensus based agreements	7	Use of consensus-based decision-making in basin-wide planning and management to balance all user needs for water resources and to provide protection from water related hazards
		8	Evidence of use of consensus methods to broker agreements on commitments within the basin, coupled with evidence of mechanisms to monitor those agreements
INFORMAL-WATER	Jurisdiction over an informal water sector is critical: regulation is meaningless if there is ineffective management of water use when there are vast numbers of small-scale users and ground water pumpers who are not linked with public institutions	9	Existence of small-scale local public water management institutions and results are recorded which demonstrate improvements made
PROTOAUTH	Protocols governing the use of coordination authority: protocols are defined and used for the array of coordination activities (who is involved), how binding or permissive is the coordination (what can be done) and on what basis is the involvement (law, policy, informal agreement)	11	Evidence of authority given to the RBO to coordinate actions and programs across the basin
		12	Existence of a business plan for the RBO which specifies coordination mechanisms between entities
		13	Existence of laws which specify authority of river basin organization to coordinate entities
RESPONSIVE DECISION-MAKING			
ADAPTOOL	Adaptive management the ability of the decision system to use flexible, adaptive methods, reacting to new research and understandings and deciding on better ways to manage natural resources	20	Use of a “learn by doing” approach by the basin organization

EFFICIENCY	Focus of efforts towards maximizing water use efficiency by using groundwater and soil water resources: capturing water where it falls and mitigating flood and drought risk; and the use of risk management to address critical water shortages (climatic drought, river drought);	23	Evidence that the basin management decision processes address critical problems first: e.g. water scarcity, flooding, droughts for very large and rapidly growing populations through risk assessment;
		24	Evidence of programs which promote more efficient water management techniques in agriculture to achieve more crop, cash and jobs for each drop
		25	Evidence of programs which capture water more effectively in the soil profile (capture water where it falls) rather than increased river diversions
		26	Evidence of programs to raise local productivity through village-led/local government initiatives in water harvesting
VERTICALINKS	Vertical management linkages	27	Evidence of methods to integrate decision-making vertically though organizations: linking local management to Cabinet-levels of government
GOALS AND PLANNING			
GOALSHIFT	The river basin management process has moved from a purely resource exploitation ethic to incorporate environmental management, social impact assessment, sustainability goals and other region specific priorities; resource development forms part of a long-term IRBM Plan; prioritization of natural resources management issues occurs	30	Evidence of an IWRM approach used as the basis for land and water resources management
		31	Use of impact assessment procedures – including Strategic Environmental Assessment
		32	Use of environmental management systems and eco-audits, voluntary regulation of practices and international standards e.g. ISO14001 (International Organization for Standardization, 14000 series on management quality) and ISO 224 [self assessment with all stakeholders pf service performances of water and sanitation utilities), EMAS (Environmental Management and Audit Scheme, the European Union's voluntary, eco-auditing and management system)
GOALSPEC/PLANNING/COMPLETE	Specificity of the problem domain and completion of work to address that problem domain	33	Existence and use of water and natural resources planning: well-defined objectives, mutually beneficial and desirable goals, and resource development priorities in a long-term integrated basin management plan
		34	Evidence of an awareness of resource availability constraints on and options for development in river basin management plans
		35	Evidence of completion of river basin management plans
FINANCIAL SUSTAINABILITY			
COSTSHARETOOL	Cost-sharing arrangements, joint ventures and agreements on sharing the cost of common projects are used to finance IRBM	37	Evidence of cost-sharing arrangements
		38	Evidence of joint ventures

FINANCE-AVAILABLE	Financing river basin management processes, finance to support a river basin organization; And training in integrated management	39	Existence of ongoing funding for river basin management
		40	Funding exists and is adequate to address at least priority natural resources management issues
		41	Funding appropriations established and operating within National and State resources management investment
		42	Funding exists for staff training in coordination practices
FINANCETOOL	The quality of tools to finance IRBM are assessed regarding their longevity and ability to providing ongoing natural resources management and of a quality and quantity to make a difference	43	Evidence of transparency mechanisms to declare all revenue streams are transparent, to stakeholders
		44	Availability of adequate financial resources
PRICINGTOOL	Water pricing and demand management ~ pricing mechanisms are applied to situations where water charges are able to be collected; the price of water retains a poverty clause to provide water as a fundamental human right; alternative demand management technologies are used with pricing, where possible.	45	Evidence of economic assessment of water management options
		46	Evidence of cost-recovery mechanisms used in water management plans
		47	Evidence of water pricing used to recover some or all of development costs
ORGANIZATIONAL DESIGN			
POLICY	National land and water policy sets the framework for the development of integrated river basin management; policy which is recognized as a tool for effective implementation of IWRM	57	National land and water policies stipulate use of river basin as a management unit for natural resources management
BOUNDARIES	Protocols governing position and boundaries	58	Evidence of institutional arrangements for basin management which specify roles and responsibilities of different entities and stakeholders
		59	Evidence that 'rules' of participation specify membership representation and exiting decision settings
REALISM	Realistic functions ~ RBOs make decisions aware of the reality of existing conditions; often compromise on the best management options is required; a stage implementation procedure is needed - addressing the most pressing resource management issues first, and recognizing what is possible in the short term; this process must be backed up by long-term planning	60	Degree to which RBO roles, responsibilities and functions reflect realities of existing conditions
		61	Evidence of strategic planning and implementation process based on communications, coordination and cooperation within a river basin organization
		62	Use of a stepped approach to decision-making is used - do what is achievable first

ORGANIZSTYLE	Characteristics of organizational structure - degree to which they address the needs of the basin's context: a choice of organizational structure is required according to: the degree of RBO development: for cross-sectoral planning and management? For coordination and advisory roles? For regulation and development authorization	63	Evidence that organization type reflects prevailing needs for river basin management
		64	Use of flatter organizational structures to improve coordination rather than steeply hierarchical structures
		65	Methods in place to deal with multilateral donor agencies and/or funding sources
		66	Evidence that RBO structures avoid dominance of one sectoral interest group
STABLEINST	Institutional stability: a stable institutional framework exists which overcomes fragmentation and overlap of responsibilities	67	The specification of organizational responsibilities is clear and determined by policy and law
ROLE OF LAW			
LAW	IRBM is supported by strong and comprehensive, but flexible legislation, regulations, decrees etc which ensure "fairness" in basin-wide decisions, a process of accountability identifies RBO functions, structure and financial base and whose administration and operation is based upon a decision-making process of authority, responsibility and accountability	69	Existence of legislation to enact natural resources management
		70	Legislation specifies functions, structure, financial base & accountability mechanisms for river basin management
LEGALACTION	Legal actions	72	Evidence that the RBO has the mandate to ensure they tale the 'big picture' in river basin management
TRAINING AND CAPACITY BUILDING			
BUILDCAPAC	Capacity building mechanisms relevant to their cultural, political and administrative setting and level of economic development of the country within which they operate	75	Evidence that the RBO provides the leading voice on basin wide land and water issues
		76	Evidence of the RBO informing its constituencies and decision-makers of basin issues and management solutions
TRAINING	Human resources capacity building	79	Evidence of training programs in the concept of IWRM and the tools of coordinated management
INFORMATION AND RESEARCH			
INFOEXCHANGE	Protocols information exchange	80	Evidence of a method to specify type of information, how it is presented and timing of information exchange in the RBO's information systems

INFOPROTOOL	Protocols which ensure best use of available data, information, knowledge and wisdom and presented in a river basin IMS (information management system) and the use of GIS (Geographic Information Systems)	85	Evidence of integration of the information on a spatial scale: provides a resource management atlas in GIS at the sub-basin scale specifying environmental conditions and best management options
INFOTOOLS	Knowledge system ~ RBOs require a high quality, reliable, uniform and comprehensive data network, available to all stakeholders in ways which suit their needs; systems and models for analysis which allow "knowledgeable" natural resources/water management policies and strategies to be developed and implemented.	89	Evidence of high reliability of information system – evidence of lack of breakdowns
		90	Evidence of sharing of data in the information system by stakeholders
		91	Evidence of uniformity of information system for entire basin
		92	Evidence that information management systems and models are used for analysis and prioritizing resource management options
RESEARCHTOOL	Culture of research-knowledge links	94	Existence of data providers who understand the basin's structure, management functions and resource use activities.
		95	Existence of a GIS which describes research programs (and outputs) for specific sub-basin locations
		96	Use of joint assessment tools like multi-objectives decision support systems, Policy Delphi techniques and others, to manage research output and use it to inform the basin's strategic natural resources management decisions
PRIVATE AND PUBLIC SECTOR ROLES			
PARTICIPTOOL	Community participation ~ strong community awareness and participation processes exist to enhance greater ownership of basin scale plans of action; the emphasis is placed on wide public and stakeholder participation in decision-making at all levels; local empowerment is facilitated if participation is a high priority	106	Existence of actions to empower local organizations and individuals, if participation is a high priority
		107	Evidence of local awareness of river basin management issues in basin community and high levels of government
		110	Evidence that river basin management plan is driven by bottom up water sector initiatives with strong NGO and village level management
		113	Use of a common language despite ethnic differences
PRIVSECTOOL	Private sector participation in IRBM - There are ample opportunities for the private sector to enact IRBM at the local level	115	Evidence of joint ventures, funding and exploiting resources

5.2 Application to river basin commissions

The Delaware River Basin Commission (DRBC) in eastern USA was used as the first application of the general performance indicators listed in Table 15. This RBO was chosen as it is a functioning US basin commission. River basin commissions remain on the institutional landscape of American water resources management, despite many changes and evolutions, some Commissions lasting for over four decades. A snapshot of selected current US water commissions, most with basin management mandates, is included as Tables 20 and 21.

The DRBC was established in 1961 as a compact commission with multi-purpose functions. Its current work plan is the 2004 Water Resources Plan which endorses integrated management (Principle 5). The DRBC will operate under a new Water Resources Program, FY 2006-2012. It has a strong interstate component, is based on a compact, was a Title II basin commission and has survived and adapted to 40 years of changing US national water policy. In this respect, it provides valuable insights into how RBOs can mature from the initial reasons for existing into a reflexive, learning organization, responding to current issues and adopting an integrated approach. These characteristics were gleaned by the author from internal discussion with Corps' Institute for Water Resources staff and by several discussions with senior management of the Interstate Council on Water Policy and the Commission itself.

The purpose of the application was to identify those indicators deemed most relevant to an interstate basin organization. Sixty-four (64) indicators were selected from Table 15's general indicators for measuring the DRBC's performance in implementing IWRM. The indicators were chosen as those tagged as 'most relevant' and 'relevant' in a workshop with DRBC staff during this study. The indicators were then assembled into eight categories (A to H) and twenty performance benchmarks were developed (Table 22).

Table 20 General features of selected US interstate Water Commissions

	Members	Year Created	Drainage Area	Population Served	Staff Size	Annual Budget	Contact Information and Web Site
Delaware River Basin Commission (DRBC)	Federal/Interstate United States, Delaware, New Jersey, New York, Pennsylvania	1961	13,539 sq. miles	7+ million in-basin, 17+ million total	48	$5 million	25 State Police Drive P.O. Box 7360 West Trenton, NJ 08628 (609) 883-9500 (609) 883-9522 fax www.drbc.net
Interstate Commission on the Potomac River Basin (ICPRB)	Federal/Interstate United States District of Columbia Maryland, Pennsylvania, Virginia, West Virginia	1940	14,670 sq. miles	5.34 million (3.6 million in metro DC area)	24	$2.56 million	6110 Executive Boulevard, Suite 300 Rockville, MD20852 (301) 984-1908 (301) 984-5841 fax www.potomacriver.org
Interstate Environmental Commission (IEC)	Interstate Only Connecticut, New Jersey, New York	1936	797 sq. miles of estuarine waters	14 million	17	$1.6 million	311 West 43rd Street Suite 201 New York, NY10036 (212) 582-0380 (212) 581-5719 fax www.iec-nynjct.org
New England Interstate Water Pollution Control Commission (NEIWPCC)	Interstate Only Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, Vermont	1947	36,293 sq. miles	31.5 million	52	$3.3 million	Boott Mills South 100 Foot of John Street Lowell, MA01852 (978) 323-7929 (978) 323-7919 fax www.neiwpcc.org
Ohio River Valley Water Sanitation Commission (ORSANCO)	Interstate Only Illinois, Indiana, Kentucky, New York, Ohio, Pennsylvania, Virginia, West Virginia	1948	164,000 sq miles (in the signatory states)	25 million	30	$5 million	5735 Kellogg Avenue Cincinnati, OH45228 (513) 231-7719 (513) 231-7761 fax www.orsanco.org
Susquehanna River Basin Commission (SRBC)	Federal/Interstate United States, Maryland, New York, Pennsylvania	1971	27,510 sq. miles	4.1 million	35 perm-anent	$4 million FY04	1721 North Front Street Harrisburg, PA17102 (717) 238-0423 (717) 238-2436 fax www.srbc.net

Source: Delaware River Basin Commission, 2005, personal communication

Table 21 Scope of services of Interstate Water Commissions

	Water Quality	Sets WQ Stds.	Water Quality	Flood Control	Education Outreach	Regulatory	Advisory	Key Projects
Delaware River Basin Commission (DRBC)	X	X	X	X	X	X		Comprehensive/Basin Plan; Toxics/Estuary TMDL for PCBs; Southeast Pa. Ground Water Protected Area; Lower Delaware Monitoring Program; Inter-state Flow Management; Christina Basin Clean Water Partnership; Tri-State Watershed Management Project
Interstate Commission on the Potomac River Basin (ICPRB)	X	X (limited by Con-gress)	X	X	X		X	Section for Cooperative Water Supply Operations (CO-OP); SWAP for Various Areas, including DC; Chesapeake Bay Program; TMDL/Stream Assessment Support; Spill Model/Tracking; Bi-Monthly Newsletter (58th Year)
Interstate Environmental Commission (IEC)	X	X			X	X		NPDES Sampling of STPs/Industrials/CSOs/ MS4s; Hypoxia & Pathogens Monitoring in Support of TMDLs for 2 NEP Programs; Coordination of Regional Bypass Response Program; Testing of Shellfish Waters for ISSP Compliance; Active Roles in NEP Programs; Regional CWA §305(b) Assessment
New England Interstate Water Pollution Control Commission (NEIWPCC)	X		X		X		X	WQ: Amb Nutrient Criteria, Consol. Assess. & Listing Method, Biocriteria, Stormwater, Comp. Watershed Mon. & Assess. Initiatives, NPS, TMDL Develop., Wetlands; Wastewater: Innov. Alt. On-Site Technol., Training, Residuals, Collection Systs. ; Drinking Water: Radionuclides Treat. & Disp., Low Flow, Leaking Undergr. Stor. Tanks, MTBE & Ethanol Studies, Source Water Assess.
Ohio River Valley Water Sanitation Commission (ORSANCO)	X	X			X	X		Water Quality/Biological Monitoring; Spill Detection, Notification and Response; Ohio River TMDLs; Seasonal Monitoring (Bacteria, Altrazine, Algae); Source Water Protection; Waste Discharge Standards; Urban Wet Weather Impact Studies
Susquehanna River Basin Commission (SRBC)	X		X	X	X	X		Comp., Basinwide Plan; WQ Monitoring (Biol. & Chem.), e.g. Nutrient/Sediment Mon. for Ches. Bay, Interstate Streams, Maj. Subbasin Surveys; Source Water Assess. /Protect. Plans; TMDL Develop.; Environ. Protect. Via Reg. of Maj. Water Withdrawals/Cons. Water Uses; Spill Response/Early Warning; Migratory Fish Restoration

Source: Delaware River Basin Commission, 2005, personal communication.

Table 22 Benchmarks of IWRM use by US river basin commissions

(A) DECISION-MAKING
Decision-making by the RBC occurs within a national framework of natural resources management objectives and investments
Decision-making is consensual & coordinates across sectors in the basin
Decision-making is reflected in a business plan, is prioritized, focuses on efficiency, links vertically to governments & provides stakeholder access to government

(B) GOALS AND PLANNING
An IWRM approach is agreed to and practiced by the RBC
Objectives specified in and articulated through feasible options in a river basin management plan

(C) FINANCING
River basin management is financed through cost-sharing
Financing is on-going, guaranteed, adequate, linked to national and state priorities
Ex-ante and ex-post economic assessments of management options practiced
Water pricing and alternative demand management practiced

(D) RBC FUNCTIONS
Stable democratic conventions exist
RBC functions are co-ordination driven, are realistic, specify clearly roles & responsibilities, & are specified by both national water policy and law

(E) LAW
Ongoing laws exist to enact natural resources management relevant to basin management
Laws specify RBC functions

(F) STAFF TRAINING
RBC has a program in place to improve staff quality for management skills, leadership and communication

(G) INFORMATION & MONITORING
RBC has its own or joint access to a well developed, accurate, up-to-date, information and monitoring system
Science informs the RBC through modeling and spatial representation of options, which are costed and linked to the RBC decision system: options are delivered through strategic planning and decision-making
The information management system reports on how the basin is being managed and resources are consumed and protected

(H) BUILDING CAPACITY FOR COORDINATED MANAGEMENT WITH STAKEHOLDERS
Public involvement processes are effective: provide for joint decision-making and conflicts are resolved
Roles and responsibilities of stakeholders are specified and understood
RBC uses joint ventures and coordinates strategic decisions between partners

Table 23 is a self-reporting scorecard of benchmarks and selected performance indicators of IWRM for river basin commissions. The scorecard can be used by river basin commissions as a template for self-evaluation against known best practice IRBM. It provides a 'road-map' of the types of functions for effective basin management. It is recommended that it be used cautiously and that an examination of the setting be undertaken prior to the use of this scorecard. Users may wish to develop numerical responses to the maturity weightings and create their own meanings of the implementation and achievement meant by the terms: 'Poor', 'Fair', 'Good' and 'Excellent'. This will improve consistency and reliability with repeated use. Similarly, users can develop their own 'poor' to 'excellent' rankings of the twenty benchmarks identified in this study in Table 22.

Once again a three way approach to the use of the scorecards, as discussed above, is recommended.

Table 23 A Self-reporting Scorecard of Benchmarks and Key Performance Indicators for River Basin Commissions

RBC Performance Indicator Acronym	Indicator #		Source of evidence [Reports, Reviews, Meeting Outcome Statements, Evaluations, Stakeholders' Feedback]	Evidence Exists? [Yes/No/Some]	Achievement Rating			
					Poor	Fair	Good	Excellent
DECISION-MAKING Benchmarks: Decision-making by the RBC occurs within a national framework of natural resources management objectives and investments Decision-making is consensual & coordinates across sectors in the basin Decision-making is reflected in a business plan, is prioritized, focuses on efficiency, links vertically to governments & provides stakeholder access to government								
DM1	1	Existence of high level, cross-sectoral policy links between natural resources management, health, population and economic development portfolios of government						
DM2	2	Existence of national and/or international coordination arrangements (dialogues, MOUs, joint programs of action) between states for river basin management						
DM3	7	Use of consensus-based decision-making in basin-wide planning and management to balance all user needs for water resources and to provide protection from water related hazards						
DM4	8	Evidence of use of consensus methods to broker agreements on commitments within the basin, coupled with evidence of mechanisms to monitor those agreements						
DM5	11	Evidence of authority given to the RBC to coordinate actions and programs across the basin						
DM6	12	Existence of a business plan for the RBC which specifies coordination mechanisms between entities						
DM7	13	Existence of laws which specify authority of river basin organization to coordinate entities						
DM8	16	Evidence that local government and state agency pollution laws and regulations are congruent with river basin management plans and goals						
DM9	18	Existence of national governments guidelines for priority action areas in natural resources management which can be implemented by basin organizations and are supported by national funding mechanisms						
DM10	23	Evidence that the basin management decision processes address critical problems first: e.g. water scarcity, flooding, droughts for very large and rapidly growing populations through risk assessment;						
DM11	24	Evidence of programs which promote more efficient water management techniques in agriculture to achieve more crop, cash and jobs for each drop						
DM12	27	Evidence of methods to integrate decision-making vertically though organizations: linking local management to Cabinet-levels of government						
DM13	28	Evidence of measures to link RBC to high levels of government decision-making						
DM14	29	Evidence of stakeholders' access to governments through RBC about natural resources management issues						
GOALS, GOAL SHIFT AND GOAL COMPLETION Benchmarks: An IWRM approach is agreed to and practiced by the RBC Objectives specified in and articulated through feasible options in a river basins management plan								
G1	30	Evidence of an IWRM approach used as the basis for land and water resources						

		management						
G2	33	Existence and use of water and natural resources planning: well-defined objectives, mutually beneficial and desirable goals, and resource development priorities in a long-term integrated basin management plan						
G3	34	Evidence of an awareness of resource availability constraints on and options for development in river basin management plans						
G4	35	Evidence of completion of river basin management plans						
G5	36	Evidence of clear specification of the roles, responsibilities and functions of river basin organization and roles are distinguished from those of other entities						
FINANCING Benchmarks: River basin management is financed through cost-sharing Financing is on-going, guaranteed, adequate, linked to national and state priorities Ex-ante and ex-post economic assessments of management options practiced Water pricing and alternative demand management practiced								
F1	37	Evidence of use of cost-sharing arrangements						
F2	39	Existence of ongoing funding for river basin management						
F3	40	Funding exists and is adequate to address at least priority natural resources management issues						
F4	41	Funding appropriations established and operating within National and State resources management investment						
F5	44	Availability of adequate financial resources						
F6	45	Evidence of use of economic assessment of water management options						
F7	46	Evidence of cost-recovery mechanisms used in water management plans						
F8	47	Evidence of water pricing used to recover some or all of development costs						
F9	48	Evidence of alternative demand management technologies used to manage water use						
RBC FUNCTIONS Benchmarks: Stable democratic conventions exist RBC functions are co-ordination driven, are realistic, specify clearly roles & responsibilities, & are specified by both national water policy and law								
O1	49	Existence of democratically elected governments which facilitate good governance						
O2	51	Evidence that national water policy functions remain through successive administrations						
O3	58	Evidence of institutional arrangements for basin management which specify roles and responsibilities of different entities and stakeholders						
O4	60	Degree to which RBC roles, responsibilities and functions reflect realities of existing conditions						
O5	61	Evidence of strategic planning and implementation process based on communications, coordination and cooperation within a river basin organization						
O6	66	Evidence that RBC structures avoid dominance of one sectoral interest group						
O7	67	The specification of organizational responsibilities is clear and determined by water policy and law						

08	68	Mechanisms exist in government to reduce jurisdictional overlap and reduce duplication (such as regulatory tribunals)						
LAW Benchmarks: Ongoing laws exist to enact natural resources management relevant to basin management Laws specify RBC functions								
L1	69	Existence of legislation to enact natural resources management						
L2	70	Legislation specifies functions, structure, financial base & accountability mechanisms for river basin management						
L3	52	Evidence that a system of water laws remains through successive administrations						
STAFF TRAINING Benchmarks: RBC has a program in place to improve staff quality for management skills, leadership and communication								
ST1	74	Evidence of training programs to improve the skills levels of river basin managers and stakeholders						
ST2	75	Evidence that the RBC provides the leading voice on basin wide land and water issues						
ST3	76	Evidence of the RBC informing its constituencies and decision-makers of basin issues and management solutions						
ST4	77	Evidence that the RBC leadership is well-trained, articulate, responsible and has 'listening skills'						
ST5	78	Existence of well-trained staff with capacity to work in teams and plan across sectors and disciplines						
INFORMATION & MONITORING Benchmarks: RBC has its own or joint access to a well developed, accurate, up-to-date, information and monitoring system Science informs the RBC through modeling and spatial representation of options, which are costed and linked to the RBC decision system: options are delivered through strategic planning and decision-making The information management system reports on how the basin is being managed and resources are consumed and protected								
IM1	80	Evidence of a method to specify type of information, how it is presented and timing of information exchange in the RBC's information systems						
IM2	81	Evidence that information is accessible by relevant stakeholders						
IM3	82	Evidence of information is appropriate to relevant stakeholders						
IM4	85	Evidence of integration of the information on a spatial scale: provides a resource management atlas in GIS at the sub-basin scale specifying environmental conditions and best management options						
IM5	87	Evidence that two-way vertical information exchange mechanisms are made a priority.						
IM6	88	Evidence that data and information are quality controlled including strong systems of field measurements and of data collection						
IM7	89	Evidence of high reliability of information system - evidence of lack of breakdowns						
IM8	90	Evidence of sharing of data in the information system by stakeholders						
IM9	91	Evidence of uniformity of information system for entire basin						
IM10	92	Evidence that information management systems and models are used for analysis and prioritizing resource management options						

IM11	97	Evidence of research collaboration between RBC, research community, government agencies and NGOs						
IM12	100	Reporting mechanisms in place between RBC and high levels of government						
IM13	101	Existence of a monitoring and information system, including a permanent, reliable and optimized system of meteorological, water resources, water use measurements linked to basin decision-making						
IM14	102	Use of a monitoring system that derives from a accurate, uniform and comprehensive data network, systems and models for analysis						
IM15	103	Use of a monitoring system and that facilitates the use of "knowledgeable" natural resources/water management policies and strategies and is linked to the basin decision systems						
COORDINATED MANAGEMENT WITH STAKEHOLDERS Benchmarks: Public involvement processes are effective: provide for joint decision-making and conflicts are resolved Roles and responsibilities of stakeholders are specified and understood RBC uses joint ventures and coordinates strategic decisions between partners								
CMS1	105	Existence of methods in the RBC to effectively manage public involvement and avoid stalemates						
CMS2	108	Evidence of capacity of local agencies, non-government organizations and user organizations to implement preferred management options in the basin						
CMS3	112	Evidence that donor agencies are sensitive to approaches to water planning						
CMS4	114	Evidence of clear specification of private sector involvement and links to basin decision systems						
CMS5	115	Evidence of joint ventures, funding and exploiting resources						

5.3 Application to a Corps of Engineers valley-scale (sub-basin) project and a UNESCO HELP basin

The second application of the general performance indicators was to the Willamette Valley, Oregon. Two key projects occur here – the Corps of Engineers Willamette River Floodplain Restoration Project (US Army Corps of Engineers 2004b) and the Willamette Restoration Strategy [involving the UNESCO HELP Program] (Anonymous 2001). Both use IWRM principles.

The Corps case was chosen as it represents a valley (or meso-) scale Corps project (the Willamette Valley is 29728 km^2 and a river length of 656 kms.). No attempt has been made to use this as a typical Corps basin project, rather to see this as a current operating project and to explore how the indicators developed in this study could be applied at this sub-basin scale. The Willamette Restoration Strategy is an example of an operational UNESCO HELP Basin (defined in Table 24). In the course of this study, it was apparent that the study would benefit from interaction with this program, as UNESCO is involved in the development of performance indicators for a range of sustainability initiatives. The same location of the two projects added economies to field work for this study, as did the intrastate emphasis and the international significance of the site.

The approach used in Willamette River Floodplain Restoration Project demonstrates many features of best practice IWRM. Here a strident effort is being made to undertake cross-sectoral management, stakeholder involvement, use of independent technical advice and a highly developed information system, clear planning strategies with milestones and cost-sharing. Once again, these suggest there is an opportunity to use the performance indicators developed in this study.

The purpose of the application was to identify those indicators deemed most relevant to a project scale. In an exploratory workshop with CoE and HELP Basin staff, the study found that at the project/sub-basin level, most of the 115 indicators were applicable. In the Willamette, there are international environmental concerns, recognition of watershed management achievement (by the UNESCO HELP program), national environmental law impacting decisions (Endangered Species Act), a rich experience of public engagement, and critical floodplain restoration issues. These conditions supported the use of many of the general performance indicators.

However, the large number of relevant performance indicators makes for a daunting, unworkable checklist considering the time constraints of a CoE project or a HELP Basin project. Consequently, I selected a small number of indicators, using comments recorded in the exploratory workshop with agency staff and comparing the comments with those of the workshop with the Delaware River Basin Commission reported above. I selected those indicators which were more relevant to project scale management, rather than basin scale management. However, there is overlap in the indicators chosen, because the local Willamette project does consider issues on a much larger scale – issues of national and international significance, for example. The resulting list in Table 25 is provided as a scorecard for selected performance indicators of IWRM for Corps of Engineers' district level projects and UNESCO HELP Basins. The scorecard uses twenty benchmarks and requires respondents to specify each benchmark's effectiveness and actions required for improvements. The scorecard is designed to be a quick performance assessment tool for project managers. I expect it would take about 15-30 minutes to complete it.

The scorecard can also be provided with the full list of IWRM basin scale indicators (Table 15) from which a project manager can select those deemed most relevant to the project. However, if this was done, the classification procedure described above should be undertaken first. This will allow the user to determine his/her project's level of auto-adaptiveness, and then choose the appropriate set of indicators used

depending on the level of maturity (Initial/Functionary, Emerging or Mature). This implies that a Corps and a HELP Basin project are micro, self-organizing systems and are compatible with organizational evaluation procedures. It is hoped that the scorecard can be used as part of CoE and UNESCO HELP Basin project performance appraisals, comparing actions in the project with international best practice. The discussion undertaken with Corps UNESCO HELP Basin staff and stakeholders suggested that, although in its infancy, the Willamette Corps project would fare well in benchmark scores/achievements, and that all 115 indicators should be retained for future reference.

Table 24 Definition of UNESCO HELP Basins

Group A Proposed HELP basin
~ may need to provide more detail for various aspects described in the Proposal Document.;
~ may not have yet achieved any initial operational activity.
~ may not have yet begun full stakeholder involvement;
~ may have identified too few or too narrow a range of the HELP key issues;
~ may also need to provide further information about official endorsement, support and funding commitments.

Group E: Evolving HELP basin
This is a basin which is not yet fully operational. An Evolving HELP basin:
~ has successfully completed its Proposal Document and has demonstrated initial progress and commitment to develop the basin in accordance with HELP principles;
~ has plans to involve stakeholder groups in regular meetings for HELP basin management;
~ has budgetary and stakeholder commitment secured and is awaiting implementation;
~ has a comprehensive project plan for proposed activities with timelines and milestones;
~ has plans for workshops, regular reporting, publications and web site ;
~ may become operational following at least one year's implementation of the project plan;
~ may solicit external support, if local resources do not suffice.

Group O: Operational HELP Basin
This is an established basin which may become a World Demonstration Basin in due course. An Operational HELP basin has had all the characteristics of an Evolving Basin and
~ has implemented the HELP philosophy;
~ has involved most HELP stakeholder groups in basin management;
~ is substantially functioning across several HELP key issues in an integrated manner;
~ demonstrates an active interface between science and water managers, and society;
~ has established mechanisms for unrestricted information and data access and exchange;
~ follows the WMO Resolution 25 on international exchange of hydrological and related data.

Group D: World Demonstration HELP Basin
This is seen as demonstrating best practice in HELP and IWRM, with something to offer other basins. A World Demonstration HELP Basin has all the characteristics of an Operational Basin and
~ has a high quality web site and a response facility for requests for information;
~ is prepared to partner, cooperate with or engage in a twinning agreement with another HELP Basin;
~ is able to provide facilities for local seminars and / or visits from other HELP Basins;
~ is able to promote and attract sponsors for the HELP concept;
~ addresses problems in all of the five HELP key issues areas;
~ has a wide and varied range of stakeholders, including water resource managers, scientists, national and local government, private sector and NGOs.

Source: http://portal.unesco.org/sc_nat/ev.php?URL_ID=1470&URL_DO=DO_TOPIC&URL_SECTION=201 Accessed March 2005

Table 25 A Self-reporting Scorecard of Benchmarks for Corps of Engineers' Projects and Meso-scale UNESCO HELP Basins

Indicator Group	Evidence exists in Project Plan	Effectiveness Rating	Specify further required actions [Provide written comments]
(A) DECISION-MAKING			
Decision-making in the project/basin occurs within a national framework of natural resources management objectives and investments	❑ Yes ❑ No ❑ Some	❑ Poor ❑ Fair ❑ Good ❑ Excellent	
Decision-making is consensual & coordinates across sectors in the basin	❑ Yes ❑ No ❑ Some	❑ Poor ❑ Fair ❑ Good ❑ Excellent	
Decision-making is reflected in a business plan, is prioritized, focuses on efficiency, links vertically to governments & provides stakeholder access to government	❑ Yes ❑ No ❑ Some	❑ Poor ❑ Fair ❑ Good ❑ Excellent	
(B) GOALS AND PLANNING			
An IWRM approach is agreed to and practiced in the project/basin	❑ Yes ❑ No ❑ Some	❑ Poor ❑ Fair ❑ Good ❑ Excellent	
Objectives specified in and articulated through feasible options in a project management plan	❑ Yes ❑ No ❑ Some	❑ Poor ❑ Fair ❑ Good ❑ Excellent	
(C) FINANCING			
Project management is financed through cost-sharing	❑ Yes ❑ No ❑ Some	❑ Poor ❑ Fair ❑ Good ❑ Excellent	
Financing is on-going, guaranteed, adequate, linked to national and state priorities	❑ Yes ❑ No ❑ Some	❑ Poor ❑ Fair ❑ Good ❑ Excellent	
Ex-ante and ex-post economic assessments of management options practiced	❑ Yes ❑ No ❑ Some	❑ Poor ❑ Fair ❑ Good ❑ Excellent	
Resource pricing and alternative demand management practiced	❑ Yes ❑ No ❑ Some	❑ Poor ❑ Fair ❑ Good ❑ Excellent	
(D) RBO FUNCTIONS			
Stable democratic conventions exist which facilitate voting and participation	❑ Yes ❑ No ❑ Some	❑ Poor ❑ Fair ❑ Good ❑ Excellent	
Project functions are co-ordination driven, are realistic, specify clearly roles & responsibilities, & are specified by national & state water policy and law	❑ Yes ❑ No ❑ Some	❑ Poor ❑ Fair ❑ Good ❑ Excellent	
(E) LAW			
Ongoing laws exist to enact natural resources management relevant to the project	❑ Yes ❑ No ❑ Some	❑ Poor ❑ Fair ❑ Good ❑ Excellent	
Laws specify project's functions and jurisdiction	❑ Yes ❑ No ❑ Some	❑ Poor ❑ Fair ❑ Good ❑ Excellent	

(F) STAFF TRAINING			
Project agencies have a program in place to improve staff quality for management skills, leadership and communication	❑ Yes ❑ No ❑ Some	❑ Poor ❑ Fair ❑ Good ❑ Excellent	
(G) INFORMATION & MONITORING			
Project agencies share a well developed, accurate, up-to-date, information and monitoring system	❑ Yes ❑ No ❑ Some	❑ Poor ❑ Fair ❑ Good ❑ Excellent	
Science informs the project's decisions through modeling and spatial representation of options, which are costed and linked to the decision system: options are delivered through strategic planning and decision-making	❑ Yes ❑ No ❑ Some	❑ Poor ❑ Fair ❑ Good ❑ Excellent	
The information management system reports on how the basin is being managed and resources are consumed and protected	❑ Yes ❑ No ❑ Some	❑ Poor ❑ Fair ❑ Good ❑ Excellent	
(H) BUILDING CAPACITY FOR COORDINATED MANAGEMENT WITH STAKEHOLDERS			
Public involvement processes are effective: provide for joint decision-making and conflicts are resolved	❑ Yes ❑ No ❑ Some	❑ Poor ❑ Fair ❑ Good ❑ Excellent	
Roles and responsibilities of stakeholders are specified and understood	❑ Yes ❑ No ❑ Some	❑ Poor ❑ Fair ❑ Good ❑ Excellent	
Project uses joint ventures and coordinates strategic decisions between partners	❑ Yes ❑ No ❑ Some	❑ Poor ❑ Fair ❑ Good ❑ Excellent	

5.4 Application to the Strategic New Directions and the Civil Works Program of the US Army Corps of Engineers

The third application of the general performance indicators was to strategic new directions in the Corps of Engineers civil works programs, including the Civil Works Strategic Plan 2004-09. This application is at the scale of both national divisions and CoE regions. The author consulted senior Corps' staff about the use of performance appraisal techniques, the origins and purpose of the Plan and new directions of Corps' activities related to this Plan. The author also reviewed the content of the Plan against the general performance indicators listed in Table 15. The result was that while the indicators were relevant, there is the need to specify a basin approach to natural resources management by the Corps and its partners before they can be used. This is a prerequisite to effective basin governance and is discussed further in Section 6.

5.5 Application to international basin compacts and treaties

The final application of the indicators was to a basin operating under an international compact or treaty arrangement. In the study, the Columbia Basin Treaty was examined and the following observations were made.

This type of application requires the recognition of the rules of the treaties and compacts, rules which dictate management of shared water resources. If the compact rules do not address issues of sustainability, or at least they are not explicit, there is little possibility of applying performance indicators for IWRM which are based on sustainable development approaches. In other words, one can develop indicators for organizational performance which can demonstrate 'good practice' but the purpose of the practice has to be explicit before any application can be made. There is, therefore, a need to examine the extent to which treaties and compacts adopt IWRM principles, as contained in the Dublin Statement on water resources management.

As a result, the evaluation of the Columbia treaty was not attempted in this study. The compact is explicit regarding prescriptive IWRM principles. If IWRM is to be the operating principle of water resources management in the Columbia, then the rules for treaties and compacts would need to be changed. This is a fanciful idea in the current political 'climate' of that basin's institutional arrangements. There would need to be an initiative from all treaty/compact partners, reflecting higher level actions in the governments of both countries towards sustainable development.

However, it should be noted that an interstate compact for the Delaware created in 1961 has not hindered the DRBC from enacting an IWRM approach. It has interpreted the compact to suit twenty-first century demands. This suggests greater local ownership and grass-roots advocacy for water development and management on a sustainable basis can work. Such institutional innovation can serve as a model of compact reform.

5.6 Constraints and opportunities for national application of indicators

The applications discussed in 5.1 to 5.5 illustrate the opportunities and the constraints to applying the river basin organization performance indicators developed in this study. The following discussion explores those opportunities and constraints.

Institutional constraints

There are a number of institutional constraints to river basin management in USA which restrict any

national application of basin organization performance indicators. These constraints are primarily related to the limitations on developing a national approach to river basin management, and include:

- calls for supremacy of states rights over federal intervention
- fragmentary national water leadership and water policy
- increasing decentralization of watershed management to local levels
- few basin organizations remaining and decreasing federal government support for river basin organizations that remain
- issues based management which precludes whole systems thinking and a large scale basin approach - no-one takes the 'big picture'.

The series of National Water Policy Dialogues which have been held in USA have flagged these issues and have called on national leaders to take action. Specifically they have called for leaders to address the nation's water issues in an integrated manner, focusing not on single projects but on programs and watershed and basin level issues. They suggest this can be done by reconciling the myriad laws, executive orders and Congressional guidance that have created the current disjointed, ad-hoc national water policy and create 21st Century goals for water (March 28th, 2005 Press Release, AWRA). These issues limit the development of a national approach to river basin management, the formation of basin organizations and national standards for RBO performance indicators.

Due to the disintegrated nature of water management in the US, any inter-basin comparison of performance against national IWRM / river basin organization experiences has limited value, if it even exists at all! One option in the current environment is to employ the principle of subsidiarity: to develop and use sub-basin applications, congruent with larger river basin management goals if they exist. Secondly, a stepped approach is warranted. States would be better served if they worked together to develop shared performance indicators and develop them on a regional, interstate basis, appropriate to their own conditions. But this will work best on an intra-state basis to begin with. This is the first step. The successes of the Florida water districts serves as a timely reminder that this is possible. The second step would be to develop an interstate application by which two states work together at the sub-basin scale to develop an agreed sub-river basin management plan and develop and apply performance indicators, specific to that situation. The role of the federal government in this process would be as a facilitator, to provide support to the states under a national natural resources investment strategy. This approach is developed in Section 6.

Data integration and data sets

The majority of indicators developed in this study require evidence of their existence and efficacy of use. Suggested data sets to provide information to measure the value of indicators include river basin management plans, performance reviews, annual reports, internal reviews and ex-post project assessments. It is recommended that RBOs could use these initially for data sets for internal self assessment procedures.

However, this is a very time consuming task, and a shorter more effective procedure is to use feedback from basin managers themselves. This can be captured in structured workshops, roundtable discussions, videoconferencing and training sessions. This allows for both individual and corporate input. This subjective approach can add much value to basin organization self assessment procedures. The first step is to use the Self-reporting Scorecard of Benchmarks and Key Performance Indicators for River Basin Commissions in Table 23. This table includes a simple evidence of existence (Yes/No/Some) response and subjective achievement ratings on a 1-5 scale. Similar scorecards can be created for lesser developed basin organizations using self-selected indicators from the Table 15 general performance indicators,

appropriate to the setting. Samples are provided as Tables 18 and 19.

The diagnostic method discussed earlier in this report should be carried out initially with RBO staff. In workshops with the Delaware River Basin Commission and the Interstate Commission on the Potomac River Basin, the dialogue between staff and stakeholders was a fruitful way of articulating the effectiveness of their commissions. These responses create a data set of the perception of maturity of each indicator and can be recorded in the data sheet shown as Table 23.

More work needs to be done on the applications developed here. There is the need to:

- Further field test the indicators with other basin organizations and specify data sources
- Analyze which indicators are most significant in specific basin settings
- Develop an efficient, workable technique to capture indicator responses from a large number of community stakeholders, in a language they understand
- Clarify scores in terms of meaning and comparability - what does “poor”, “fair”, “good”, “excellent” mean with respect to the achievement of performance amongst users (Table 23)? Are scores comparable between stakeholders and settings? Can and should an ‘industry standard’ be developed by basin managers, such as an ISO standard, or equivalent?
- Specify how results of the use of the performance indicators are used in an RBO’s decision-making. This can be done by developing a user manual for that organization.

6.0 Discussion

The development and application of general performance indicators of river basin organizations in the United States raises some fundamental questions about the directions of US water policy, specifically with regard to river basin management. There is limited movement at the national level to establish integrated river basin management, yet there is a policy debate regarding the US approach to IWRM. The following discussion is provided to support that policy debate. It also provides some specific suggestions regarding strengthening river basin management in the Unites States.

6.1 US river basin management

Devolution of power – facilitating sub-basin management

This study has shown that the application of international best practice IWRM and IRBM, as reflected in RBO general performance indicators, presents a challenge to US conditions. This is not unique to the US and many nations are experiencing challenges in implementing collaborative basin governance in both developed and developing countries (Shah, Makin, and Sakthivadivel 2004; Sabatier et al. 2005; Hooper 2005). These challenges frequently center around the conflict between water resources development and natural resource conservation, a fundamental issue in sustainable development which has and continues to be worked out in many different river basins (Jaspers 2003).

Substantial progress was made in US water development projects in the first half of the twentieth century and in water quality management initiatives in the latter half, but today basin coordination is lacking at the federal and state levels, while the US has the technologies and capabilities for river basin management (Howe 2005). One of the key reductions in river basin management activity occurred in the withdrawal of federal funding for Title II Commissions in the Regan administration. Another reduction is the ongoing

withdrawal of federal support for remaining river basin commissions. However, current processes result from a desire to devolve power from federal administration to more local initiatives. This policy shift should be seen as an opportunity not a constraint on river basin management for reasons explained below.

In the current adversarial water policy environment, particularly in western USA, there remains a limited number of basin organizations in the US. They range from more formal basin organizations such as river basin commissions, to those operating under treaty arrangements to less formal arrangements such as joint initiatives of State government agencies, basin research programs, and basin lobby groups and associations. Basin scale initiatives exist without a formal basin organization and these arrangements are enacted by State and/or Federal Agencies, such as in Florida. Elsewhere, international agreements (such as the Columbia Basin Treaty) and interstate compacts (such as the Delaware Basin Compact) exist. However, a policy vacuum exists regarding basin management ~ there is no national RBO agenda, mandate nor procedures, nor are there initiatives to reinstate basin organizations, nor a willingness to consider this in some quarters. Indeed, some would support no national water agenda or policy, rather recommend substate actions and collaborative local actions (as, for example, between local water districts) to achieve more for basin management than a Federally driven approach. Perhaps, this augurs well for those supporting the use of subsidiarity.

The problems in the coordination of natural resources management at the basin scale reflect this ongoing debate about national approaches to water resources management. As (Stakhiv 2003) points out, 'disintegrated', rather than integrated water resources management now characterizes the American water scene. While there are significant administrative challenges in basin scale management, the future may lie in strengthening the processes of dialogue and interagency coordination (Loucks 2003; American Water Resources Association 2005; Vigmostad et al. 2005; Howe 2005; Jacobs 2005).

Rather than relying on legal solutions worked out through court orders, there is an opportunity to use 'soft engineering' solutions such as collaboration and coordination mechanisms, joint action programs and sub-basin land and water resources management plans. However, improved collaboration does not occur spontaneously, even as the result of catastrophic hydrological events (flooding, droughts); rather, it frequently needs to be stimulated from both a top-down and a bottom-up approach, working simultaneously to cause such actions. The 'top-down' approach suggests national leadership from the federal government to bring together federal agencies and the states in specific basins to work together for a common river basin management plan. The 'bottom-up' approach suggests a grass-roots movement to drive agencies (the public good managers) to work together for specific goals. In some respects, the latter has happened with many environmental restoration initiatives across the US. The response has been a national effort at local watershed initiatives led by EPA. However, the top-down end of this continuum needs strengthening. Is this possible? (Rogers 1996) provides five perspectives on federal water policy relevant to this issue:

- Federal water policy does not exist; it merely reflects the times
- There are times when policy change is politically possible and times when it is not
- A pendulum effect characterizes the history of federal water policy
- Various engines trigger change in federal water policy: cataclysms, national development commitments, environmental restoration goals
- Individual policymakers make a difference.

His perspectives suggest that unless one or several of these triggers are in place, no IRBM initiative will occur, at least one stimulated by federal government. He also maintains that there is national water policy in US by default; that it is ad hoc, and has been a response to specific problems or opportunities.

The need is, then, to establish national coordination of water policy and to create enduring institutions to lead national water resources management. But this has been fraught with difficulty in the past (Loucks 2004). There is concern over the duplication of and undue interference of federal administration in the affairs of the states. For example, virulent criticisms of the 1998 Report of the Western Water Policy Review Commission illustrate this concern:

> (1) "Rather than supporting local efforts, the Commission encourages federal intrusion. The proposed governance system is little more than additional levels of bureaucracy with a heavier and deeper involvement of federal agencies". Source: Dissenting Views letter to the Western Water Policy Review Advisor Commission, April 2, 1998, from F.H. Murkowksi and Jon Kyl, Chairmen, Committee on Energy and Natural Resources, United States Senate. In (Western Water Policy Review Advisory Commission 1998)
>
> (2) "…. The tone of the report is decidedly biased against irrigated agriculture and commodity production, fails to respect state law, and advocates a significant expansion of the federal role in watershed management…… We find it problematic that the "…principal federal role is shifting from water developer to water manager". Letter from Senator T. Stevens, Chairman if the Senate Appropriations Committee and Congressman Don Young, Chairman of the House Resources Committee. In (Western Water Policy Review Advisory Commission 1998).

The dialogues on state versus federal power in water resources planning and management continues. This appears to be one of the most powerful reasons why river basin management stumbles, at least from the down-top perspective. The substantial challenge is to recognize the perceived supremacy role of state water rights over federal rights which pervades water policy dialogues at present. The challenge is to translate that concern into an effective form of IRBM. This can be done by interstate collaboration at the sub-basin level as the first step in improving basin governance. In this case, the federal government facilitates action and States implement programs which are agreed to and cost-shared between the States and the Federal Government.

What type of organizational structure would work here? One option is to establish (reestablish?) a leading national water institution, perhaps a Water Resources Council, to facilitate this type of sub-basin collaboration. However, the 1965 attempt had a checkered career and today national coordination is undertaken essentially as a function of the Office of Management and Budget, by default. The 1965 Council achieved limited success and its basin experiences were fraught with federal-state rivalries:

> "While some commissions had proved useful, many were simply not appropriate to state needs. And the principle of state representation coequal with federal representation that the basin commissions embodied was not carried forward at the level of the council's own deliberations". (Rogers 1996) p.176

Collaborative Federalism

Rogers' critique points to the need for another model of federal-state cooperation and coordination. One option could be to develop a model based on a shared regional resources management vision and goals, developed within a national natural resource investment framework and in which the federal government provides seed money to encourage state actions at the sub-basin level, under a regional (basin) cost-shared agreement. This would require enabling legislation to facilitate the formation of basin and sub-basin initiatives, and would be similar to the Murray-Darling Basin Commission model in Australia, where the states do the work. However, this still does not address the need for national water policy which is required to facilitate the formation of effective basin commissions (World Bank 2006).

There are dangers in cross-Pacific transfer of policy innovation, such as that which created the Murray-Darling Basin Commission. This Australian model of cooperative governance, a form of new federalism, was driven by three critical factors: it was developed within the context of national economic reform in the water sector (the National Competition Policy); had strong political forces and policymakers who made the difference; and there was growing awareness of the need to address widespread land degradation (soil

salinity).

Both Australia and US need to address over allocation of water supplies and restoration of degraded riverine and land environments. The issue of State and Federal representation in this model would require strong enforcement, as this is one of the fundamental constraints to previous top-down coordination experiences in the US. However, in most western democracies, national governments are downsizing their commitment to the natural resources management sectors, seeking to place the burden of management on the States and local entities. So, a devolved approach may have some merit.

The history of water resources management in the USA clearly demonstrates that this is a somewhat limited perspective without further rigorous policy debate and field testing. In recent discussions[3], it is apparent to the author that unless a reform of current institutional arrangements in the West occurs, gridlock will continue to characterize water resources allocation procedures there. A regional approach, built within a national investment framework, appears to hold some promise, one unique to basin states (e.g. in the Colorado), one in which a stepped process of reform occurs, in the context of climate change and drought mitigation and one which facilitates the transfer of water between uses.

Towards a Process for National Investment in Integrated Natural Resources Management

Integrated water resources management investment strategies include regional socio-economic and ecological variations and focus on activities at a river basin / regional scale. Table 26 outlines principles to achieve successful integrated water resources management.

The following discussion is drawn from Australian experience in developing and applying this process and draws primarily from that work (AACM International and Centre for Water Policy Research 1995). There is a need for Federal investment in integrated water resources management - across all portfolios - to be clearly linked to a process which links the philosophy of integration with products which meet national and river basin needs. While the process needs to be clearly defined and sufficiently generic to be applicable across USA, it must be flexible enough to address different hydrological conditions, political requirements and property rights regimes.

There is disagreement about the philosophy of IWRM in USA, confusion, ignorance and uncertainty of how an IWRM process should be put into practice. A set of guiding principles is useful (Table 26), but what would be of more use is a set of core elements of good practice. These include:

- clear identification of an investment framework which uses resource economics and national policies to define national resource management interests - across all portfolios - over a three year planning horizon;

[3] The author is indebted to Jerry DelliPriscoli (pers. comm., August, 2006); Gene Stakhiv, Pete Loucks, Peter Rogers (July, 2005); Paul Bourget and Hal Cardwell (June 2006) in this regard.

Table 26. Guiding principles for successful integrated water resources management

CLEAR INVESTMENT FRAMEWORK A national Integrated Resource Management Investment Strategy, based on resource economics, which clearly establishes priorities for Federal and State investment in natural resource management as a framework for regional resource management planning activities.
CYCLICAL RESOURCE MANAGEMENT PROCESS A cyclical approach to planning which uses rolling renewal of programs to allow dynamic responses to changing priorities and community perceptions whilst demonstrating a long-term commitment to integrated resource management.
COST SHARING FOR CO-MANAGEMENT PARTNERSHIPS Clear co-financing of resource management activities on the land to establish a strong foundation for co-management partnerships between government and individuals. Use of resource economics to allocate public and private costs and benefits for different resource management activities.
CONTRACT FOR ACTION Contracts - between incorporated community groups and landholders, technical services agencies, local government and public sector investment programs - lead to open and sustainable co-financed management partnerships. Contracts would involve the development of appropriate cost-sharing, co-financing and co-management arrangements.
MULTI-DISCIPLINARY TEAM APPROACH Multi-disciplinary teams provide a means of integrating different skills, and establishing working relationships and communication between and within different government agencies. This approach integrates institutions horizontally and vertically.
STRENGTHEN WITH LEGISLATIVE FRAMEWORKS A legislative framework is required to strengthen and formalize the process for coordination and management of resource management investments. It also provides a mechanism of last resort for minimizing risks affecting outcomes expected from Federal investments in integrated resource management.

Source: modified from (AACM International and Centre for Water Policy Research 1995)

- a cyclical approach to planning which uses rolling renewal of programs to allow dynamic responses to changing priorities and community perceptions, whilst demonstrating a long-term commitment to IWRM;
- broad allocation of public and private responsibilities for each component of the investment strategy;
- integration of national investment priorities and regional needs, by regional institutions and local communities, through planning of detailed resource management activities (for example in sub-basin land and water management plans) within the national priority and co-financing framework;
- allocation of national funds directly to regional groups according to co-management partnership agreements confirmed in writing between Federal, State and basin management organizations;
- allocation of responsibilities for implementation in co-management partnership agreements;
- monitoring of implementation activities according to agreed evaluation indicators relevant to each component of the investment strategy; and
- annual reporting of progress, lessons learned, and regional resource conditions for integration with national State of the Environment reporting activities.

With these institutional requirements in place, and undertaken through a steeped approach, it is possible to allocate Federal and State investments - from a range of portfolios - directly to incorporated river basin management organizations. In this way these organizations:

- integrate field activities implemented by community groups, landholders, local government, State government agencies, and other resource users;
- clearly allocate national investment funds through the States as the public sector contribution in

proportion to national benefits or interests;
- provide an avenue for regional and local co-financing of resource management activities; and
- act as a broker between different Federal, State and regional programs.

Property rights regimes and performance indicators

In this context, property rights regimes set the scene for water allocation mechanisms in basin management. The two pervasive water property rights' doctrines (prior appropriation (Western) and riparian water rights (Eastern), create different management regimes, interpretation of water laws and entitlements, and opportunities for water trading. There appears to be little interest in creating a unified national water policy doctrine to address these different approaches. It makes sense then to create regionally developed solutions at the whole of basin scale, rather than national approaches, despite the need for national water policy. Once again, however, this reform is fanciful in the current antagonist regime. One option is to use reform of sub-basin/sub-state transfer systems as an option[4]. This offers more possibility at the local level. Congruent with this approach is the need to recognize, the strength of basin and sub-basin management in national water policy, and stimulate intra-state and interstate water trading.

The challenge for basin management and the river basin organization performance indicators developed in this study is to create a regime of indicators appropriate to these sub-basin/substate conditions, and relevant to water trading. It is recommended that this work be developed further as a first field trial, rather than attempting a full river basin scale application. Tying the indicators to water allocations would make sense as it is the critical issue, especially in western basins experiencing drought (Hooper and Ward 2006).

The work undertaken in this report suggested there is another opportunity for application of the indicators - to develop performance indicators for specific government projects, for example, Corps of Engineers projects, EPA restoration projects and State agency projects, within a larger basin framework. In this regard, there is a need to differentiate between basin and sub-basin performance indicators. Sub-basin indicators can be used for projects such as floodplain management and river segment restoration. However, they do not address the larger scale, 'big picture' of basin-wide management problems and large scale ecosystem (biome) management. This is complicated further if there is no basin scale strategy in place. Frequently, national laws (e.g. Endangered Species Act) drive sub-basin actions and this acts as a surrogate to a basin management strategy. These Acts can be used as a first step at a sub-basin level to develop indicators to measure the effectiveness of the implementation of the relevant act. Once again, the property rights regime of the specific project must be considered in the selection of indicators to measure basin organization performance.

Covenants of mutual obligation

Covenants of mutual obligation provide an opportunity for improved sub-basin management. Covenants are reciprocal agreements for action between stakeholders in a river basin. A covenant is often defined as a land title or a constraint on land use over a parcel of land. But this is not the meaning here, rather it refers to the Biblical concept of promise and lasting agreement.

IRBM covenants include several elements:

[4] Mike Pease's research at Southern Illinois University, for example, demonstrates useful mechanisms to facilitate water transfers in the West. These mechanisms could be accounted for on a sub-basin/substate basis as an initial 'field trial' of this approach.

- a vision statement of the desired future for land and water resources management within a 25 year period, and longer if possible
- clear identification and specification of water rights
- identification of cost-sharing arrangements to share river basin management expenses
- clear specification of river basin works and targeted actions, and who is responsible for each
- contractual agreements between stakeholders including government departments, industry organizations, water user groups and RBOs to undertake actions, and
- an external review process to audit outcomes.

There are several critical factors which need to be addressed to implement covenants of mutual obligation:

- building and maintaining strong leadership of the 'engaged' communities
- ensuring membership of river basin management organizations is on a skills basis, not a representative basis
- developing trust between all stakeholder groups to agree on each other's mutual obligations
- ensuring a sustained funding base
- designing a clearer definition of property rights
- understanding the reasons why landowners are unable and unwilling to adopt sustainable land and water management practices, and
- using support tools such as interactive catchment information systems.

Such covenants could be developed by river basin organizations, using the framework for national investment discussed above. One way to do this is to establish three way funding mechanisms between the Federal, State governments and local entities which will facilitate:

- the formation of a river basin organization and programs to cost-share river basin management with private sector interests.
- leadership training and further research in basin management with the establishment of a national training and research institute, and
- the implementation of river basin information systems to facilitate information exchange.

6.2 Towards Corps of Engineers' leadership in basin management

The work undertaken in this study referred to the role of Corps of Engineers in basin scale management. The Corps' work is managed on basin divisions, districts and projects. It is a task oriented organization and there are recent calls for its renewal and building capacity in this regard (Loucks 2003; Tarlock 2004; Howe 2005). Likewise, recent legislation [The Water Resources Planning and Modernization Act of 2006] brought to the House by Senators McCain and Feingold (2/26/2006) would require the Corps to modernize its approach to water resources planning and prioritize projects within a national framework.

There is internal discussion within the Corps of Engineers regarding its role in basin governance and the Corps has adopted an IWRM approach in its Civil Works Strategic Plan 2006-09. As the Corps' programs are driven along business lines, it would make sense to develop related performance indicators. However, IRBM transcends the role of one federal agency, even if the Corps were to be the lead agency in basin management. The challenge, therefore, is to identify a lead agency and to work with the current

disaggregated management system to enact IRBM. With no overall coordination framework, there is limited opportunity to build river basin management plans, let alone river basin organization performance indicators. What is needed is a process to stimulate interagency coordination and a possible model was presented in the policy discussion above.

There are several large scale treaty organizations and basin scale projects in the US. They include initiatives such as the International Joint Commission, the Chesapeake Bay Program, Gulf Coast restoration projects, and others. Without a national coordinating body, nor any willingness to do this at present, the Corps of Engineers is ideally positioned to take the leadership in regional scale projects and be the IWRM lead coordinating agency. It could fill the leadership vacuum in basin management. It has a national perspective on natural resources management, a track record of significant basin projects, water resources planning and policy skills, and the experience of working collaboratively with State agencies as partners. However, congressional mandates and a greater leadership commitment to the IWRM approach will be required. The latter is embryonic and needs stronger articulation and political commitment. The Corps can become the nation's leader in basin governance and enact that basin leadership through its Civil Works Strategic Plan 2004-09, but it needs a Congressional driver and leading policy makers to support it.

Until this happens, it will be difficult to become the lead agency. However, there are a number of immediate opportunities which the Corps can use:

A stepped campaign

This involves promoting IWRM and IRBM in the Corps of Engineers. IWRM has been well articulated in the Corps (Stakhiv 1999; Martin and Stakhiv 1999; Stakhiv 2003; Cardwell, Cartwright, and Martin 2004; US Army Corps of Engineers 2004a). Furthermore, Delli Priscoli (pers. comm. September, 2005) articulated the mechanisms of IWRM for basin organizations, including vertical integration, horizontal integration, multidisciplinary integration and multi-objective integration. He maintains that two dimensions of the integration process override integration: planning versus regulation, technical considerations versus political agenda. The Corps has both planning and technical capability to address these issues and is therefore well-placed to assume the IWRM/IRBM leadership role.

The preferred approach to implement IWRM and account for basin governance effectiveness should be evolutionary. The CoE can continue national dialogues with its stakeholders and create a forum for testing applications such as scenario-based planning, impact assessment, and basin organization performance indicators tagged to regional initiatives and Civil Works projects. This dialog can follow the listening sessions already undertaken by the CoE and use their outcomes. There is the need to ensure that all stakeholders are involved in these dialogues, not just cost-share partners. The outcome can be a pilot basin project where the scenario-based planning, impact assessment, and basin organization performance indicators are tested, lessons learned and a refined processes used. Strong political support from Congress for this suggestion is warranted.

Interstate governance: from rivalry to collaboration

Governance is not government. It involves decision-making by relevant authorities, jurisdictions and powers in different agencies and organizations in different states. The history of interstate collaboration in water management in the US continues to difficult and it appears that a substate level opportunities exists for improved IWRM. This is evidenced in the improvements made in the Florida water management districts. Managing water resources, including water allocations across state boundaries, has been and continues to be a source of intense conflict and a reason for the lack of advance in river basin management. Resorting to a federal arbiter may not necessarily be the best solution as the current administration favors a devolved

approach.

The alternative to a federally-led approach is to establish processes which facilitate state agencies to share information and build trust in water allocation and water quality improvements programs. One option is to provide incentives for the states to collaborate, a federal initiative by which funding to states for major water works, remediation programs, conservation projects and local initiatives is established and led by a lead federal agency. In this regard, the Corps of Engineers could take the lead.

Leadership of regional initiatives

The US Ocean Action Plan uses a regional, collaborative approach and could form the model for Corps led collaboration on land-based natural resources. This requires expansion of high level dialogue between the Corps, EPA & other partners in watershed management and the Ocean Action Plan. This dialogue and resulting action can be scaled up to basin level. New basin coordinating organizations are needed, supported by the Corps as the lead federal technical agency, with clear lines of accounting and reporting to federal organizations and basin communities, interagency communication lines, and demarcation of roles and responsibilities between agencies, regional organizations, community groups and the private sector. The role of Congress in this initiative would be to provide enabling legislation and appropriations, using the principles of a national investment strategy outlined above.

The basin organizations can be supplemented with Community Consultation Committees, facilitated by the Corps and its partners, which provide direct input into natural resources management planning, and report back to their regional communities; and a basin wide education and investigations program to promote the new basin organization and identify research needs and priorities. The community participation procedures will increase the likelihood of the Corps and the basin organizations emergence as learning, auto-adaptive organizations. There is also the need for a national prioritization of basins at risk, and where new basin organizations should be established. Wherever possible, new basin organizations should evolve from pre-existing basin initiatives to facilitate their formation and streamline cost-shared funding.

Scenario-based planning

The Corps' Senior Leaders Conference held in August 2005 indicated that collaborative watershed planning was a Civil Works goal. The email reporting this event [from R. Pietrowsky 8/16/2005) uses the language of IWRM: "integration with sponsors", "sustainable development", "collaborative planning environments", "policy review", "holistic watershed approach", "potential new watershed partnerships (perhaps with the need for new authorities)", "collecting and disseminating best practices", "a sustainable water dialogue". This language suggests a move towards reform.

The challenge is to translate this language, favorable to IWRM and improved basin governance, into regional initiatives working in collaboration with regional partners. This can be done through the scenario-based planning work at CoE's Institute for Water Resources. This Institute can be the leader in developing ex-ante and ex-post assessment tools for basin-scale regional water resources initiatives, using its scenario-based planning programs. The indicators developed in this study can be linked to scenario-based planning as a starting point and further refinement of them to region specific applications is warranted. However, caution is required in this approach: there is the need to focus on collaboration and not lose the long tradition of public involvement well established at IWR and in the CoE. The Community Consultation Committees described above can be used to facilitate ownership and provide input into to collaborative, scenario-based planning. This tool will add value to the suggested basin organizations' capability in natural resources management.

Much can also be learnt from the current CoE leadership in international transboundary basin initiatives such as in the International Joint Commission. This organization is one of the world's successful transboundary lake and river basin organizations. There is an opportunity for the CoE to use the learnings of the IJC's experience throughout the US and mesh them with the indicators developed for basin commissions in this report. This in turn can be linked to the local model of governance promoted in Cooperative Conservation America. This initiative has gained a good deal of interest both within and outside CoE. It is seen as a way by which grass roots activism is facilitated. COE has the opportunity to link this "bottom-up" approach to natural resources management with a "top-down" approach using its water resources planning tools. Further work is needed amongst key federal water agencies to examine the experiences of the International Joint Commission and Cooperative Conservation America to identify opportunities for the creation of basin organizations supported by the Corps and Community Consultation Committees.

7.0 Next steps

The outcomes of this study were procedures to:

- measure the capacity of river basin organizations to implement IWRM using key performance indicators,
- self-identify the stage of auto-adaptiveness of a river basin organization,
- use key performance indicators in river basin commissions, a Corps of Engineers project and a UNESCO HELP basin project, using a scorecard approach.

The study concluded with a discussion on suggested policy reforms required to enhance river basin management in the US and to strengthen the role of the Corps of Engineers so that it becomes the national IWRM/basin management leader. Some specific procedures which could be developed to use the key performance indicators in this study are:

- The application of key performance indicators can occur through Objective 1.2 of the CoE Civil Works Program ('Support the formulation of regional and watershed solutions to water resources problems'), which is discussed further in Appendix B ('Addressing Water Resources Challenges Through a Watershed Approach', especially pages 56-58, 'Organizational and Technical Effectiveness').
- The application of indicators can also be applied to CoE joint venturing programs at the basin-scale, in water resources management plans with EPA, US Fish and Wildlife Services, FEMA and others.
- It is suggested that the procedures outlined in Sections 5 and 6 of this report be considered as sub-basin scale and project scale Corps performance indicators. This requires adaptation of the performance indicators to specific settings, using the discussion in these sections of this report. This will require aligning the RBO performance indicators with budget-based performance measures as a tool to enact self-assessment and external reporting.
- It is recommended that CoE and the Office of Management and Budget work together to create a template of performance measures using a subset of indicators developed in this study, in conjunction with partner federal agencies, and in regional contexts with state agency partners.

The assessment of basin governance is an evolving process, as are the roles and responsibilities of RBOs. Overall it should be stressed that good governance, for which indicators are a tool, is an evolving process, ever dynamic and developing, responsive to changing conditions. The challenge is to develop useful tools, apply them to various settings and create a 'toolbox' of organizational performance indicators relevant to the specific basin setting, dynamic as it is.

This study has raised many issues regarding river basin management and the meaning and use of the term, integrated water resources management. These issues are complex and clever solutions are required. However, the inventiveness of the American people, seen in its significant water resources management history provides ample evidence that smart outcomes can be achieved.

This study should be considered a work in progress. The thrust of the work in this Fellowship was deliberately exploratory. Further efforts are required to harmonize the outcomes of this study with current CoE programs and discussions about the future of water resources management in the USA.

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Universities Council on Water Resources Fellowship

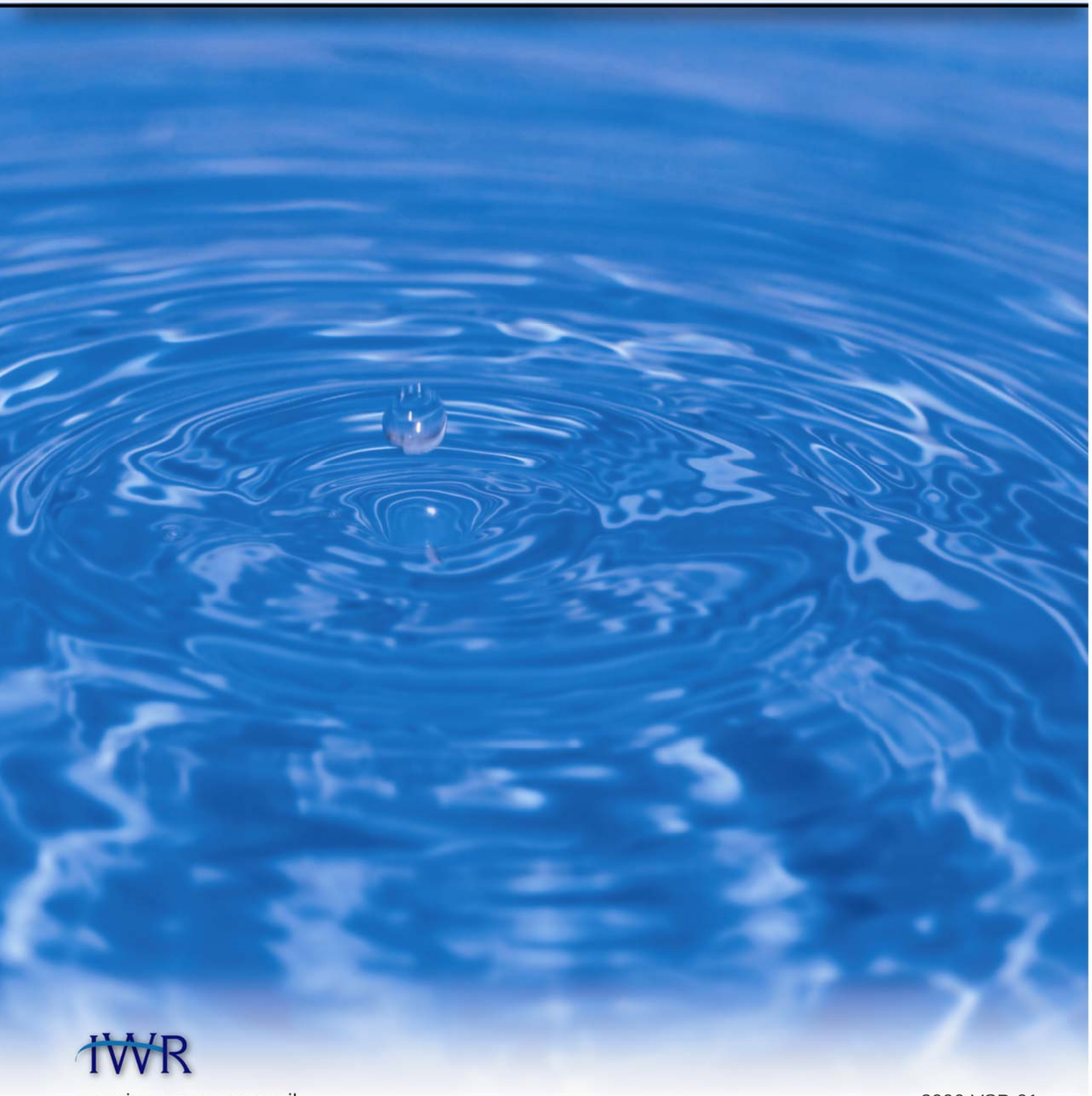
2004 – 2005: Dr. Bruce Hooper

Associate Professor Bruce Hooper, Southern Illinois University, was the first UCOWR Water Resources Fellow at IWR. He has extensive research, consulting and teaching experience in policy and program development in water resources management, information exchange in catchment management and floodplain management. Dr. Hooper holds a Ph.D. in Geography and Masters of Natural Resources degrees from the University of New England, Australia. He has advised Australian and Indian governments on institutional strengthening and capacity building in water resources management and integrated catchment management. He played a key role in identifying institutional arrangements for local government to address the Sydney Water Crisis of 1998, developed a toolbox of water policy instruments with the Global Water Partnership in 2001 and has received national awards for his work in floodplain management policy and performance indicators.

Dr. Hooper's research projects have resulted in the development of a prototype information exchange program for watershed management (winning a Land and Water Australian Innovation Award), and policy recommendations for integrated floodplain management and improved adoption of salinity management in the Murray-Darling Basin. He is currently developing river basin organization performance indicators to self-assess their ability to implement integrated water resources management.

About the Fellowship

The Universities Council on Water Resources (UCOWR) and IWR developed a visiting scholar program in 2003. The program's intent is to invite academicians to the Institute to focus on emerging water resource issues of relevance to the civil works mission. While on sabbatical these scholars are expected to perform applied, policy-relevant research to extend the U.S. Army Corps of Engineers knowledge of and thinking about emerging water resources needs and issues. UCOWR Fellows, chosen via a UCOWR/Corps panel, are university professors who have substantial applied experience in water resources planning and management, as well as strong teaching credentials. The position is a six- to nine-month assignment based on scope of the proposed research project submitted in response to a topic of interest to the Corps of Engineers.



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