

**Sustainable Water Resources Roundtable (SWRR)  
Proceedings for Meeting on June 19 & 20, 2003  
U.S. Geological Survey, Reston VA**

**Attendees**

Paul Barlow, DOI, USGS  
Matthew Borgia, Nat. Oceanic & Atmospheric Adm.  
Paul Brouha  
John Dawes, W. PA Watershed Program  
Paul Freedman, Limno-Tech  
Stephen Gasteyer, Rural Community Ass't. Prog.  
Andrew Hagelin, Army Civil Works  
Ted Heintz, DOI, CEQ  
Doug Holy, Nat. Resources Conservation Service  
Toni Johnson, US Geological Survey  
Jill Lane, Water Emt Federation  
Kevin Lynott, National Weather Service  
Marshall Popkin WEF intern  
Doug Ryan, US Forest Service  
Jim Sedell US Forest Service  
Karen Solari, US Forest Service  
Rahul Vaswani  
Harry Zhang, American Water Resources Assoc.  
David Berry, SWRR Manager/Facilitator

Steve Borchard, Bur. Land Management  
Tracy Bowen, Alice Ferguson Foundation  
John Castellano, US Fish & Wildlife Service  
Warren Flint, Sustainable DC  
Cynthia Garman-Squier, US Army Civil Works  
Bob Goldstein, Electric Power Research Institute  
Keith Hanson, Minnesota Power  
Steve Hellem, Global Emt Mgmt Initiative  
Sean Ianicone Intern US Forest Service  
Rhonda Kranz, Ecological Society of America  
Chris Lant, Univ. Council on Water Resources  
Robin O'Malley, Heinz Center  
Stephen Ragone, Nat. Ground Water Assoc.  
Craig Schiffries, Nat. Council Science & Emt.  
Ron Shafer, Environmental Protection Agency  
Rick Swanson US Forest Service  
John Wells, State of Minnesota  
Tim Smith, SWRR Coordinator

**Day 1**

**Opening and review of the SWRR purpose and work done so far. Ted Heintz**

How can we move toward a National System of Indicators on Natural and Environmental Resources? We can develop a framework for the long run and draw upon many building blocks from previous work. Water Resources is an important part of natural and environmental resource systems

How can we use other Roundtables conducted in the areas of forests, rangelands, and minerals?

1. Roundtables as open, collaborative efforts among people with:
  - Different expertise and interests
  - Different knowledge and concepts
  - Sometimes conflicting goals
2. Roundtables share processes that "construct shared knowledge:"
  - Broad stakeholder participation
  - Committed people and organizations
  - A culture of respect and trust despite differences
  - Tolerance of fuzziness
  - A mix of work settings and processes

Summary of Main Points:

Sustainability is a long run goal that reflects both widespread human values and our scientific knowledge of the biosphere and the role of the human species within it. The SWRR focus on indicators is consistent with the fundamental concept that the miracle of the biosphere's sustainability is in major part due to the feedback processes. Indicators can help us to achieve sustainability by improving the realism of the feedback within our social and economic systems. Such feedback is a key element in most decision and management processes. The SWRR can provide a process involving people from various contexts who can together decide what indicators are relevant and useful in managing water resources, a resource that

is very important to achieving sustainability. A key outcome of such efforts is the recognized legitimacy of the information that is eventually assembled.

Questions for Ted Heintz

What is the role of CEQ in determining national environmental indicators?

Ted: This group will discuss agency programs and the capability, expertise, and equipment to do so; and which/where will be a National lead/repository. We need to discover how to consolidate access to multiple aspects of a resource, to conduct routine statistical reporting on large assemblages of information (like economic stats) and to collect/monitor ambient quality data

## **Keynote Panel: Presentations on Sustainability of Water Resources from six points of view followed by discussion. Rhonda Kranz, ESA moderator**

### **Steve Hellem – Global Environmental Management Initiative GEMI**

The Global Environmental Management Initiative (GEMI) is a non-profit organization of leading companies dedicated to fostering environmental, health and safety excellence and corporate citizenship worldwide through the sharing of tools and information in order for business to help business achieve environmental excellence. In this SWRR meeting, we can focus on the fact that indicators should have truly global impacts. GEMI has done considerable work on the sustainability of water resources and has water trends and other information on its web site at [www.gemi.org/water](http://www.gemi.org/water). We have a vision that the interests of our participating corporations and all industry are supported by sustainability. The business case for pursuing sustainability includes awareness of the uses and supply of water, the potential for business disruption if water resources are not sustained and customers expectations related to water. Smart companies will get out in front of the issue.

GEMI has a water sustainability tool on its web site. We have also made case studies and drawn some key lessons for companies.

### **Keith Hanson – Minnesota Power**

Minnesota Power operates Coal / hydroelectric power plants in North Central Minnesota which is a water-rich environment (the Land of 10,000 lakes) and also part of the Great Lakes Basin. There are increasing pressures on water quantity in the Region.

Corporations have an interest in maintaining a sustainable supply of clean water for their operations and to meet customers' needs. Performance is enhanced using technology to use water more efficiently for their operations and having data a water balance within the system. A next step for Minnesota Power is to look at the water balance on a watershed scale to assess vulnerability to droughts. The watershed view should help to enhance the overall performance.

Minnesota Power attempts to meet corporate and social goals by:

- a) Reaching out to stakeholders
- b) Watershed Partnership (Business, industry, municipal, local, tribal, NGOs, educational, and research)
- c) Developing a watershed analysis for NW Lake Superior's watershed
- d) Framework designed to evaluate water resource issues and strategy

In response to a question from Rick Swanson of the Forest Service, Keith said that the source waters for his company were primarily from public land and that they had contacts with the Forest Service.

### **John Wells: State of Minnesota. State Perspective on Sustainable Water Management**

Defining what's sustainable. Minnesota has invested time and energy into understanding "sustainable development" and its implications and opportunities. The concept may best be understood when stated simply as:

- Thinking and acting as if the long-term future mattered

- Recognizing how things connect
- Living within our means
- Meeting people's needs in ways that are good for communities, profitable and compatible with nature

We see a sustainable community, state or nation, as one that can persist over generations and not undermine its economic, environmental or social wealth, or that of others.

The water context for understanding sustainability in Minnesota Minnesota has identified nearly 2,000 impaired lakes & streams so far, based on assessment of only 5% of its streams and 12% of its lakes. Of the 911 impaired lakes identified thus far, 87% are due to mercury in fish – a regional, if not national problem. Up to 90 % of all lakes in agricultural areas are thought to be impaired by excess nutrients. The more one travels south in Minnesota, the more a water body is likely to be impaired.

The presence of herbicides is pervasive in shallow wells, with detections of parent compounds in 60% of the 200 wells tested and degradates in 95 % of the wells. Volatile organic compounds, pharmaceuticals, growth hormones, endocrine disrupters and antibiotics are also present. Every fish has mercury. Some also have PCBs, dioxins and polybrominated diphenyl ethers. Minnesota also has concerns with frog malformations and fish gender morbidity.

The availability of water in many areas also may limit growth. Heading northwest of Minneapolis along a major growth corridor, supplies of ground water become limited. Yet, we don't know the safe yield of aquifers in the area, nor do we understand surface-ground water interconnections or the sensitivity of aquifers to contamination. No one takes responsibility for assessing the implications of projected growth on supplies. All are keys to the sustainable management of water. The use of Minnesota's waters does not appear to be on a sustainable course.

The role of states and the opportunities: It can only get increasingly difficult to protect the environment as time passes if the economy says not to. States interested in aiding the move to sustainability therefore have a responsibility to recognize a triple bottom line. They must work hard to be – and help others become – fiscally prudent, ecologically intelligent and socially just. The state role in helping society become sustainable is complex and multi-faceted. States are advocates and integrators of social, economic and environmental goals. They work to protect and allocate resources. They levy taxes and set fees, fund research, educate, regulate, subsidize, invest and act as product consumers. They also collaborate extensively with local governments, regional organizations and the federal government. How the states perform each of these jobs is the key. Understanding how to do a job in a sustainable manner is not always easy, and states will need help and guidance to do so.

Indicators help us think long term with systems & interconnections in mind. Through the use of indicators, people can develop a common language and better understand what outcomes are likely to be sustainable, and where mid-course corrections are needed. According to the Bellagio Principles, states (and others) must measure the well-being of the whole system and its social, economic and environmental parts. They need to understand the state of the system, as well as its direction and rate of change and the interactions across system parts. They also need to track the drivers of change, including intended and unintended incentives, and their consequences. To understand water sustainability, states must understand how water affects and is affected by social, economic and environmental systems, today and long term.

This is a daunting task, and it makes opportunities for collective action important to seize. Examples of these opportunities include:

- Understanding systems, system change and drivers
- Understanding out-of-bounds inputs and sinks (such as mercury or acid deposition from sources outside a state's boundaries)
- Collaboration in monitoring, research, assessment, regulation, education, fund raising, consuming

These state responsibilities also show the work of the Sustainable Water Resources Roundtable to be timely and on target. In particular, the SWRR can help by developing a uniform framework for

understanding water sustainability, including a vision, principles, criteria and indicators. It also can identify the key water connections within social, economic and environmental systems.

States would benefit greatly from a commonly accepted model for understanding and measuring progress toward water sustainability. The model could include examples of how the concept of water sustainability includes, pervades and affects social, economic and environmental elements. Just like you cannot “take water out of the environment,” you cannot divorce water from its uses and benefits when analyzing its “sustainability.” The concept of “water sustainability” has little meaning in a vacuum – without the tie to how water may or may not meet existing and long term future demands of humans and ecosystems.

### **Linda Eichmiller, ASIWPCA: Sustainability in the Water Arena**

Traditional national mandates and one-size fits all solutions are not adequate, but that realization needs to be translated into a new management paradigm at the national, state and watershed levels. Many challenges can only be resolved at a watershed level and collaboration is needed due to complex and interrelated issues. Perhaps the greatest challenge that a manager faces is the need to effectively communicate with, and engage, the public as full partners. This includes seniors, youth and the private sector.

Generally, the technology and science exists to move forward in an adaptive management process. The human factor is the weak link that needs much greater attention. This entails new management skills, improved strategies and better communication. Successful application of social marketing principles is important, due to the need for behavioral and life style changes. But, that is a foreign concept to managers. Since resources are limited, it is important to correctly diagnose the situation and consider the benefits and risks of alternatives, without getting bogged down in trying to craft “the perfect solution.”

Starting small and building on success is often a good strategy. Education may be the single most effective management practice. State, regional and national governments must take a leadership role to establish a clear vision and facilitate the process. Other stakeholders rely on them for useful information and tools to help focus on the right questions and penetrate the thicket of intertwined programs, laws and regulations. Since effective approaches involve local land use, the traditional national/state toolbox must be supplemented with other stakeholders’ tools. New and more creative approaches are needed, including flexible market based approaches. Stakeholders at all levels of government need to gain a better understanding of, and fully utilize, their collective assets. Significant progress has been made on coordination, but we have only scratched the surface of what stakeholders are capable of doing.

Stakeholders need to reach consensus on what biological integrity means, how it should be measured. While this is the Clean Water Act’s goal, the national program has not been driven by that goal. More monitoring and better techniques are needed to gather the right kind of data and provide enough information to make good decisions. Managers should seek creative alternatives. Volunteer and other 3<sup>rd</sup> party initiatives should be encouraged. Improvements are essential in data base management as well as public access to information. National governments need to pay more attention to transboundary issues and foster large multi-jurisdictional watershed efforts. Watershed managers in the public and private sector need a forum to periodically come together to discuss issues and share information. Issues that need much more attention include: The impact of air deposition (mercury); Infrastructure – how to build and pay for it; and drought management and climate change.

### **Chris Lant, University Council on Water Resources: Water Resources Sustainability: An Ecological Economics Perspective.**

Ecological economics provides us with the best normative and analytical guide to identifying sustainable paths and rectify unsustainable paths by, essentially, expanding the meaning of “efficiency” to include system interactions and non-market components such as ecosystem services and human capital. Figure 1 presents a systems conceptualization of sustainable development where natural, human, intellectual

and manufactured capital are transformed continuously, one into another, by the processes of the market economy.

Water plays at least three critical but distinct roles in the ecological-economic process diagrammed in Figure 1. 1) withdrawn water as a raw material or a factor of production of a number of marketable commodities 2) potable water as a critical contributor to human health 3) water in oceans, estuaries, rivers, lakes, wetlands, soil, and other components of the hydrologic cycle as a, if not the, critical factor of production of ecosystem services.

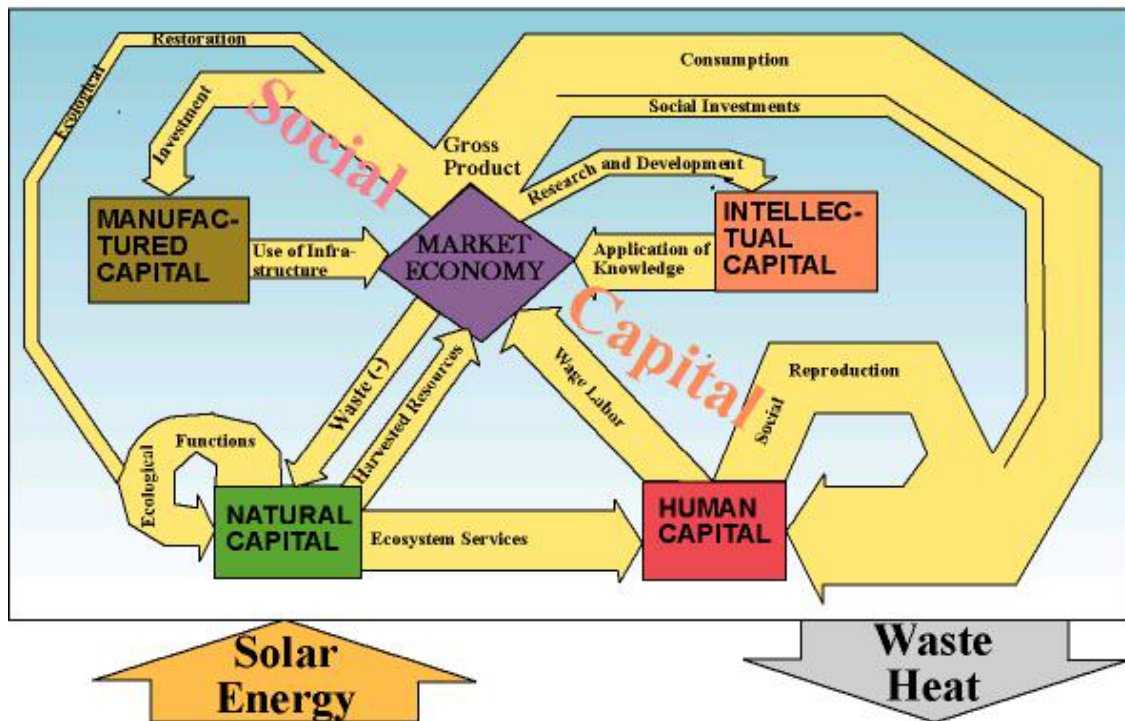
Measuring the components of this figure in specific situations, however, represents a steep methodological challenge that has not yet been met. In order to apply ecological economics rigorously in any given specific situation, we need to know how to measure the current local marginal ecological opportunity costs and benefits associated with various management or policy options as well as the marginal economic costs and benefits. Contingent valuation and genetic algorithms currently represent the most promising methodologies.

These ideas were applied to three issues in water resources management:

- 1) a human right to water
- 2) integrated water resources management (IWRM)
- 3) virtual water

Each were found to be generally consistent with the ecological economics perspective on sustainability.

### A DYNAMIC SYSTEMS CONCEPTUALIZATION OF SUSTAINABLE DEVELOPMENT



#### **John Dawes Summary: Western Pennsylvania Watershed Program**

The purpose of the Western Pennsylvania Watershed Program is to protect or restore Pennsylvania's unique water resources on an ecosystem basis and to foster separate technologies used to preserve and reclaim watersheds.

The Western Pennsylvania Watershed Protection Program is a small grants program, funded by private philanthropy, with the intent to leverage state and federal contracts for watershed restoration and preservation. To date, having been in business for nine years, \$3m has been granted to watershed associations, and this has resulted in over \$27m. in projects.

Program areas include, Abandoned Mine Drainage. Whether a discharge is acidic or alkaline makes a difference in design of a passive treatment system and the Program fosters separate technologies. A unique opportunity has been an outcome of Program grants. Some groups are attempting to implement separation technologies for metals into their designs, in order to produce a saleable oxide as well as produce clean water. This Program area is called Resource Recovery. Non-point source pollution is becoming the number one water quality problem in the state, as stretches of stream come back to life through AMD abatement. Toward this end, grants are made to groups that implement rotational grazing systems, spring development, and streambank fencing. Riparian planting using native species is a good method for filtering nutrients. Accompanying this Program area is the Cold Water Heritage Fisheries Program of DCNR and the Western Pennsylvania Watershed Program makes small grants to facilitate this planning process.

### **Presentation by Sustainability Concept Group (Stephen Gasteyer).**

Members of the group: Rhonda Kranz, Ted Heintz, Warren Flint, Al Steinman and Stephen Gasteyer. We discuss concepts in order to better deal with complexity and to build a shared language and common understanding. This understanding will help to structure the SWR Roundtable process and promote learning needed to move toward sustainability

There are a number of systems concepts we can use to understand how the world works including the Systems Perspective and Set Theory Model. We see a biosphere, encapsulated with three systems: natural, social, and economic systems. Two examples were given of how these interconnect:

- 1) Community Water Supply Example of the Systems Perspective
- 2) Hydropower and Fishery Example of the Systems Perspective

All systems have subsystems and components, structure and processes through which subsystems and components interact and properties that result from the characteristics of subsystems, components structure, and interactions.

In a view of sustainability we must look at the role of capital. Capital is the capacity to produce a flow of value over an extended time and all three systems produce flows of services, experiences, or goods over time. All three systems contain capital. Sustainability can thus be assessed using criteria and indicators of environmental, social, and economic capital. Capital is a property that results from the characteristics of subsystems, components, structure, and interactions. The Brundtland Commission definition of sustainability as: "Meeting current needs without compromising the opportunities to meet the needs of future generations" it can be closely related to the maintenance of these various forms of capital.

Concepts We Can Use to Organize Information:

Roles and Uses of Information: Three Views:

- Assessment, Diagnosis, Prognosis, Prescription, Treatment, Reassessment
- Policy Making, Forecasting and Evaluation, and Management
- Research and Education

Information Pyramid shows the levels of data, information and indicators and distinguished the role of each.

Three Meanings of "Criteria":

- A specific target that is accepted as a threshold of success for an objective
- A generally desirable direction of change for a category of phenomena
- A general category of phenomena for which we may later specify the desirable direction of change or a specific target

A Process for Identifying Criteria and Indicators Based on Relationships Between Systems & Information Concepts to Assess Resource Sustainability could link the idea of criteria to a set of general categories of capital. Once categories of capital have been identified, indicators can be determined. Here are some examples of identifying criteria:

Types of outputs people value: Food, Energy, Recreation, Wildlife, Drinking water

Types of valued capital: Biodiversity and biological productivity, climate and hydrologic capacities, built structures and facilities, fish and water stocks, fisheries management laws and institutions

Questions and Answers regarding Sustainability Concept Group (Stephen Gasteyer presiding)

In the discussion period the SWRR participants spoke about the relationship between long-term and immediate concerns, the need to look broadly into many issues such as technology and salinization, agricultural development, and a focus on the future. We need to develop indicators that might lead to alternative outcomes perhaps through a discussion of water budget. Any discussion of sustainability must factor in how we impact the inputs and outputs of the water cycle.

### **Breakouts on Concepts of Water Sustainability**

1. Questions and discussion on the concepts presented? On components of sustainability?
2. Is anything missing? What should be added or deleted?
3. Is the focus on long-term capacity (capital) rather than indicators of current outputs acceptable and within constraints of programs you work with?
4. Is focus on assessment in criteria and indicator selection, setting aside diagnosis and forecasting to be addressed later in the roundtable process acceptable?
5. Will the concepts presented work as a guide for the roundtable process of selecting criteria, indicators and related elements?

### **Summary – Robert Goldstein—Brown Group**

Unlike the first SWRR workshop, that was for the most part organizational, this workshop centered on substantive deliberations about water resources sustainability issues, criteria, indices and research. SWRR already has gone a long way to producing two important products, both of which have been discussed at this meeting. The first is a conceptual framework for surface water resources sustainability, produced by Rhonda Krantz and her conceptual framework committee. The second is the review by Tim Smith of the literature on environmental and sustainability criteria and indices. At the meeting it was decided that Rhonda and Tim will be responsible for preparing papers on their products to be published in a special issue of Water Resources Update devoted to the topic of water sustainability.

Key points by Ted Heinz. Decision-making is an iterative long-term process. While there will be major data and knowledge shortcomings that impact our ability to produce criteria and indices, it is important for SWRR to start now. Our objective should be to affect the way decisions are made, improve decisions, and promote sustainability. It is important that SWRR be an open collaborative process. In comparing sustainability topics (forests, rangelands, minerals, water), it is worth noting that not all are equally fuzzy. I would argue that minerals and water are more tractable than forests and rangelands.

Key points by Panel. Both industrial panelists, Keith Hanson and Steve Hellern, emphasized importance for industry to be proactive in reaching out to stakeholders. Both agreed that water sustainability was an important issue for industry. The pharmaceutical industry which had not thought about water availability in the past, has recently seen that a sufficient supply of inexpensive, clean, fresh water to meet its needs may not always be there. Hellern also called for a simple set of indicators such as a car instrument panel.

John Wells emphasized the need to balance growth against environmental and human health protection. He pointed out the lots of agencies are collecting relevant data but no one is integrating these data into the big picture. Linda Eichmiller discussed the need for a toolbox to solve water sustainability issues. She noted that one approach does not resolve all issues. She also advocated more monitoring and the creation of new scientific techniques. John Dawes demonstrated how a local-based environmental group could use small grants to leverage highly effective environmental projects. He specifically spoke about

restoration of waters impaired by acid mine drainage in western Pennsylvania and the value of local action. His perspective was bottom-up, down-to earth and pragmatic. In contrast, Chris Lant from academia took a more conceptual, philosophical, top-down perspective. Chris introduced terms such as natural, social, intellectual and manufactured capital, as well as virtual water. He spoke about needing to transform the existing economic system to effectively deal with the different types of capital.

### **Summary – Paul Freeman—Blue Group**

This breakout discussion group agreed with the basic foundation of “capital” proposed by the Sustainability Conceptual Framework Work Group but had other suggested improvements. The group felt the concept of capital was an effective tool to balance and allocate “spending” in our analogous water “checkbook and savings accounts”. The goal would be to balance our account or even accrue added capital to the accounts. The group felt that the hydrologic cycle should be the basic organizing structure. For the assessment and allocation of water capital, natural, economic and social factors would effect valuation and allocation of “spending.” The group also emphasized, that the conceptual framework needs to start with a vision, and then building a model that allows assessment diagnosis and forecasting.

### **Summary – Rick Swanson - Green Group**

The breakout group began with a discussion of the presentation on concepts of sustainability. The group looked at uses of economic indicators as a precedent for sustainability indicators on water. They discusses the differences in looking at capital rather than or in addition to the output sphere (includes social, economic, and environmental). There was a discussion of measuring process vs. stressors on the quality and supply of water with the idea that criteria and indicators should trigger futuring i.e. thinking about the future. The group agreed that basic principles need to be articulated.

Who’s not here? The group discussed the need to involve more corporations, non-profit groups, communities and states in the process. Sustainability is an issue at different scale levels. The group liked the use of water budget as a basic framework for indicators.

### **Questions and comments following Breakout Session (Facilitated by David Berry)**

Warren Flint was concerned that too much focus on indicators will limit us.

Stephen Gasteyer said we should not forget work on indicators that’s already been done.

Doug Holy said the vision from the Bellagio Principles will help us to determine various other factors.

Rhonda Kranz reminded us that moving forward, people with new ideas need to participate more fully. People respond differently to initiators and language.

Ted Heintz spoke of using the hydrologic cycle and water budgets as organizing principles

Chris Lant said we can rally other groups around the notion of natural capital. Is natural capital the actual indicator and how do we measure natural capital?

John Castellano: Social and economic values of water are based on usage.

Ted Heintz : Hesitant about the use of the word value

Craig Schiffries: Indicators may change over time.

John Castellano: Worried that we’re looking at sustainability only as a water factor. Water budgets change over long periods; any study requires that we make projections into the future.

Rhonda Kranz: People seem to like the idea of capital  
Interest in using the hydrologic cycle must include social, economic, and natural capitals.



Other systems and models may be incorporated.  
Issues persist related to vision and time scale.

David Berry: The roundtable approach for identifying criteria and indicators allows people with many views to comment & move toward consensus.

### **Criteria & Indicators, Tim Smith**

What Studies Exist about Sustainability? This review is based on seven existing studies that include criteria and indicators. There are others too, but this is a good place to start. The links to each of these studies can be found on the Water Roundtable web site, at <http://water.usgs.gov/wicp/acwi/swrr/>. The seven studies are:

- Roundtables on Forestry, Rangelands, and Minerals (each developed water indicators)
- “Sustainable Development in the U.S.” (IWGSDI)
- “State of the Nation’s Ecosystems” (Heinz Center)
- EPA State of the Environment Report, in draft form
- USGS “Concepts for National Assessment of Water Availability and Use” (Circular 1223)

What do we need to learn? By examining these studies, we hope to draw on knowledge that will help the Water Roundtable to address such important questions as:

- What criteria do others use to select good indicators?
- How can these criteria be adapted for SWRR use?
- What do others define as an indicator?
- How can these indicators be used by SWRR?
- What indicators might be added or deleted?
- What is the SWRR rationale for these choices?

Technical Criteria for indicators: First we can look in the professional literature to see what kinds of criteria are proposed for selecting good indicators. One such source lists the following criteria

1. The indicator from which it is calculated should be readily available.
2. The indicator should be easy to understand.
3. The indicator must be measurable.
4. The indicator should measure something believed to be important in its own right.
5. There should only be a short lag time between the state of affairs referred to and the indicator becoming available.
6. The indicator should be based on information that can be used to compare different geographical areas.
7. International comparability is desirable.

These criteria are from Moffatt, Ian, Nick Hanley, and Mike D. Wilson, “Measuring and Modelling Sustainable Development,” Parthenon Publishing, New York, 2001.

Category or subject related criteria for Indicators: If we look at the seven studies, we see that the definitions of criteria for selecting indicators are quite varied. For example, here are how the different studies conceive of criteria:

First, looking at the other three sustainable resource roundtables: The Roundtable on Sustainable Forest stated criteria as goals as has the Sustainable Rangelands Roundtable. The Sustainable Minerals Roundtable uses criteria which are goals supplemented by indicator properties.

The Interagency Working Group on Sustainable Development Indicators (SDI Group) used six technical indicator properties. The Heinz Center used goals plus some indicator properties as criteria for indicators. The EPA Report on the Environment used quality, coverage, & suitability categories with details about indicator properties. The USGS Concepts for National Assessment of Water Availability and Use used a mix of indicator technical properties plus geographical and process requirements.

## Day 2

### Breakouts on Criteria

Initial discussion to identify a range of categories to be addressed. Which criteria common to other roundtables and groups are most useful to the SWRR? What additional ones or modifications are needed in our discussions on water sustainability? Can the groups identify 8 -10 categories or criteria subjects? Steering Committee members facilitate groups.

Green Group: Cynthia Garman Squier, Sean Ianacone, Rick Swanson, Matt Borgia, Jim Sedell, Chris Lant, Steve Ragone

#### General Criteria

Surface water quality	Physical condition of waterways	Biological condition of waterway
Ground water quality	Ground water quantity	Use and availability of water
Security	Water infrastructure and condition	Public health

#### Externalities

Climate	Population density	Technological innovation
Policy regulation	Land use/cover/change	Security issues – extreme events
Ecological / Economic / Social		
Availability / condition	Security	Public health

#### Construct

Net availability	Water budget	Hydrologic function
Spatial / temporal / scale	Water imbalance	Data / knowledge base
Legal / economic		

Blue Group: Robin O'Malley, Doug Holy, John Wells, Keith Hanson, Paul Barlow, Paul Freedman, Marshall Popkin

#### Criteria groupings

Recreation	Power / industrial	Wildlife
Quality / quantity	Ground water / storm water	Natural / social / economic
Matrix		

Key: Capital that has value to protect has relevance to sustainability

#### Uses

Recreation	i. Boating	ii. Fishing	iii. Swimming	iv. Viewing / aesthetics
Ecosystem	i. Flora	ii. Fauna	iii. Flood protection	iv. Water quality / waste

#### Drinking water

Transportation	i. Navigation	ii. Pipelines / coal slurries
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#### Industrial / Commercial

#### Waste management

#### Role of energy/energy industry

Brown Group: Tim Smith, Steve Borchard, Bob Goldstein, Karen Solari, Kevin Lynott, Stephen Gasteyer, John Castellano, Jill Lane, Rhonda Kranz

#### Conservation of watershed conditions

Water yield dynamics (including physical attributes)  
Biological & hydrogeologic cycling (function)

#### Biodiversity

Habitat fragmentation  
Population health  
Invasive Species

#### Water quality / bioquality

By use

By sector

In stream  
 Withdrawal  
 Ground water system integrity  
 Water hazards

Floods  
 Droughts  
 Systemic hazards  
     Endocrine Disruptors  
     Species Deformity  
     Pharmaceutical concerns  
     Pathogens  
 Extreme weather events  
 Security (terrorism, hazardous waste, slurry holding areas)

Social Infrastructure

Legal institutional policy / framework  
 Spiritual  
 Ethical  
 Cultural

Economic Infrastructure

Degraded water resources  
 Potentially treatable water sources – water reuse – recycling

Coastal Estuarine  
 Human Hazards

Security (terrorism, hazardous waste, slurry holding areas)

**Discussion on Criteria Reports from breakouts.**

David Berry: Compatibility with other roundtables and the CEQ effort is nontrivial. It is good to have a debate today, but we should have a sub-group refine the criteria & come back to us. What are the commonalities of the three groups?

Robin O'Malley: In the Heinz Project we looked at the extent of the system; its chemical and physical characteristics; biological components; and the uses we make of it

Paul Freedman – A sub-group will need guidance before going to work.

Matt Borgia: Maybe there should be one sub-group that takes the “capital and hydrologic” approach, while another takes the “uses” approach

Chris Lant: Argued for defining criteria now; a subcommittee could tackle the next level. We should develop materials for a conference presentation for others to recruit new participants (no special authorization is needed). The “destination” of the SWRR process is CEQ; Heinz Center (which gets federal \$ from CEQ); USFS 2005 report on state of the nation’s natural resources; USFS will use the indicators in setting resource management goals, etc.; BLM may follow.

Chris Lant suggested the following criteria:

- Criteria one: Maintaining the availability of water of sufficient quality & quantity for legitimate uses
- Criteria two. Maintaining the physical & biological integrity of aquatic, wetland and coastal environments
- Criteria three. Protecting human health & property against damages from floods, droughts, water-borne disease and hostile actions
- Criteria four. Maintaining the functionality and safety of water resources infrastructure
- Criteria five. Building & retaining the knowledge and database needed to assess the degree to which these criteria are being met at the basin and watershed scale and the understanding of social factors that affect these criteria.
- Criteria six. Ensuring the water resources decision-making process is participatory, democratic and Equitable

Robin O'Malley: National perspectives are important, but they should be focused also on spinning off into small-scale places. Are national questions and indicators the same at local levels? At what level do you measure: local or national?

Tim Smith – The definition of sustainability can be different based on whether the level considered is local or national. Working “top down” and “bottom up” simultaneously to identify “the issues” and evolve indicators from the “issues”. We need to measure sustainability at all scales.

We also need to set boundaries around water indicators to maintain focus on water capital.

Scarcity is a fundamental issue and may be an effective focus that covers many other issues.

### **Presentations on indicators: Tim Smith**

Summary: Water Indicators Used in Studies.

Now it is possible to summarize the very large number of water indicators as used in the seven studies mentioned yesterday:

Roundtable on Sustainable Forestry: Area, flow, biological diversity, quality.

Sustainable Rangeland Roundtable: Area, flow, erosion, biota, quality, channels, ground water change, wetlands, riparian extent and condition

Sustainable Minerals Roundtable: Quality compliance, problem sites re withdrawal & ground water, use, consumption, discharge, recycling, reinjection, evaporation.

SDI Group: Sustainable Development in the US: Quality, supply vs. withdrawal

Heinz Center State of the Nation's Ecosystems: Area, length, chemical & physical conditions, biota, withdrawal, groundwater level, disease, recreation

EPA Report: Area, length, use standards, withdrawal, ecosystems, riparian land cover, atmospheric deposition, runoff, sedimentation, toxic releases, nutrients, wetlands, coastal waters, eutrophication, drinking water quality, recreation, seafood consumption.

USGS Circular: Surface & ground-water availability (flow, storage); withdrawal, consumption, losses; water cycle (inflow, outflow, storage).

Conclusions: The seven studies examined for this analysis show a great variety of water indicators, although there are a few that appear repeatedly. The purposes of each study are different, and that certainly tends to tailor the indicator to the purpose. For example, the Sustainable Minerals Roundtable is very concerned with the problems associated with extractive mineral sites, and for that reason there tends to be a concentration on water quality and compliance measures at individual sites. In some of the studies water is just a part of the focus, which tends to preclude going into detail if a limited number of total indicators is an objective. Clearly, it will be much harder to grasp an overall picture if one must deal with a very large number of indicators.

Some types of indicators tend to recur. For example, some measure of water quantity, measured in flow, area, water use, or availability. The terminology may differ. Also, we find measures of water quality in chemical and biological terms. It's much harder to find indicators of extreme hydrologic conditions, such as floods and droughts. There may be an assumption of “business as usual” underlying these studies.

Future selection of indicators for the Water Roundtable may thus depend on how one defines water resources sustainability. If sustainability implies some form of long-term balance among environmental, economic, and cultural elements, then water indicators must be connected not only with other parts of the environment, but also with the economy and the culture as well. Substantial research problems exist in

developing just how this might be done. It is likely that working on these problems will be part of the future work of the Water Roundtable, and perhaps finally lead to water indicators of sustainability that can be used by a wide variety of organizations throughout the nation.

### **Research on water sustainability: Bob Goldstein**

There are several possible SWRR research roles including serving as a forum for discussion among participants and organizing sessions at SWRR workshops. SWRR could be a catalyst for project development among member organizations.

In the future a newsletter could be circulated with critical reviews of research. There could be SWRR sponsored research projects directly funded by members or with SWRR serving as a funding broker

Research Topics could include:

- Criteria and indices
- Best Management Practices with respect to water for agriculture, forestry and other industries
- Advanced cooling technologies
- Degraded water use
- Watershed management decision support models
- Water conservation technologies
- Water banking and trading
- Advanced monitoring technologies

Set up of workgroups on indicators and research. David Berry (participants choose from breakout groups based on the criteria categories identified earlier. There will also be a breakout group on research. This is the beginning of parallel work groups.)

### **Summary of Meeting: Bob Goldstein**

- A. Simplicity of the criteria is pertinent
- B. Many groups collect data, but much of that data has not been integrated
  1. Widespread problem
  2. SWRR could play a role in mitigating this issue.
- C. One science doesn't fit everything--different regions have different problems.
- D. Need more and better monitoring techniques
- E. Small amounts of money can be leveraged to make a big impact in an area. Bottom up approach. Top down approach should be done simultaneously
- F. Publication of SWRR work should be considered
- G. When should we hold the next meeting? Early November?
- H. Look for free/donated space—possibly in federal building
- I. Outreach to other groups needed (David Berry to chair Outreach)

### **Meeting Close: David Berry**

Action Items:

Criteria Group: Rhonda Kranz will call the Concept group into session to integrate the criteria. Ted Heintz, Steve Gasteyer, Warren Flint, Al Steinman, Paul Freedman, David Berry (others welcome to join)

Outreach Group: To enroll new participants: David Berry, Tim Smith, Tracy Bowen

Research Group: Bob Goldstein

Facility Group: To find Free meeting space: Tracy Bowen, David Berry

Funding Group: Rick Swanson, Bob Goldstein, David Berry, Ted Heintz. Help with Congress from Paul Freedman, John Dawes. Requests to Foundations – Rhonda Kranz will check with ESA and Jill Lane will check with WEF.