REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 074-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	1999	Final Report

4. TITLE AND SUBTITLE
Freshwater Decision Makers' Information Needs

5. FUNDING NUMBERS
N/A

6. AUTHOR(S)

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
RAND Environmental Science & Policy Center, Washington, DC

8. PERFORMING ORGANIZATION REPORT NUMBER
N/A

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)
SERDP
901 North Stuart St. Suite 303
Arlington, VA 22203

10. SPONSORING / MONITORING AGENCY REPORT NUMBER
N/A

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION / AVAILABILITY STATEMENT
Approved for public release: distribution is unlimited.

12b. DISTRIBUTION CODE
A

13. ABSTRACT ***(Maximum 200 Words)***

This project was launched as a follow up to the Freshwater Imperative, which was initiated in 1990. The project was developed as a three-phase effort to identify priority research issues based on the needs of decision makers. The purpose of the Freshwater Decision Makers' Information Needs (FIN) is straightforward: to enhance the use of scientific information by those responsible for managing, restoring and conserving freshwater systems by strengthening the linkages between research and decision making. RAND has designed a multiphase process that allows freshwater decision makers to convey their information needs to the research community. After decision makers identified the policy questions and key issues, the research community will identify current or future research to address these needs. Then relevant research guidance will be developed at both the national level and regional scale. The results of this iterative process will enhance the dialogue between the research and decision making communities.

14. SUBJECT TERMS
SERDP, SERDP collection, freshwater, Freshwater Imperative (FWI), Freshwater Information Needs (FIN)

15. NUMBER OF PAGES
11

16. PRICE CODE
N/A

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
unclass	unclass	unclass	UL

CS1086-1

SERDP FINAL REPORT

Freshwater Decision Makers' Information Needs

CS-1086

SERDP
Strategic Environmental Research and Development Program

Strategic Environmental Research
and Development Program
U.S. Department of Defense

December 1999

FRESHWATER DECISION MAKERS' INFORMATION NEEDS

PHASE I REPORT

RAND Environmental Science & Policy Center
Washington, DC

1999

Freshwater is a strategic national and regional resource in a rapidly changing world. It is a source of energy, an avenue of transportation, a habitat for a myriad of organisms, and essential for life. Freshwater structures the physical landscape, is a central feature of climate, and exerts major influences on economic growth and demographic patterns. Yet, as the human population increases, more and more demands are placed on freshwater ecosystems. Already, sufficient clean water and healthy aquatic habitats have become a rare natural resource. Understanding the abilities and limits of freshwater ecosystems to respond to human-generated pressures has become vital to long-term societal stability. Changes in the distribution, abundance, and quality of water and freshwater resources in this century represent a strategic threat to the quality of human life, the environmental sustainability of the biosphere, and the viability of human cultures (Naiman et al., 1995).

BACKGROUND

The **Freshwater Imperative (FWI)**, which was initiated in 1990, involved a coalition of aquatic scientists from federal agencies, academia and the private sector and aimed to identify and set priorities in freshwater research, as documented in the *The Freshwater Imperative: A Research Agenda* (Naiman et al., 1995). Within the federal government an ad hoc Coordinating Council formed by federal agency managers and researchers coordinated research, and jointly sponsored projects to further both the science and policy related to freshwater systems. The near-term objective of the FWI was to promote interdisciplinary and institutional cooperation to improve the understanding of freshwater systems in the context of environmental change, and to further environmental sustainability of inland aquatic systems.

The FWI has identified both national-level water issues and regional-scale objectives that need to be addressed by research. The national issues listed below focus on the long-term vitality of human and biological systems.

- Freshwater ecosystems play a central role in balancing socio-economic values and environmental sustainability.

- The scope of water-related environmental issues – ecological impoverishment, water availability, human health, quality of life – exceeds the capacity of individual disciplines, institutions, or nations to address them.

The regional objectives address the following:

- Prediction of the effects of regional climate and landscape change on freshwater ecosystems;

- Development of an environmental perspective from which biophysical and socio-economic scientists can work cooperatively toward an understanding of regional aquatic problems; and

- Resolution of regional freshwater problems through an understanding of underlying systemic factors.

The current freshwater research efforts lack cohesiveness and usually do not focus on the needs of resource managers and policy initiatives. Management strategies are needed that are more efficient and less costly in the long term. Accordingly, scientific research, management and decision making must be balanced and integrated more effectively.

The project on **Freshwater Decision Makers' Information Needs (FIN)** was launched as a follow-on to the FWI effort. The project was developed as a three-phase effort to identify priority research issues based on the needs of decision makers. Phase I was sponsored by the Department of Defense Strategic Environmental Research and Development Program, the U.S. Environmental Protection Agency Office of Water, and the Electric Power Research Institute. Funding for Phases II and III is currently being sought from public and private sector organizations. FIN was designed and conducted by the RAND Environmental Science & Policy Center (formerly Science & Policy Associates, Inc.). This report describes the activities and results of Phase I.

FRESHWATER DECISION MAKERS' INFORMATION NEEDS

Though challenging, the purpose of FIN is straightforward: to enhance the use of scientific information by those responsible for managing, restoring and conserving freshwater systems by strengthening the linkages between research and decision making. RAND has designed a multi-phase process that allows freshwater decision makers to convey their information needs to the research community (see Figure 1). After decision makers identified the policy questions and key issues, the research community will identify current or future research to address these needs. Then relevant research guidance will be developed at both the national and regional scale. The results of this iterative process will enhance the dialogue between the research and decision making communities.

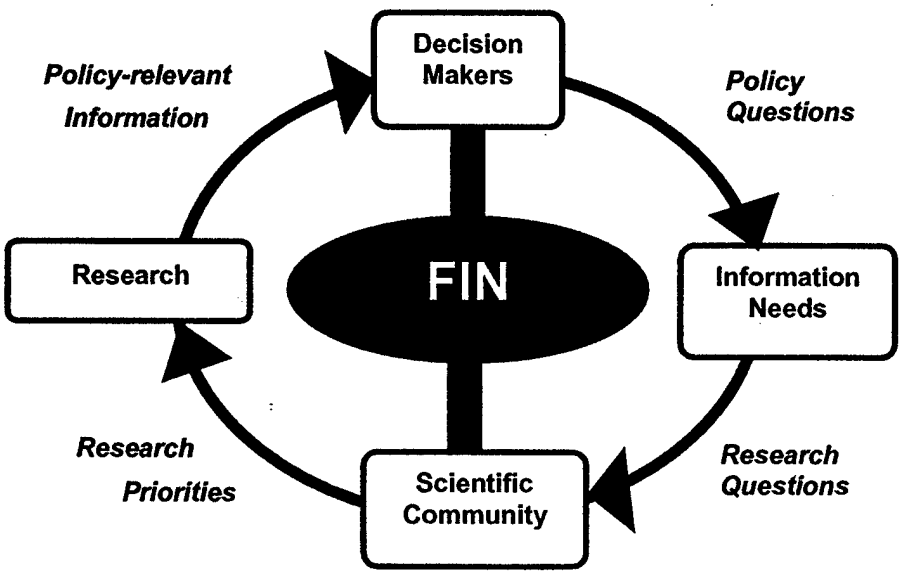

Figure 1. Iterative Process for Developing Policy-Relevant Research Guidance

The specific objectives of FIN are as follows.

- Establish an ongoing dialogue between the producers of scientific information on freshwater systems (researchers) and the users of that information (decision makers).
- Develop a list of priority information needs based on scientific understanding that is tailored to address management and policy goals.
- Broaden the constituency for up-to-date results of freshwater research.

The project began by examining freshwater issues at the broad national level. A pilot study is planned to extend the results to important water resources in different regions.

Significance of FIN

- To identify information most important to actual decision makers
- To focus decision makers on their information needs and the research community on policy-relevant research
- To develop a basis for research planning
- To bring together regulatory and resource management organizations in defining key research needs
- To serve as a first step toward establishing an assessment process

Approach

The FIN project is being conducted in three phases with opportunity for interaction and review by the two communities – decision makers / resource managers and researchers. The overall process is illustrated in Figure 2.

Phase I – Decision Makers' Information Needs *(complete)*

In Phase I, key decision makers in the public and private sectors worked together in a number of capacities to create a preliminary framework of decision makers' information needs. Initially, a small group of decision makers was identified and interviewed to elicit their information needs. The results of these interviews were instrumental in providing a context, and therefore direction, for the FIN project. The FIN steering committee and project team then brought together five freshwater science and/or policy experts as a core group to provide guidance on the project and develop a preliminary framework of priority issues. As a final step, focus groups were held to allow diverse sets of decision makers to interact and discuss the framework. The results of Phase I are summarized in the next section.

Phase II – Research Guidance

In Phase II, the decision makers' needs will be translated into a set of policy-relevant science questions. Leading natural and social scientists will examine these research questions in the

context of the existing Freshwater Imperative Research Agenda (Naiman et al., 1995) and assign priorities based on decision makers' needs identified in Phase I. A workshop with researchers and decision makers will be conducted to discuss the priority issues and time frame for results. The workshop will elevate the level of interaction between the two communities. At the conclusion of Phase II, a research guidance document will be developed that focuses on freshwater issues at the national level.

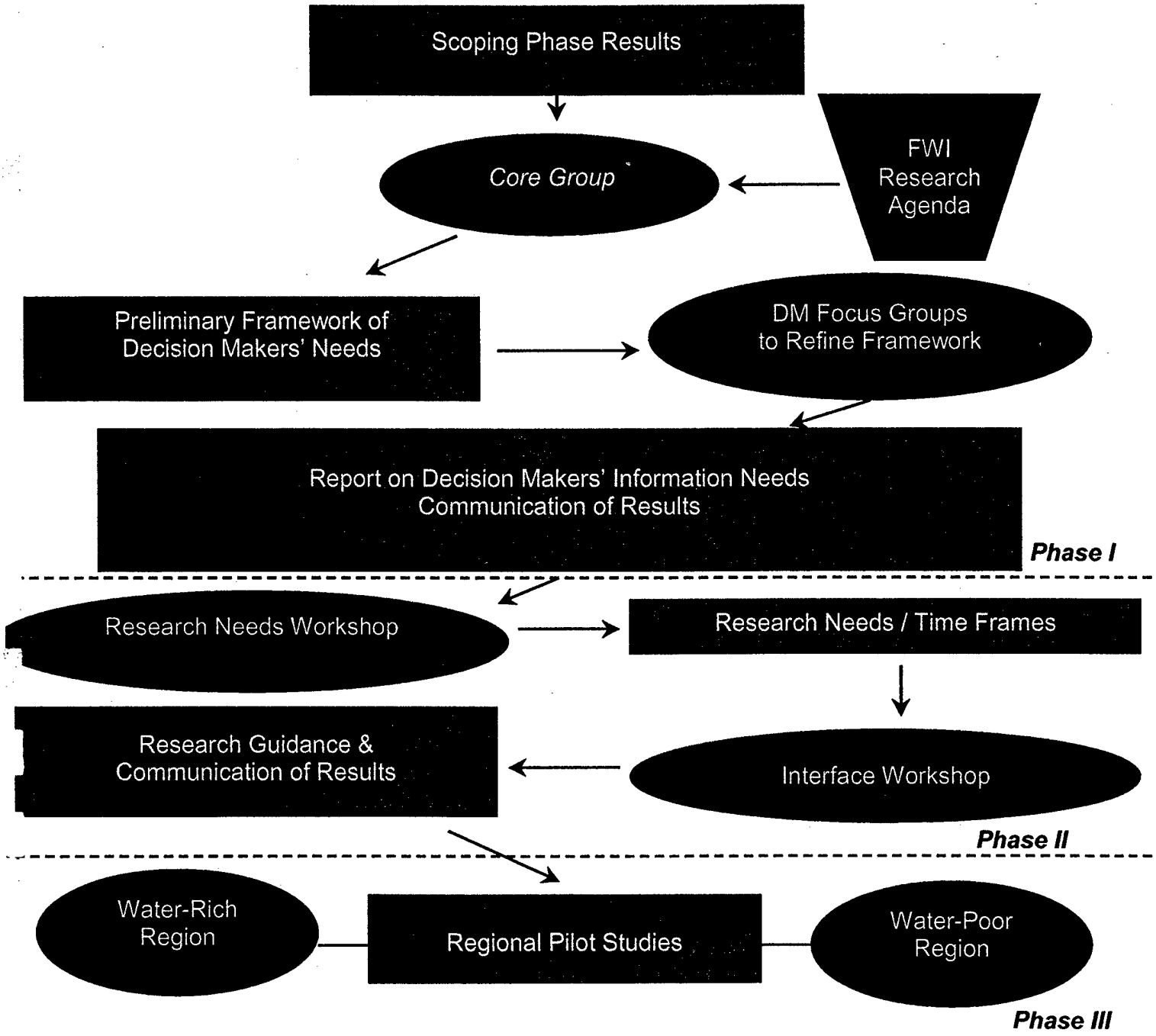

Figure 2. FIN Process

Phase III – Regional Pilot Study

In Phase III, the interactive dialogue between decision makers and researchers will continue at the regional level. Two regions will be selected: one water-rich region (e.g., the Great Lakes,) and one water-poor region (e.g., the Colorado River Basin or Southern California). Research, management, and communication guidance will be developed to address the particular issues and concern of the regions selected.

Results of Phase I

During Phase I of the project, the FIN steering committee was established to assist in defining the scope of the project, identify decision makers to involve and provide overall guidance. The steering committee includes members of the FWI Coordinating Council, current and potential sponsors of the work, and additional members of the scientific community involved in developing the FWI research agenda.

Scoping Activities

As part of an initial scoping effort, the FIN project team prepared a report that identified and described information resources currently available to decision makers responsible for water resources. This survey included data systems, World Wide Web sites, and other electronic and print resources. The project team then compiled a list of about 40 key decision makers to participate in interviews, focus groups, and/or the workshop in Phase II. The decision makers represented local, state and federal levels of the public and private sectors.

Having identified decision makers, FIN project team then conducted telephone interviews to begin eliciting freshwater information needs. The interviews were primarily with national-level representatives of state and local water resource decision makers as well as some managers from federal resource management agencies (Table 1).

Table 1. Interview Participants

Association of State Drinking Water Authorities –Vanessa Leiby, Executive Director
Association of State Wetland Managers – Jon Kusler, Executive Director
Ground Water Protection Council – Michael Paque, Executive Director
International Association of Fish and Wildlife Agencies – Gary Taylor, Legislative Director
National Association of Conservation Districts – Don Wells, Water Quality Specialist
Trout Unlimited – Steve Moyer, Director of Governmental Affairs
U.S. Bureau of Reclamation – Stan Ponce, Senior Water Resource Specialist
U.S. EPA / National Health and Environmental Effects Research Laboratoty – Jennifer Orme-Zavaleta, Assistant Director

The interviews provided insight on the issues and perspectives that were likely to emerge during Phase I of FIN, and began to build a constituency for the project. The five associations contacted cover a range of perspectives, including drinking water, ground water, water quality districts, wetlands management, and wildlife and habitat conservation. Most of the members of these associations are state or local governing officials who are responsible for making regulatory, management and operational decisions. The two government agencies contacted, EPA and the Bureau of Reclamation, have vastly different mandates. While EPA regulates water quality and promotes ecosystem management, the Bureau builds, manages, and operates dams and irrigation systems.

As anticipated, the interviewees identified a wide range of priority issues. Despite the diversity of perspectives, all of the information needs could be grouped into three issue categories.

- Water Quantity and Flow
- Human Health and Pollution
- Ecological Issues

FIN Core Group

After the initial interviews were conducted, the FIN project team worked with members of Steering Committee to form a core group of experts for the FIN project. It was the core group's role to assist with the assessment of decision makers' information needs. The core group met to discuss the results of the interviews with decision makers and organized the conclusions into a preliminary framework of key issues and issue categories.

Members of the core group were selected based on their understanding of decision makers' needs in the three critical areas identified in the project scoping phase: water quantity and flow, human health and pollution, and ecological issues. Included in the core group are representatives from relevant federal, regional and state government agencies, private sector, trade associations, and experts in academia associated with information users (see Table 2). Core group members also represented decision makers at the state level and the national level as well as the private sector.

Table 2. Core Group of Experts

Stan Changnon – former director of Illinois State Water Survey (hydrology / agriculture)

Ken Frederick – Resources for the Future (water resource management / economics)

Bob Naiman – University of Washington (freshwater ecosystems)

Dan Pedersen – American Water Works Association (drinking water quality and human health)

Chip Smith – Army Corps of Engineers (water quantity and flow)

The core group reached consensus on the following parameters for Phase I:

- Project Scope

  The project should address both current and emerging issues. Other potential issues will surface through research but will not be considered directly within FIN. The project will be U.S. focused but internationally relevant. Coastal zones and estuarine systems are not covered under the current FIN program.

- User Audience

  The primary users of Phase I results are decision makers at the policy level: Congress and Executive Branch, federal and state agencies, regional commissions, water utilities and industry organizations, infrastructure and engineering firms, and interest groups.

- Criteria for Setting Priorities

  The group agreed on three key issues to use as criteria for identifying priorities.

  - Relevance to policy
  - Current or emerging issue
  - Tractability of the issues

- Driving Forces of Information Needs

  The core group identified important overarching issues that function as driving forces in the water resource area.

  - Land-use change
  - Climate change, shifting extremes
  - Budget constraints
  - Changing social values
  - Technological change

- Classification Scheme

  The core group developed a preliminary framework of freshwater information needs which serves as a classification scheme for organizing the information (Table 3). The categories follow.

  - Current and potential conflicts
  - Human health / drinking water quality
  - Ecological integrity and restoration
  - Economic efficiency
  - Technological and social alternatives
  - Institutional issues

Table 3. Framework of Decision Makers' Information Needs

Current and Potential Conflicts

- Quantification of water rights on federal lands
- Quantification and marketability of Indian water rights
- International, interstate and interbasin water conflicts (for example, conflicts between the states of Colorado and Kansas over the Arkansas River; current and potential conflicts between the U.S. and Mexico, etc.)
- Maintenance of minimum flows for fish and wildlife habitat (a component of instream use) versus withdrawal and consumptive uses of water
- Management of dams and reservoirs for competing uses, including flood control, water supply, navigation, recreation and aquatic habitat (for example, issues associated with outdated water control manuals for federal dams and the relicensing of hydropower dams)
- Urban versus rural water uses and users

Human Health / Drinking Water Quality

- Protecting public health by reducing microbial threats
- Wise use of pesticides and how to prevent their introduction into drinking water sources
- Occurrence and monitoring data on other chemical contaminants
- Identification of drinking water sources and how to protect them from pollution

Ecological Integrity and Restoration

- Effects of non-point source pollution
- Restoration and rehabilitation of ecosystems
- Maintenance of biodiversity
- Effects of altered hydrologic regimes on the flow of water, sediments, nutrients and organisms in river channels, lake basis, wetlands and groundwaters.
- Environmental goods and services provided by freshwater systems
- Prediction of human-induced changes
- Discovery and understanding of natural processes (hydrologic and ecological)

continued

Table 3. Framework of Decision Makers' Information Needs (cont.)

Economic Efficiency

- Economic value of water in alternative uses (instream uses include fish and wildlife habitat, navigation, recreation and hydropower; withdrawal uses include municipal, industrial and irrigation)
- Maintenance of habitat
- Water subsidies and pricing policies, including the challenge of creating / altering policies to reflect the current needs of all water users
- Constraints on water transfers
- Removal of impediments to water marketing, including factors related to both the nature of the resource (e.g., the importance of third party impacts) and institutional factors (e.g., laws that treat water as a free resource and limit the ability to transfer it among alternative uses)
- National versus local water standards
- Financing of infrastructure (including flood and crop insurance)
- Structural versus non-structural options, including the examination of their effects and the evaluation of current policies to determine why certain options may be chosen over others (e.g., building levees to control floods or creating water supply projects to meet growing water demands versus encouraging better flood plain or demand management)

Technological and Social Alternatives

- Methods for increasing effective water supplies (e.g., recycling and integrated watershed management)
- Improving land use to reduce non-point pollution and flooding
- Improving and protecting water quality and human health
- Reducing demand for water by using more water-efficient plumbing and other options
- Watershed / land use management
- Education on water issues
- Improving predictive capability, both short-term and long-term

Institutional Issues

- Determination of the level of governance most appropriate for planning, managing, protecting and allocating water, including the establishment and enforcement of water quality standards
- Implementation of integrated water management by establishing clear goals and standards for balancing environmental, public health and economic objectives
- Coordination of federal, state, basin, and local governments' regulations, policies and planning / management activities
- Coordination across policy areas, including land use, agriculture and energy
- Ownership and management of federal facilities and infrastructure, including the exploration of transferring ownership and management to private or state entities (e.g., should the Central Valley Project be turned over to the State of California? If so, under what terms?)
- Improvement of the accuracy and efficiency of data monitoring, collection and analysis, and determining who should be responsible for these activities

Focus Groups

RAND designed and conducted two focus groups to allow freshwater decision makers to review and discuss the preliminary framework of information needs. Each of the focus groups involved key representatives of industry, interest groups, and federal, state, and local governments and afforded the participants an opportunity to articulate their perspectives and primary information needs. The participants are listed in Table 4.

Table 4. Focus Group Participants

Focus Group I	**Focus Group II**
James Davenport National Association of Counties	Paul Brouha American Fisheries Society
Susan Davies U.S. EPA / Office of Water	Steve Clark U.S. EPA / Office of Groundwater and Drinking Water
Deborah Jensen The Nature Conservancy	Dave Davis U.S. EPA / Office of Water
Steve Moyer Trout Unlimited	Louis Jenny National Association of Water Companies
Stephanie Osborne American Public Works Association	Stan Ponce Bureau of Reclamation
Donald Wells National Association of Conservation Districts	Norm Starler Office of Management & Budget

Specifically, the focus groups had three objectives.

- To review the preliminary framework of decision makers' information needs prepared by the core group
- To discuss how perspectives toward freshwater resources vary between and among sectors and disciplines
- To increase sector awareness of the efforts of the Freshwater Imperative and FIN project.

In preparation for the focus groups, participants were given the preliminary framework developed by the core group as well an outline of the factors that should be considered when reviewing the document. The outline focused on three aspects of the framework: organization, content and usefulness. During the focus groups the participants engaged in a facilitated review session, taking time to examine the items in the framework in light of each aspect. As anticipated, many valuable comments concerning both organization and content were made, all of which will be explored in Phase II of the project. Generally, focus group participants affirmed the work the core group had done and agreed that the framework was useful.

In addition to reviewing the framework, participants discussed the importance of the issues addressed by the overall project. Often relating their own past experiences, participants discussed the challenges they face and agreed that the existing shortcomings in freshwater information can cause significant problems in resource management. Freshwater decision making would be greatly improved if the right people could receive the right information – the very motivation for the FIN project. This in mind, participants also considered the next phases of FIN, expressing approval of the overall layout of the project and offering guidance on how to ensure the project's effectiveness. Some of the issues discussed include the following.

- Mid-level freshwater technicians should be the audience for information produced by FIN; they are often charged with day-to-day decision making, and also provide the best conduit of information to upper-management.

- Research outputs should be practical and presented in such a way that researchers and decision makers of all levels can utilize them.

All of these considerations will be factored into future phases of the project.

Summary

The results of Phase I – Decision Makers' Information Needs will be useful for decision makers and resource managers as well as researchers to help focus the limited available resources on priority research issues. Any follow-on activities will further enhance the linkages between research and decision making on freshwater issues. More specifically, the results of FIN will:

- Improve the use of scientific information in environmental policy and management decisions.

- Provide guidance for research that addresses decision makers' information needs.

- Broaden decision makers' understanding of freshwater research results and their value.

The sponsors and promoters of FIN encourage other agencies and organizations to support the future phases of the project.

References

Naiman, R.J., J.J. Magnuson, D.M. McKnight, and J.A. Stanford, eds. 1995. *The Freshwater Imperative: A Research Agenda.* Washington, DC, Island Press.

12 JAN RECD

RAND Environmental Science & Policy Center

DATE: 6 January 2000

TO: Brad Smith, SERDP

COPY: Robert Holst, SERDP

FROM: Katie Smythe, Project Manager

SUBJECT: Final Report – Project #CS1086

Enclosed is a file copy of the final report for Phase I of the project entitled *Freshwater Information Needs of Decision Makers (FIN)*. A draft of the report was distributed to the project steering committee earlier in 1999; no comments were received. This report on Phase I fulfills our contractual obligations under SERDP Project #CS1086.

Please contact me if you have any questions about the project or the report (Tel: 202-296-5000 ext. 5264; Fax: 202-296-7960; Email: smythe@rand.org). We look forward to the potential opportunity to work with you in the future.

Best regards.

Katie Smythe

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