



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
WASHINGTON, D.C. 20460

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OFFICE OF  
RESEARCH AND DEVELOPMENT

Dr. James H. Johnson, Jr.  
Chair, Board of Scientific Counselors  
Dean, College of Engineering, Architecture, and Computer Sciences  
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Dear Dr. Johnson:

The Office of Research and Development (ORD) would like to take this opportunity to thank you and the members of the Board of Scientific Counselors (BOSC) for the June 2005 program review of the Drinking Water Research Program (DWRP). We especially thank the members of the Drinking Water Research Subcommittee who conducted the review: Drs. Gary Saylor (Chair), James Johnson, Jr. (Vice-Chair), Chi-Hsin Selene Chou, James Raymer, David Sedlak, and Mary Ward (consultant).

Enclosed with this letter is our response to the recommendations in your Report of October 27, 2005. Please feel free to contact me if further information is needed.

We are pleased that the BOSC found that the DWRP was an important contributor to protecting the Nation's drinking water. The Subcommittee's advice will be used by the DWRP to improve the program. ORD intends to request the next program review for the DWRP in about 4 years and to ask the BOSC for a mid-cycle consultation in 1-2 years.

Again, thank you for your valuable efforts.

Best regards,

A handwritten signature in black ink, appearing to read "George Gray".

George Gray  
Assistant Administrator

Enclosure



Office of Research and Development's (ORD) Response to the Board of  
Scientific Counselors (BOSC) December 2005 Final Report that  
Reviews ORD's Drinking Water Research Program

**BOSC Drinking Water Subcommittee:**

Dr. Gary Sayler, Chair

Dr. James H. Johnson, Jr., Vice Chair

Dr. Chi-Hsin Selen Chou

Dr. James Raymer

Dr. David L. Sedlak

Consultant to the Subcommittee: Dr. Mary H. Ward

**Submitted:**

Dr. Greg Sayles

Acting National Program Director

Drinking Water Research Program

Office of Research and Development

**ORD Response to the Board of Scientific Counselors (BOSC) Review of the Drinking Water Research Program (DWRP)**

A Drinking Water Subcommittee of the BOSC conducted a review of ORD's drinking water research program in 2005. As part of the review, the subcommittee conducted conference calls on June 6 and September 7, 2005, and held a face-to-face meeting in Cincinnati, Ohio on June 21-23, 2005. The draft subcommittee report was reviewed by the BOSC Executive Committee at their September 2005 meeting, and the final BOSC report was transmitted to ORD in December 2005.

The following is a narrative response to the recommendations provided by the BOSC review of ORD's drinking water research program. The BOSC recommendations are listed below (in italics following its reference number) under the most relevant Charge Question (recommendations expressing common themes are combined). The ORD response follows each set of recommendations.

**Charge Q1: Program Relevance. Is the DWRP focusing on EPA's strategic goals, and are potential public benefits clearly evident?**

No BOSC recommendations for Charge Question 1.

**Response:** ORD is pleased to receive the subcommittee's conclusion that the DWRP is "...relevant and critically important to EPA's mission in protecting human health and the environment. The program is focused on high quality research of national importance in support of OW, and in particular EPA's Strategic Goal 2 for Clean and Safe Water."

**Charge Q2: Program Design. Is the program design logical, with goals and priorities clearly identified and with the MYP describing an appropriate flow of work?**

*(2a) The decision to consolidate three LTGs into two is not well justified. Although it may lead to a streamlined research plan, it also may result in an unintended de-emphasis of source water protection and distribution systems research. Given budget constraints this may be unavoidable, but it is likely that these research areas will continue to grow in importance, partly as a result of homeland security issues and the further recognition of the impact of source water on drinking water quality. The ORD/DWRP should continue to evaluate the question of whether the two LTGs can accommodate the source water protection and distribution systems research needs adequately.*

**Response:** ORD agrees with the recommendation. The DWRP concluded that the two-goal structure proposed to the BOSC based on regulatory status of contaminants is not sufficient to ensure adequate consideration of source water protection and distribution systems. In response to this BOSC counsel and several other recommendations below, the DWRP has drafted a new set of long term goals (LTGs).

- **New LTG1: Support SDWA Mandated Revisions and Rule Implementation.** Focused short to medium-term research that OW, Regions, States, municipalities and utilities will use in legislatively-mandated six-year review and implementation of existing rules.

- **New LTG2: *Source to Tap – Assessing and Managing Risks.*** Medium to long-term research that OW and the Regions will use when making future decisions, organized into themes of the drinking water life cycle:
  - Source Water*** – Research needed to protect source waters from pathogenic and chemical contamination and to assess risks associated with these contaminants.
  - Treatment*** – Research needed to effectively treat source waters including (1) determining the performance and cost of processes to remove pathogenic and chemical contaminants and (2) characterizing of the formation and risk of the byproducts of treatment.
  - Distribution*** – Research and development needed to maintain the safety of treated DW as it is distributed, and to assess and manage the risks associated with the aging DW infrastructure.This new LTG allows research to evolve in a problem-driven atmosphere rather than in the regulatory status-driven environment (old LTGs).

*(2b) The issues pertaining to distribution systems need to be better integrated (e.g., chemical and biological processes should be considered together). Furthermore, ORD should not restrict research on distribution systems to contaminants listed under LTG 1. The distribution system is relevant to many of the issues addressed in LTG 2.*

**Response:** ORD agrees with the recommendation. The recently drafted LTGs (see 2a) place distribution systems (DS) research in the revised LTG2 where distribution issues will be addressed in the context of the source to tap continuum, regardless of contaminant type or regulatory status. Biological and chemical components of DS research are being better integrated in current revision of the MYP.

*(2c) ... [an] important issue related to LTG 1 is the question of whether too much focus on regulatory determinations can be a handicap. There are real issues related to the Agency's goal of safe drinking water that are not addressed effectively by LTG 1 and LTG 2. For example, how are ORD staff members anticipating new problems outside of CCL issues? Where does water reuse fit into the research program? Anticipatory research may fit well with the STAR Program rather than with proscriptive Requests for Proposals (RFPs).*

**Response:** A strong motivation to build the new LTG structure (see 2a) is to facilitate thinking outside traditional regulatory boxes, fostering anticipatory research ideas. The revised MYP will likely include investment in several areas of research that do not explicitly support decision-making mandated by SDWA such as water reuse, groundwater protection, underground injection of CO<sub>2</sub> for carbon capture and storage, and the aging DW infrastructure. The MYP revision process will determine in which of the above topics and to what extent should DWRP resources be invested, including a determination of what research is best accomplished by STAR grants.

*(2d) The potential and possible need exist to develop a strategy to manage arsenic in residual wastes from treatment on a long-term basis. The magnitude of the problem scope has not been delineated fully. Technically, it may represent a significant issue, and there is a mandate to manage arsenic in residual wastes.*

**Response:** ORD agrees that questions remain on how best to manage arsenic treatment residuals. The DWRP's Arsenic Treatment Technology Demonstration Program (ATTDP) is

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determining the quantity and character of the residuals generated by its treatment processes at locations across the U.S. Since each state establishes its own approach to managing these wastes, the development of a nationwide strategy is probably not a valuable use of resources. The ATTDP disseminates the results of its treatment demonstrations including data on residuals to states, municipalities and utilities to better inform their arsenic management decisions. Commitment to this work is reflected in the 2003 and the revised MYP. No additional ORD action is required.

*(2e) The need for a thorough evaluation of [the source water protection portion of the DWRP]...for protecting ground water resources may be a priority item. Furthermore, it appears that ORD should not restrict research on source water protection to contaminants listed under LTG 2 as source water protection research is relevant to some regulated contaminants in LTG 1... The SDWA well-head protection program is an important part of EPA's efforts at source water protection; however, little documentation nor a description of this program were available; also, the obvious links to homeland security issues were not documented. The need for a thorough evaluation of this program for protecting ground water resources may be a priority item.... ORD should consider that further efforts to integrate research on source water protection with the CCL research would be advantageous.*

**Response:** Addressing the concerns of the BOSC regarding DWRP's source water protection (SWP) research is underway. "Source Water" is identified as a separate research theme under the "source to tap" continuum (new LTG2 – see 2a), promoting the consideration of all relevant contaminants, regulated or not. The revised MYP will expand research on the groundwater aspects of SWP, perhaps including work on aquifer storage and recovery and underground injection of CO<sub>2</sub> for carbon capture and storage. The relationship of the SWP research to related work supported by the National Homeland Security Center will be clarified in the revised MYP.

**Charge Q3: Progress on Key Scientific Questions and Client Needs. Has progress been made toward the LTGs while addressing key science questions in a rational and clearly articulated manner? Has the research met the clients' needs in a timely fashion with outcomes identifiable in environmental decisions, regulations, and technical assistance?**

*(3a) The CCL process is challenging, given the potential for large numbers of contaminants. Additional resources ultimately will be needed by ORD to respond adequately to this mandate. ORD is strongly encouraged to aggressively pursue partnering with other agencies and NGOs to ensure that the CCL needs are addressed adequately.*

**Response:** ORD agrees that such partnering would benefit the Agency by broadening the science base of the work and by leveraging resources. Historically, the DWRP has funded key partners such the CDC and NIEHS. With diminishing resources, over time partnerships will need to evolve from one-way funding toward relationships based on the integration of in-kind contributions to address research of mutual interest.

*(3b) The SDWA and rules drive the MYP for Drinking Water Research; this in turn, guides research efforts and investment in the DWRP, which further constrains the scope of research and limits the magnitude of "anticipatory" research the program can support. ORD should evaluate*

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*strategies that could be implemented to encourage more cutting edge research to identify and circumscribe issues, problems, and solutions that impact safe drinking water. One such strategy could be to invest greater resources in the STAR Program for an enlarged anticipatory research effort.... The STAR Program remains critical to EPA's overall research strategy and capabilities. The program lends diversity and vigor to ORD's research mission. To anticipate new problems in drinking water contamination, treatment, distribution, and source water protection, the Agency should consider STAR solicitations that are somewhat more open ended. In particular, research contributing to the CCL process could benefit from greater levels of anticipatory/exploratory research.*

**Response:** DWRP is encouraging more cutting-edge, anticipatory research in its intramural and STAR programs by redesign of its LTGs (see 2a). The revised LTG2 promotes integrated source-to-tap approaches to DW research questions. Anticipatory intramural and grant-supported research are facilitated by organizing this work into the source-to-tap scheme (LTG2) and by enhancing the workforce available to carry out this research by moving science FTEs from research on regulatory issues (LTG1) to LTG2. The STAR program will continue its recent approach to publishing open-ended RFAs to encourage innovative research on DW problems. The present MYP revision will show research directions that the DWRP anticipates will be best conducted by STAR while continuing the responsiveness of the grants program by conducting annual solicitations.

**(3c)** *Opportunities exist to develop research to fill data gaps in potential health risks and treatment technology of newly identified DBPs in drinking water treated with chlorination, such as haloacetonitriles, in addition to dibromoacetonitrile.*

**Response:** ORD agrees that the DWRP has the opportunity lead the nation's research on newly identified, unregulated DBPs. The DWRP plans to seize this opportunity - addressing research questions on the impacts of disinfection on treated water quality is the DWRP's responsibility. This research area will contribute to the "Treatment" theme of the newly drafted source-to-tap LTG (LTG2), and this line of research will be described in the revised MYP.

**(3d)** *It appears that EPA needs some way to respond quickly to the detection of new contaminants.... Recent experience shows that identification of new contaminants requires followup on unusual observations and support for research that is not centrally planned 8 years in advance.*

**Response:** ORD plans research 5 to 10 years in advance to inform long-term decisions on budget, workforce, facilities and science directions, and to communicate planned research directions and products to stakeholders. Newly identified research needs that require immediate attention can be initiated by the DWRP NPD working with the ORD Labs and Centers and program clients.

**(3e)** *Continuing research on waterborne disease requires ongoing surveillance efforts and long-term epidemiologic studies. Challenges in this area include the limited research budget for conducting the longer-term epidemiologic studies required. Additional opportunities should be sought for partnering with academic institutions and other government agencies.*

**Response:** ORD agrees that additional partners would help leverage funding and bring greater breadth of skills to this research. In addition, ORD acknowledges the need to address research skills as a vital component of workforce planning including, possibly, enhancing ORD's inhouse epidemiology staff.

*(3f) ORD should find water reuse to be an issue on the near-term horizon and, a strategic research plan for this area will have to be developed in the near- to mid-term.*

**Response:** ORD agrees. The U.S. reliance on reused water is expected to increase rapidly as demand for water increases and the quality of available source water continues to deteriorate. This trend compels the DWRP to begin a significant research area on water reuse and is currently planning studies on aquifer storage and recovery and on dual distribution of water. If ORD determines that a more extensive water reuse program is warranted, the expertise of several ORD programs would be tapped including Drinking Water, Human Health, Water Quality, and perhaps Ecosystems and Global Climate Change. ORD will consider leading the development of a Federal-wide research plan on water reuse.

**Charge Q4: Scientific Quality. What is the scientific quality of the research product, and is it ensured through competitive merit-based funding? How is quality maintained, and how are funds allocated for non-competitively awarded projects?**

*(4a) Cooperative agreements resulting in intramural collaboration receive internal peer review but are not open to an extensive outside review process. This may tend to perpetuate some research efforts that are past their prime and may leave the Agency open to concerns of "cronyism." ORD could consider a streamlined external review process that could make suggestions to improve the quality and/or timeliness of the cooperative venture.*

**Response:** EPA-wide requirements for the competition needed prior to awarding cooperative agreements and other assistance agreements are addressed in EPA Order 5700.5A1 (January 11, 2005), "Policy for Competition of Assistance Agreements," available at [http://www.epa.gov/ogd/competition/5700\\_5A1.pdf](http://www.epa.gov/ogd/competition/5700_5A1.pdf). ORD Labs and Centers comply with this order including when DWRP funding is used.

**Charge Q5: Scientific Leadership. Have the program and/or individual ORD researchers demonstrated or played a leadership role in drinking water research, problem-solving, or advancing the frontier of science?**

*(5a) EPA's role as a science leader is multifaceted and is perceived differently by differing constituents both within and outside the Agency. In a pure research context, however, ORD's historical leadership role in drinking water research is eroding. While it is expected that islands of science and scientific leadership will be maintained, resource availability and federal regulatory mandates will define those areas where ORD will have recognizable international leadership. ORD is strongly encouraged to develop a "Science Leadership" mission statement and to identify those areas it believes it is capable of establishing or sustaining international leadership over the long term. This will be challenging, given the dynamics of such issues as*

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*homeland security or global change as they are superimposed on more conventional topics and mandates in drinking water research. Without such a vision, however, ORD runs the risk of becoming too applications-oriented and implementations-oriented in its DWRP, with little direction for individuals to strive for scientific leadership.*

**Response:** ORD agrees that developing a “Science Leadership” mission statement is important to help define the program’s future. Such an exercise would encourage the program to integrate its constraints - examining its technical strength and weaknesses, anticipated research areas of growth and decline, and expected resources – to develop a forward-looking strategy on how to maximize the program’s leadership given these constraints.

**(5b)** *ORD is strongly encouraged to continue to press for timely appointments to these key leadership positions.... The Subcommittee believes there is need to fill the acting positions to solidify the program’s leadership as soon as possible.*

**Response:** ORD agrees that filling acting positions, including the National Program Direction (NPD) for Drinking Water Research, with permanent appointments is beneficial.

**(5c)** *Although it is somewhat difficult to compute, an analysis of the publication records of the DWRP researchers, managers, and STAR grant participants indicates the average publication rate for peer-reviewed and total publications per person per year over the last 10 years is less than 1.0. The Subcommittee views this as below the expected publication rate of a program that aspires to be a leader in drinking water research.*

**Response:** The draft BOSC report included a statement similar to the quotation above from the final report. ORD provided feedback to the BOSC disagreeing with the approach taken to calculate publication rates and proposing an alternative method. The September 2005 BOSC Executive Committee meeting minutes (page 34) indicate that the BOSC accepted ORD’s proposed alternative approach and would use it in the final report. However, the ORD approach is not reflected in the final report. Using ORD’s approach, the number of publications per Principle Investigator per year for 2000-2004 is estimated to be 1.8 and 1.2, based on total publications and on peer-reviewed journal articles, respectively.

**Charge Q6: Coordination and Communication. Does the program effectively engage scientists and managers from both ORD and DW in planning and identifying key gaps? Is the process open to all stakeholders and the science community? How effective is interagency interaction in advancing EPA’s research agenda, and are there effective mechanisms for research communication?**

**(6a)** *ORD’s DWRP has had significant outputs that have been translated by its clients into outcomes, largely in support of its principal client, OW, but also in support of states and industry. Unless the client is active in attributing ORD’s research contributions to outcomes, these contributions are difficult to identify and quantify. ORD needs to be proactive in developing metrics to document and support its assertion that translation of its research outputs is making significant contributions with respect to downstream outcomes as part of the overall*



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*logic model. If “outcomes” are indeed an important GPRA and PART process metric, then a focused effort is needed to make the process of outputs-to-outcomes transparent.*

**Response:** ORD agrees. ORD is in a process of developing metrics to demonstrate the impact of its programs. DWRP is participating in the ORD-level efforts and is also considering additional metrics specific to the DWRP.

**Drinking Water Research Program  
Summary of BOSC Recommendations From December 2005 Final Report and Proposed  
ORD Actions and Timelines**

(includes entries only for those recommendations that require ORD action)

<b>Recommendation</b>	<b>ORD Action</b>	<b>Timeline for Action</b>
<p><b>(2b)</b> <i>The issues pertaining to distribution systems need to be better integrated (e.g., chemical and biological processes should be considered together). Furthermore, ORD should not restrict research on distribution systems to contaminants listed under LTG 1. The distribution system is relevant to many of the issues addressed in LTG 2.</i></p>	<p>1) LTGs have been drafted that support DS research of all relevant contaminants;</p> <p>2) Better integrate biological and chemicals components of the DS research in the MYP.</p>	<p>(1) Done</p> <p>(2) ORD plans to complete the draft revision of the MYP by October 1, 2006.</p>
<p><b>(2c)</b> <i>... [an] important issue related to LTG 1 is the question of whether too much focus on regulatory determinations can be a handicap. There are real issues related to the Agency's goal of safe drinking water that are not addressed effectively by LTG 1 and LTG 2. For example, how are ORD staff members anticipating new problems outside of CCL issues? Where does water reuse fit into the research program? Anticipatory research may fit well with the STAR Program rather than with proscriptive Requests for Proposals (RFPs).</i></p>	<p>(1) New LTG design supports anticipatory research that is not aimed explicitly at known regulatory needs;</p> <p>(2) New non-regulatory areas of research will be incorporated in the revised MYP.</p>	<p>(1) Done</p> <p>(2) ORD plans to complete the draft revision of the MYP by October 1, 2006.</p>

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<b>Recommendation</b>	<b>ORD Action</b>	<b>Timeline for Action</b>
<p><i>(2e) The need for a thorough evaluation of [the source water protection portion of the DWRP]...for protecting ground water resources may be a priority item. Furthermore, it appears that ORD should not restrict research on source water protection to contaminants listed under LTG 2 as source water protection research is relevant to some regulated contaminants in LTG 1... The SDWA well-head protection program is an important part of EPA's efforts at source water protection; however, little documentation nor a description of this program were available; also, the obvious links to homeland security issues were not documented. The need for a thorough evaluation of this program for protecting ground water resources may be a priority item.... ORD should consider that further efforts to integrate research on source water protection with the CCL research would be advantageous.</i></p>	<p>(1) New LTG design supports SWP protection research on all relevant contaminants;</p> <p>(2) The revised MYP will include appropriate groundwater SWP research and will clarify its relationship to homeland security research.</p>	<p>(1) Done</p> <p>(2) ORD plans to complete the draft revision of the MYP by October 1, 2006.</p>
<p><i>(3a) ORD is strongly encouraged to aggressively pursue partnering with other agencies and NGOs to ensure that the CCL needs are addressed adequately.</i></p>	<p>The National Program Director (NPD) will encourage ORD Labs and Centers to partner with extramural agencies and NGOs when these collaborations add value to DWRP's research.</p>	<p>The DWRP will report on the status of partnering at the mid-cycle consultation with the BOSC.</p>

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<b>Recommendation</b>	<b>ORD Action</b>	<b>Timeline for Action</b>
<p><b>(3b)</b> <i>The SDWA and rules drive the MYP for Drinking Water Research; this in turn, guides research efforts and investment in the DWRP, which further constrains the scope of research and limits the magnitude of “anticipatory” research the program can support. ORD should evaluate strategies that could be implemented to encourage more cutting edge research to identify and circumscribe issues, problems, and solutions that impact safe drinking water. One such strategy could be to invest greater resources in the STAR Program for an enlarged anticipatory research effort.... The STAR Program remains critical to EPA’s overall research strategy and capabilities. The program lends diversity and vigor to ORD’s research mission. To anticipate new problems in drinking water contamination, treatment, distribution, and source water protection, the Agency should consider STAR solicitations that are somewhat more open ended. In particular, research contributing to the CCL process could benefit from greater levels of anticipatory/exploratory research.</i></p>	<p>1) Newly drafted LTGs (see 2a) embrace open-ended and anticipatory research directions;</p> <p>(2) Continue to plan anticipatory DW research including annual open-ended STAR solicitations.</p>	<p>(1) Done</p> <p>(2) At the BOSC mid-cycle consultation, report on DWRP’s open-ended, anticipatory research plans including STAR solicitations.</p>
<p><b>(3c)</b> <i>Opportunities exist to develop research to fill data gaps in potential health risks and treatment technology of newly identified DBPs in drinking water treated with chlorination.</i></p>	<p>Include research on newly identified, unregulated DBPs in the revised MYP.</p>	<p>ORD plans to complete the draft revision of the MYP by October 1, 2006.</p>
<p><b>(3e)</b> <i>Continuing research on waterborne disease requires ongoing surveillance efforts and long-term epidemiologic studies. Challenges in this area include the limited research budget for conducting the longer-term epidemiologic studies required. Additional opportunities should be sought for partnering with academic institutions and other government agencies.</i></p>	<p>The DWRP will continue to seek appropriate partners for this work and will consider workforce planning when developing and implementing the Science Leadership mission statement (see 5a).</p>	<p>The DWRP will provide a status report on partnering at the mid-cycle BOSC consultation.</p>

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<b>Recommendation</b>	<b>ORD Action</b>	<b>Timeline for Action</b>
<p><b>(3f)</b> <i>ORD should find water reuse to be an issue on the near-term horizon and, a strategic research plan for this area will have to be developed in the near- to mid-term.</i></p>	<p>(1) Water reuse research will be included in the revised MYP;</p> <p>(2) the DWRP will develop a plan of action that will determine the need for an increased water reuse research effort within ORD and if a cross-Federal government research planning effort would be useful.</p>	<p>(1) ORD plans to complete the draft revision of the MYP by October 1, 2006.</p> <p>(2) The water reuse plan of action will be presented to the BOSC at the mid-cycle consultation.</p>
<p><b>(5a)</b> <i>ORD is strongly encouraged to develop a “Science Leadership” mission statement and to identify those areas it believes it is capable of establishing or sustaining international leadership over the long term.</i></p>	<p>Develop a DWRP Leadership mission statement.</p>	<p>DWRP plans to propose the mission statement to the BOSC at its mid-cycle consultation.</p>
<p><b>(5b)</b> <i>ORD is strongly encouraged to continue to press for timely appointments to these key leadership positions.</i></p>	<p>ORD will continue to recruit for the NPD for Drinking Water Research.</p>	<p>ORD intends to fill the NPD position in 2006.</p>
<p><b>(6a)</b> <i>ORD needs to be proactive in developing metrics to document and support its assertion that translation of its research outputs is making significant contributions with respect to downstream outcomes as part of the overall logic model. If “outcomes” are indeed an important GPRA and PART process metric, then a focused effort is needed to make the process of outputs-to-outcomes transparent.</i></p>	<p>Continue efforts to build useful metrics of program impact and pilot a promising set of metrics.</p>	<p>DWRP will report to the BOSC on progress with metrics at its mid-cycle consultation.</p>