

**21ST CENTURY WATER PLANNING:  
THE IMPORTANCE OF A  
COORDINATED FEDERAL APPROACH**

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**HEARING**  
BEFORE THE  
**COMMITTEE ON SCIENCE AND  
TECHNOLOGY**  
**HOUSE OF REPRESENTATIVES**  
ONE HUNDRED ELEVENTH CONGRESS

FIRST SESSION

MARCH 4, 2009

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**21ST CENTURY WATER PLANNING: THE IM-  
PORTANCE OF A COORDINATED FEDERAL  
APPROACH**

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**WEDNESDAY, MARCH 4, 2009**

HOUSE OF REPRESENTATIVES,  
COMMITTEE ON SCIENCE AND TECHNOLOGY,  
*Washington, DC.*

The Committee met, pursuant to call, at 9:30 a.m., in Room 2318 of the Rayburn House Office Building, Hon. Bart Gordon [Chair of the Committee] presiding.

BART GORDON, TENNESSEE  
CHAIRMAN

RALPH M. HALL, TEXAS  
RANKING MEMBER

U.S. HOUSE OF REPRESENTATIVES  
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**Hearing On**

***21<sup>st</sup> Century Water Planning: The Importance of a Coordinated  
Federal Approach***

Wednesday, March 4, 2009  
**10:00 a.m. – 12:00 p.m.**  
2318 Rayburn House Office Building

**Witness List**

**Dr. Henry Vaux, Jr.**  
*Professor Emeritus  
University of California, Berkeley*

**Dr. Peter Gleick**  
*President  
Pacific Institute for Studies in Development, Environment, and Security*

**Mr. Mark Modzelewski**  
*Co-founder  
Water Innovations Alliance*

**Ms. Nancy Stoner**  
*Co-director, Water Program  
Natural Resources Defense Council (NRDC)*

**Ms. Christine Furstoss**  
*General Manager of Technology  
General Electric (GE) Water and Process Technologies*

COMMITTEE ON SCIENCE AND TECHNOLOGY  
U.S. HOUSE OF REPRESENTATIVES

**21st Century Water Planning:  
The Importance of a  
Coordinated Federal Approach**

WEDNESDAY, MARCH 4, 2009  
10:00 A.M.—12:00 P.M.  
2318 RAYBURN HOUSE OFFICE BUILDING

**Purpose**

On Wednesday, March 4th, the Committee on Science and Technology will hold a hearing entitled “*21st Century Water Planning: The Importance of a Coordinated Federal Approach*” at 10:00 a.m. in Room 2318 of the Rayburn House Office Building. The purpose of the hearing is to receive testimony on the *National Water Research and Development Initiative Act* and examine the opportunities for the Federal Government to better coordinate and support research and technological innovation.

The witnesses will provide testimony on the research needed to address the challenges of managing water supplies to meet social, economic and environmental needs in the United States to accommodate population growth, climatic variation, and other factors. In addition, they will discuss their views on the need for federal research and development in the areas of water supply, water conservation, and water management. The witnesses will offer their perspectives on the *National Water Research and Development Initiative Act* and discuss its relationship to other federal policies and legislative proposals.

**WITNESSES**

- **Dr. Henry Vaux, Jr.**, *Professor Emeritus, University of California, Berkeley.* From 1994 to 2001, Dr. Vaux served as Chair of the Committee of the Water Science and Technology Board which prepared a report in 2004 on federal research and development to address water resource issues. Dr. Vaux will testify on his work chairing the Committee and how the *National Water Research and Development Initiative Act* addresses the recommendations of the 2004 NRC report.
- **Dr. Peter Gleick**, *President of the Pacific Institute for Studies in Development, Environment, and Security.* The Pacific Institute is a research institute dedicated to addressing the connections between water and human health, the hydrologic impacts of climate change, sustainable water use, privatization and globalization, and international conflicts over water resources. Dr. Gleick will discuss his research and provide his perspective on the *National Water Research and Development Initiative Act* and its relationship to other federal programs and proposals.
- **Mr. Mark Modzelewski**, *Co-founder Water Innovations Alliance.* Created in 2008, the Alliance serves as an industry association working towards increasing water research funding, strengthening federal research and development, and improving education and outreach for water industry professionals. Mr. Modzelewski will offer an industry perspective to the need for increased federal research and development related to water.
- **Ms. Nancy Stoner**, *Co-Director of the Water Program at the Natural Resources Defense Council (NRDC).* NRDC is a national, nonprofit organization of scientists, lawyers and environmental specialists with a long history of working to protect the Nation’s waters. Ms. Stoner will offer an environmental perspective on the importance of additional federal efforts to ensure clean water supplies, her perspectives on the National Water Research and Development Initiative, and the legislation’s relationship to other federal programs and proposals.

- **Ms. Christine Furstoss**, *General Manager of Technology, General Electric (GE) Water and Process Technologies*. At GE, Ms. Furstoss leads approximately 350 technologists working on critical chemical, membrane, device and processing technologies aimed at providing water treatment, water re-use and efficient process system solutions. Ms. Furstoss will testify about her work in water technology development and the role of private industry in water science research.

## BACKGROUND

The Nation's water policy remains essentially unchanged despite a myriad of reports recommending broad changes to address dwindling water supplies. Multi-year droughts continue to plague regions and states around the country, including the Southeast, Texas, and California. For many municipalities, intense competition for water and diminished supplies will force local water agencies to make tough decisions on water allocations including implementation of restrictions to protect essential ecosystem services.

Droughts, changing patterns of precipitation and snowmelt, and increased water loss due to evaporation as a result of warmer air temperatures are indicators that climate variability and climate change have impacts that are being felt across the United States.<sup>1</sup> The Intergovernmental Panel on Climate Change's (IPCC) latest report projects that water supplies stored in glaciers and snow cover will decline in the course of the century, thus reducing water availability in regions supplied by melt water from major mountain ranges.<sup>2</sup>

January 2009, the driest month in California history, has left California's reservoirs and rivers operating at near record lows. On February 20, the Bureau of Reclamation announced that a large percentage of agricultural contractors in the State are expected to receive no water deliveries this year due to California's extreme drought and municipal contractors should count on receiving a 50 percent of their normal supply. The Bureau prepared two forecasts: a conservative forecast with a 90 percent chance of having runoff greater than forecasted and a median forecast with a 50 percent chance of having runoff greater than forecasted.

**Figure 1: California Water Allocation by Forecast<sup>3</sup>**

Mid-Pacific Region: Initial Water Year 2009 Supply Forecast									
Probability of Exceedence Forecasts	Historical Average Sacramento Valley Index & Year Type	North of Delta Allocation				South of Delta Allocation			
		Ag	M&I	R	WR	Ag	M&I	R	WR
Dry Forecast (90%)	41% Critical	0%	50%*	75%	75%**	0%	50%*	75%	77%
Median Forecast (50%)	55% Critical	10%	60%*	100%	100%	10%	60%*	100%	100%
Ag = Agriculture M&I = Municipal and Industrial R = Refuges WR = Water Rights M&I supply is based on historical deliveries									
*The allocation percentage for M&I is approximate and may be adjusted to meet public health and safety needs.									
**The potential for further reductions may exist if critically dry conditions continue.									

<sup>1</sup> U.S. Environmental Protection Agency. 2008. *Water Impacts of Climate Change*. Office of Water. EPA 800-R-08-001. [www.epa.gov/water/climatechange](http://www.epa.gov/water/climatechange). Accessed February 26, 2009.

<sup>2</sup> Bates, B.C., Z.W. Kundzewicz, S. Wu and J.P. Palutikof, Eds., 2008: *Climate Change and Water*. Technical Paper of the Intergovernmental Panel on Climate Change, IPCC Secretariat, Geneva.

<sup>3</sup> Mid-Pacific Region Office, 2009. *Reclamation Announces Initial 2009 Central Valley Project Water Supply Allocation*. U.S. Bureau of Reclamation. <http://www.usbr.gov/newsroom/newsrelease/detail.cfm?RecordID=26721>. Accessed February 26, 2009.

### Recommendations for the Obama Administration

Last fall, the Pacific Institute's Dr. Peter Gleick provided water policy recommendations to the next Administration. Dr. Gleick's priorities include developing a comprehensive national water policy, spotlighting national security issues related to water, expanding the role of the U.S. in addressing global water problems, and integrating climate change into all federal water planning and activity.<sup>4</sup>

The United State's fresh water resources are used ineffectively due, in part, to a lack of a national water policy. Dr. Gleick argues, "If inefficient use and water contamination continue unabated, they will impoverish this and future generations, destroy the limited remaining aquatic ecosystems, and threaten our future food supply."<sup>5</sup>

In developing a 21st Century National Water Policy, the Pacific Institute recommends a reorganization of the diverse and uncoordinated federal water responsibilities and expanding the collection of water-use and water-quality data. In addition, the Institute calls for the re-establishment of a new national, bipartisan Water Commission for the 21st Century to evaluate and recommend changes to national water policy.

### H.R. 1145: National Water Research and Development Initiative Act

The Committee held two hearings in the 110th Congress—on May 14, 2008 and July 23, 2008—on water supply research and development. At the hearings, witnesses' discussed the need for better coordination of federal efforts on water, increased funding for research on the effects of climate change on groundwater, and improved consideration of efficient water use in energy systems. They also recommended that additional money be spent on public education programs.<sup>6</sup>

Despite an interagency research budget of approximately \$700 million, an increase in the number of water shortages and emerging conflicts over water supplies suggest that we are inadequately prepared to address the Nation's water management issues. The 2004 report by the National Research Council entitled *Confronting the Nation's Water Problems: The Role of Federal Research*,<sup>7</sup> advocates for a clear national water strategy to coordinate the 20 plus federal agencies responsible for conducting and funding research in order to avoid duplication and to tackle the looming challenges of maintaining adequate water supplies.

Chairman Gordon introduced the National Water Research and Development Initiative Act on September 23, 2008 following the Committee hearings (H.R. 6997) and in response to the recommendations in the Academy's 2004 report.

Chairman Gordon reintroduced the legislation on February 24, 2009. H.R. 1145 coordinates federal research water efforts to ensure we have the best tools and information to maintain adequate supplies of water for Americans in the coming decades. The bill seeks to improve the Federal Government's efforts in water research, development, demonstration, education, and technology transfer activities to address changes in water use, supply, and demand in the United States.

The bill codifies the Interagency Committee created in 2003, the Subcommittee on Water Availability and Quality (SWAQ) of the National Science and Technology Council's Committee on Environment and Natural Resources. SWAQ was created to identify science and technology needs to address the growing issues related to freshwater supplies, develop a coordinated a multi-year plan to improve research on water supply and water quality, and to enhance the collection and availability of data needed to ensure an adequate water supply for the Nation. H.R. 1145 incorporates suggestions in the National Academies' 2004 report that are intended to strengthen the Committee. By strengthening the SWAQ and providing it explicit Congressional authorization, the recommendations of the 2007 SWAQ report<sup>8</sup> will

<sup>4</sup> Gleick, Peter, 2008: *Water Threats and Opportunities: Recommendations for the Next President*, Peter Gleick. Pacific Institute. 3 pp. [http://www.pacinst.org/publications/essays\\_and\\_opinion/presidential\\_recommendations/background.pdf](http://www.pacinst.org/publications/essays_and_opinion/presidential_recommendations/background.pdf). Accessed February 26, 2009.

<sup>5</sup> *Ibid.*, p. 1.

<sup>6</sup> For more information on these hearings, visit the House Science Committee website at [http://science.house.gov/publications/hearings\\_markup\\_details.aspx?NewsID=2187](http://science.house.gov/publications/hearings_markup_details.aspx?NewsID=2187)

<sup>7</sup> National Research Council. 2004. *Confronting the Nation's Water Problems: The Role of Research*. Water Science and Technology Board. Committee on Assessment of Water Resources Research. National Academies Press, Washington, D.C., p. 324.

<sup>8</sup> National Science and Technology Council, Committee on Environment and Natural Resources, Subcommittee on Water Availability and Quality. 2007. *A Strategy for Federal Science and Technology to Support Water Availability and Quality in the United States*. Washington, D.C., p. 35.

receive due consideration and form the start of a national strategy to ensure we have a sustainable water supply.

Information and recommendations from witnesses obtained through the two hearings in the 110th Congress and from other water experts were incorporated into the bill introduced in the 111th Congress. Specific recommendations that have been included in the current legislation include: an expanded list of research outcomes, specific mechanisms to increase public input and involvement in shaping and evaluating the Initiative, and provisions to facilitate communication and outreach opportunities with non-governmental organizations.

#### **Additional Water Legislative Proposals**

As Congress seeks to address future water supply challenges, it is important to consider how the *National Water Research and Development Initiative Act* relates to other federal policies and legislative proposals. Two bills that also address federal water policy are: H.R. 135, the *21st Century Water Commission Act* and S. 22, the *Omnibus Public Land Management Act of 2009*.

#### **H.R. 135: 21st Century Water Commission Act of 2009**

H.R. 135 was introduced by Rep. John Linder (R-GA). This legislation would establish a Commission to provide for water assessments to project future water supply and demand, review current water management programs at all levels of government, and develop recommendations for a comprehensive water strategy. Modeled after the 1968 *National Water Commission Act*, H.R. 135 creates a commission consisting of non-federal experts appointed by the President, the Speaker of the House, and the Majority Leader of the Senate.

H.R. 135 requires the Commission to investigate a number of solutions to avert future water shortages including: aqueducts and pipelines, aquifer recharge, repairing aging infrastructure, building dams and reservoirs, desalination, the capture and storage of rainwater, recycled wastewater, conservation, and wetlands creation.

H.R. 135 complements the *National Water Research and Development Initiative Act*. The Commission's recommendations would be carried out by the 20-plus agencies overseeing federal water policy. In order to effectively implement these recommendations, the Federal Government must have a coordinated structure in place.

#### **S. 22: Omnibus Public Land Management Act of 2009**

S. 22, the *Omnibus Public Land Management Act of 2009*, authorizes many programs and activities in the Department of the Interior and the Department of Agriculture related to public lands.

Title IX, Subtitle F of this legislation directs the Secretary of Interior to conduct a variety of activities related to water management on federal lands. The Secretary is required to establish a climate change adaptation program to address water management in watersheds containing federally authorized reclamation projects. The bill also directs the Secretary of Energy to conduct an assessment of potential climate change impacts on hydropower projects under the authority of the Federal Power Marketing Administration. In addition, S. 22 directs the Secretary of Interior to establish an interagency committee on water and climate change to review the impacts of climate change on freshwater resources in the U.S., to develop strategies to improve observations and expand data collection needed to assess climate impacts. The bill also provides an increased authorization for the U.S. Geological Service (USGS) for the National Streamflow Information Program and for expanded monitoring of groundwater resources.

H.R. 1145 ensures coordination of the research, development and demonstration activities of all federal agencies with expertise in water that will be required to develop the required assessments and the adaptive management strategies for water resources. Participation of the key federal agencies with expertise and authorities over water resources in the interagency committees authorized under these two bills will facilitate a transfer of coordinated research into coordinated water management policy.

Chair GORDON. This hearing will come to order, and good morning, and welcome to today's hearing on the 21st Century Water Planning. I thank our witnesses for accommodating our change of schedule. I thank my partner, Mr. Hall, for, on short notice, allowing us to change the schedule. The reason being Prime Minister Gordon Browning will be speaking to a joint session later today. We are not allowed, and we should not be meeting during that time. We do not want to hold witnesses up by having to wait for that uncertain time to be over with, and it does mean that this is a little bit of sync, and so our Members may be coming and going. I thank Ms. Johnson and Mr. Rohrabacher for being here this morning. But the most important thing is we are going to get your testimony on record, and that will help us move forward with our legislation.

Now, the most recent outlook issued by NOAA's National Center for the Environmental Prediction indicates that drought conditions will continue to plague a number of states and regions throughout the United States. California, the Central Plains, Texas, and Oklahoma and the southeastern states of Georgia, South Carolina, and Florida are all likely to experience drought conditions in the coming months. We need to take decisive action to ensure that the United States can meet the water challenges of 2009, and beyond.

Last Congress this committee brought attention to the water supply challenges by holding hearings and introducing legislation to address technological and strategic deficiencies at the federal level.

Economic recovery legislation recently signed by President Obama included significant and long overdue funds for states and localities to improve water infrastructure. Upgrading and repair of the water delivery and treatment systems will conserve water, improve public health, and create jobs.

This is a good start, but we must do more. We need new tools to evaluate the status of our water infrastructure and our water supplies. We need effective and efficient technologies and management practices to improve water quality, and we must learn to use water more efficiently.

We need a national water policy, and research and development must be an integral part of that policy. Research and development are key ingredients to sound water resource management.

At the end of the last Congress I introduced legislation to establish a National Water Research and Development Initiative, and I reintroduced this legislation last week. H.R. 1145 incorporates recommendations from a 2004 report by the National Academies of Science and from witnesses who appeared before our committee in the last Congress. This legislation will ensure that the 20 federal agencies, that is 20 federal agencies, that are conducting and funding research and development activities on water will coordinate their efforts to achieve the goal of managing our water resources for the benefit of our nation.

I think one way that we get more money into research is by using the money that we have more efficiently and through that coordination.

We have an excellent panel of witnesses with us this morning who will share their views on what we need to do as a nation to

manage our water resources effectively and efficiently, and I want to thank you all for being with us. I look forward to your suggestions for addressing the challenges of water management through federal legislation and leadership.

[The prepared statement of Chair Gordon follows:]

PREPARED STATEMENT OF CHAIR BART GORDON

Good morning and welcome to today's hearing on 21st Century Water Planning. The most recent outlook issued by NOAA's National Center for Environmental Prediction indicates that drought conditions will continue to plague a number of states and regions throughout the United States. California, the central plains of Texas and Oklahoma, and the southeastern states of Georgia, South Carolina and Florida are all likely to experience drought conditions in the coming months.

Constraints on water supplies are taking a toll on society, our economy, and the environment. Water is too valuable a resource for us to manage in a crisis-by-crisis fashion.

Recent reports of California's water shortages carry dire predictions. This year's drought is projected to be one of the most severe in California's recorded history. On February 20th, the Bureau of Reclamation announced further cut backs in water supplied to municipalities and agriculture for the state.

Differing forecast scenarios predict a substantial impact to California's agricultural economy and indicating that some areas will receive no water this year. As a result, agriculture losses could reach \$3 billion in 2009 and water delivery reductions could result in a loss of 80,000 jobs.

We need to take decisive action to ensure that the United States can meet the water challenges of 2009 and beyond.

Last Congress, this committee brought attention to water supply challenges by holding hearings and introducing legislation to address technological and strategic deficiencies at the federal level.

Economic recovery legislation, recently signed by President Obama, included significant and long-overdue funds for states and localities to improve water infrastructure. Upgrading and repair of water delivery and treatment systems will conserve water, improve public health, and create jobs.

This is a good start, but we must do more. We need new tools to evaluate the status of our water infrastructure and our water supplies. We need efficient and effective technologies and management practices to improve water quality. And we must learn to use water efficiently. We need a national water policy, and research and development must be an integral part of that policy. Research and development are key ingredients to sound water resource management.

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We have an excellent panel of witnesses with us this morning who will share their views on what we need to do as a nation to manage our water resources effectively and efficiently. I thank you all for being with us here today, and I look forward to your suggestions for addressing the challenges of water management through federal legislation and leadership.

Chair GORDON. I now recognize our distinguished Ranking Member and my good friend, Mr. Hall.

Mr. HALL. Thank you, Mr. Chair, and you are correct. As a matter of fact, this is the fourth hearing we are holding on water issues in the last year and a half, and I think it is the second at the Full Committee level.

There is not one district I am aware of that has not had to deal with a water problem in the last few years, whether it is because there is too much of it or not enough, and I have had both. You know, I introduced a bill several years ago, and you helped pass

it through to address the drought over in east Texas and then south Tennessee. And as you could guess, at Paris, Texas, an old man said after I had introduced it and told him about it, he said, "Congressman, can you make it rain?" I said, "Yes, sir," and about two and a half years later we had a five-inch rain. I called him, got him out of bed about three o'clock in the morning, and I said, "Mr. Roscoe, you know, I keep my word." You have to remind them, you know.

But I am pleased that the Committee's taking such an interest in such a very important topic, and I really commend you for continuing the work started some time ago. Three years ago we passed and the President signed a *National Integrated Drought Information System Act of 2006*; legislation that we introduced to help our constituents and many others deal with the devastating effects of prolonged drought.

In the 110th Congress and again at the beginning of this Congress this committee moved two water bills: my *Produced Water Utilization Act* and Mr. Matheson's *Water Use Efficiency and Conservation Research Act*, and the Full House agreed to send these bills to the Senate on a voice vote last July. Energy and Environment Subcommittee has received testimony on draft legislative that is now the Chair's *National Water Research and Development Initiative Act*, the bill we are here to discuss today.

The amount of legislation, including this very important legislation, that our committee has moved on water issues in the past few years demonstrates our awareness of the need to address the critical issues our Nation faces with regard to water quality, supply, and availability. I have heard it said that when one bottle of water like this costs as much as a good bottle of beer, well, we got to get pretty doggone serious about it.

The House is not alone in recognizing the problems we face with water. Senate bill S. 22, the *Omnibus Lands Bill*, that includes the *Secure Water Act*, another piece of legislation that attempts to address shortcomings in our National Water Research Strategy.

Considering the Chair's bill we are discussing here today, I hope we have an opportunity to collaborate with the Senate to create a truly comprehensive and rational approach to water research. The testimony we will hear today from our very qualified panelists will help us better understand what opportunities exist for the coordinated federal research. It may also be wise to hear from the agencies that are most involved in federal water research. With the new Administration in place I think we would benefit from learning how they intend to approach water research and what kind of legislation would help, best help them implement a coordinated federal strategy. Comments from the Office of Science and Technology policy, as well as the other agencies, might help in our authorization process.

And I thank you, Mr. Chair, and I yield back the balance of my time.

[The prepared statement of Mr. Hall follows:]

PREPARED STATEMENT OF REPRESENTATIVE RALPH M. HALL

Thank you, Mr. Chairman. This is the fourth hearing we are holding on water issues in the last year and a half, the second at the Full Committee level. There is not one district I am aware of that has not had to deal with water problems in

the last few years, whether it's because there is too much of it or not enough of it. I am pleased that the Committee is taking such an interest in such a vital and important topic.

Three years ago, we passed, and the President signed, the *National Integrated Drought Information System Act of 2006*, legislation I introduced to help my constituents and many others deal with the devastating effects of prolonged drought. In the 110th Congress and again at the beginning of this Congress, this committee moved two water bills, my *Produced Water Utilization Act* and Mr. Matheson's *Water Use Efficiency and Conservation Research Act* and the Full House agreed to send these bills to the Senate on a voice vote. Last July, the Energy and Environment Subcommittee received testimony on draft legislation that is now the Chairman's *National Water Research and Development Initiative Act*, the bill we are here to discuss today. The amount of legislation our committee has moved on water issues in the last few years demonstrates our awareness of the need to address the critical issues our nation faces with regards to water quality, supply and availability.

The House is not alone in recognizing the problems we face with water. The Senate has sent S. 22, an omnibus lands bill that includes the *SECURE Water Act*, a piece of legislation that attempts to address shortcomings in our national water research strategy. Considering the Chairman's bill we are discussing here today, I hope we have an opportunity to collaborate with the Senate to create a truly comprehensive and rational approach to water research.

The testimony we will hear today from our very qualified panelists will help us better understand what opportunities exist for coordinated federal research. It may also be wise to hear from the agencies that are most involved in federal water research. With a new administration in place, I think we would benefit from learning how they intend to approach water research, and what kind of legislation would best help them implement a coordinated federal strategy. Comments from the Office of Science and Technology Policy as well as other agencies might help in our authorization process.

Thank you, Mr. Chairman, and I yield back the balance of my time.

Chair GORDON. Thank you, Mr. Hall, and you are absolutely right. We do need to get information from those sources so we can have the best bill possible.

Members may submit additional statements, and they will be included in the record at this point.

[The prepared statement of Mr. Costello follows:]

PREPARED STATEMENT OF REPRESENTATIVE JERRY F. COSTELLO

Thank you, Mr. Chairman, for holding this hearing today, as this is an important opportunity to plan for the future and conserve our resources appropriately. It's a matter of common sense that we must better coordinate research and technological innovation to enhance water supplies and water quality on a national level.

We know from the droughts over the past years and the rising concern surrounding global warming that water resource problems are growing both in number and in intensity. Over twenty federal agencies carry-out research and development on some aspect of water supply, and as recent reports have indicated, we must do more to better-coordinate these efforts and together work towards solutions.

In the past, the Committee has held hearings on this issue during which we have heard from private industry about steps which the commercial sector is taking to conserve water resources. Fourtune Brands, an Illinois-based company, has taken a leading role to promote smart technology and conservation practices, and with companies like Anheuser-Busch have formed a coalition to come together to share industry-wide best practices to reduce the use of water and conserve a valued natural resource.

I look forward to our testimony today, and I believe the proposed legislation is an important step in planning for our nation's future. I hope that during this Congress we are able to pass H.R. 1145, the *National Water Research and Development Initiative Act*, and enact some of the reforms that the Intergovernmental Panel on Climate Change report recommended. Thank you Mr. Chairman for your leadership of this subcommittee; and I look forward to hearing from our witnesses.

[The prepared statement of Ms. Johnson follows:]

## PREPARED STATEMENT OF REPRESENTATIVE EDDIE BERNICE JOHNSON

Good morning, Mr. Chairman and Ranking Member.  
As you know, the State of Texas has suffered a terrible drought in recent years. It has had large impacts on agriculture and on ranching.

Our nation's water supply is an indispensable commodity. Access to water has never been more important for our citizens, plants and animals.

It is also important for so many other things, such as industry, research, even leisure and sporting activities.

Scientists who serve on the Intergovernmental Panel on Climate Change's (IPCC) have reported that water supplies stored in glaciers and snow cover will decline in the course of the century.

The result will be a reduction in water availability in regions supplied by melting water from major mountain ranges.

Melting polar ice caps could also cause the rise in sea levels; the impact on coastal states like Texas and Florida will be tremendous.

Never before has it been more important to establish a national plan on water research and conservation.

The Science Committee has held hearings in 2008—in May and in July—on water supply and development.

Witnesses recommended better coordination of federal efforts on water.

They also recommended increased funding for research on the effects of climate change on groundwater, and improved consideration of efficient water use in energy systems.

In addition, they also recommended that additional money be spent on public education programs.

Mr. Chairman, I will be interested to hear stakeholder feedback on H.R. 1145, the *National Water Research and Development Initiative Act*.

The bill would establish an Interagency Committee to coordinate water research, development, data collection, education and tech transfer. The Office of Science and Technology Policy will chair this committee.

Today's panel of witnesses brings a variety of perspectives.

The breadth of experience will provide Committee Members with the kind of feedback needed to devise and refine policy.

For years, I have been involved in this issue as a Member of the Transportation Committee's Subcommittee on Water Resources and Environment.

Because I chair that subcommittee, I am in a position to help guide and facilitate this bill through the legislative process.

Chairman Gordon, I thank you for your interest in this issue and look forward to working with you on it, going forward.

Thank you, and I yield back the remainder of my time.

[The prepared statement of Mr. Carnahan follows:]

## PREPARED STATEMENT OF REPRESENTATIVE RUSS CARNAHAN

Mr. Chairman, thank you for hosting this important hearing on 21st century water planning. Population growth, variation in our climate and degradation of water quality all complicate current water supply management and coordination in our nation.

As we see increasing competition for a limited water supply, the importance of a coordinated federal approach can provide an effective framework to address these water resource challenges. Through efficient communication, duplicative and conflicting actions by different agencies can be reduced, as well as ensuring the collection of comprehensive data to make water management decisions.

Additionally, at the federal level, interagency action and cooperation are essential for looking at comprehensive water concerns rather than agencies just focusing on their core missions. States must think of the larger watershed rather than just the part of the watershed that touches each individual state, because the management of a watershed in one state has an effect on the larger watershed.

I am encouraged by the proposed legislation before us today. This is an important step at finally encouraging cooperation among federal agencies with respect to water-related research and avoiding duplication of efforts to ensure optimal use of resources and expertise.

To the witnesses before us today, I want to thank you for taking the time out of your busy schedules to appear before us. I look forward to hearing your testimonies and of ways in which we might improve our efforts on these matters.

[The prepared statement of Mr. Mitchell follows:]

## PREPARED STATEMENT OF REPRESENTATIVE HARRY E. MITCHELL

Thank you, Mr. Chairman.

Today we will discuss the research need to address the challenges of managing water supplies to meet social, economic, and environmental needs in the United States to accommodate population growth, climatic change, and other factors.

Arizona is no stranger to the pressures of rising population and prolonged drought.

We are one of the fastest growing states, and many portions of our state are still well into a second decade of drought.

I believe that it is absolutely critical that we address the growing shortage of our nation's water supply and work to establish progressive and cost-effective water resource management policies.

I look forward to hearing more from our witnesses on Chairman Gordon's proposed legislation, the *National Water Research and Development Initiative Act*, H.R. 1145.

I yield back.

[The prepared statement of Mr. Smith follows:]

## PREPARED STATEMENT OF REPRESENTATIVE ADRIAN SMITH

As our country tackles issues related to water consumption and conservation practices, research and development will continue to play an important role in decisions made at all levels of government. Increasing demands on water supplies have resulted in conflicts throughout the Nation. Droughts, coupled with new laws and regulations to protect endangered species, as well as reduce or eliminate pollution, continue to add even more stress to our developed water and power supplies.

Representing a predominantly rural, agricultural-based district in which surface water and groundwater issues are at the forefront of many decisions and debates, my principal goals are to create policies which will strengthen rural America and provide long-term stability for our nation's producers. Ensuring the sustainability of our country's water supply through increased coordination, research, and development is of utmost importance to the economic and social well-being of our nation and its citizens.

Enhanced coordination at not only the federal level, but also State and local levels, is necessary to ensure a sustainable future for one of our most essential natural resources.

Chairman Gordon's legislation, H.R. 1145, the *National Water Research and Development Initiative Act of 2009*, takes a positive step in seeking to improve the Federal Government's efforts in water research, development, and technology transfer. By adequately studying and addressing water use, as well as supply and demand issues, we can ensure our country's access to this important resource.

I appreciate the Committee holding this hearing to explore the opportunities for the Federal Government to better coordinate and support research and technological innovation. I look forward to discussing and exploring this important issue further through the Science and Technology Committee.

Chair GORDON. Our first panel and our only panel here today, I will now introduce our witnesses. First, Dr. Henry Vaux is Professor Emeritus at the University of California, Berkley, Dr. Peter Gleick is President of the Pacific Institute for Studies in Development, Environment, and Security, and Dr. Mark Modzelewski is the Co-founder of the Water Innovations Alliance. And now for the ladies' side of the table. Ms. Nancy Stoner is the Coordinator of the Water Program at the Natural Resources Defense Council, and Ms. Christine Furstoss is the General Manager of Technology at the General Electric Water and Process Technologies.

As I pointed out earlier, this was not a planned effort to segregate you, and we are glad you are here. As you know, we try to limit our witnesses' oral statement to about five minutes, and all your record—written statement will be a part of the testimony. And when you complete your testimony, we will begin the questions. So each Member will have five minutes to question the panel.

And we will start with Dr. Vaux.

**STATEMENT OF DR. HENRY VAUX, JR., PROFESSOR EMERITUS,  
UNIVERSITY OF CALIFORNIA, BERKELEY; ASSOCIATE VICE  
PRESIDENT EMERITUS, UNIVERSITY OF CALIFORNIA SYS-  
TEM**

Dr. VAUX. Thank you for introducing me, Mr. Chair, and thank you for the opportunity to appear before your committee this morning.

At the outset I should state that I was the chair of the two National Academy of Science committees whose reports are referred to in Section 2 of the bill, and although I do not formally speak for the National Academy of Sciences or the National Research Council, my testimony is based upon the analysis and recommendations contained in those reports.

We face many difficult challenges in this first decade or at the end of this first decade of the 21st century, but the challenge of husbanding and managing our water resources is a longer-term challenge than many of the others and will remain with us throughout the remainder of the century.

The ease or difficulty with which we adapt to this growing and intensifying water scarcity will depend critically upon our willingness to invest in additional science. The Federal Water Research Portfolio today suffers from a variety of ills. Too heavy an emphasis on short-term research and operationally-oriented research, it is a portfolio that is out of balance with current water realities, and the research across the board suffers from the absence of any agreed-upon agenda and set of priorities for water research.

The major explanation for the state of our water research is as you said, Mr. Chair, not so much a lack of money as a lack of coordination and a lack of communication. The proposed legislation would, if enacted in its present form, create a strong and appropriate basis for addressing the problems that currently characterize our national water research efforts.

I have detailed the significant strengths of that legislation in my written testimony. Let me turn in the time that remains to four suggestions for ways in which the Act might be further strengthened.

First of all, a funding suggestion. The provision or authorization of additional funds both for research and to defray the costs of implementing the Act, and so many agencies I think it is more likely that we would get a productive response to the Act if there were money involved and if that money, the availability of it, was made contingent upon progress in meeting the goals and objectives of the Act. So additional funding is one suggestion.

Additional research outcome, Subsection 2C2 is reasonably comprehensive, but a ninth category is needed, focusing on the social sciences, research in the social sciences needed to facilitate the development of innovative water management institutions. And a tenth category is also needed. That category focused on understanding the hydrologic and water use implications of climate change.

Let me also urge that you add a subsection emphasizing modern research themes in an effort to encourage the agencies to depart

from the reductionist approach to research that has characterized the last century. Those modern research themes require an interdisciplinary approach to research, require a research framework, which is cast in a broad-systems context, requires the specific acknowledgement and characterization of the uncertainty associated with the research results, and also acknowledges the importance of being adaptive.

A final suggestion for improvement in the legislation is based upon the need to involve academic researchers in the efforts called for in the bill, because academic researchers are well equipped to undertake the longer-term research. And the most straightforward way in which this could be done would be by including directly a role for the Water Resources Research Institutes, which reach out to all institutions of higher education, colleges and universities in all of the states and trust territories. The Institutes were most recently authorized, reauthorized in Public Law 109-471.

I urge also that you consider making one or more institute directors a member of the interagency committee, either *ex officio* or as regular members. This addition would be especially important since it takes advantage of established relationships between the Federal Government and the academic water resources, research community.

Mr. Chair, thank you again for the opportunity to appear before your committee.

[The prepared statement of Dr. Vaux follows:]

PREPARED STATEMENT OF HENRY VAUX, JR.

Mr. Chairman, my name is Henry Vaux, Jr. and I am Professor Emeritus of Resource Economics at the University of California, Berkeley. I am also Associate Vice President, Emeritus of the University of California System. I wish to thank you for the opportunity to appear before your committee this morning at this hearing on the proposed *National Water Research and Development Initiative Act*.

At the outset, I should state that I was the Chair of the National Academy Committees which created two of the reports referred to in Section 2 of the proposed Act. These reports were entitled: *Envisioning the Agenda for Water Resources Research in the 21st Century* and *Confronting the Nation's Water Problems: The Role of Research*. Although I do not formally speak for the National Research Council, most of my testimony is based on those analyses and on the recommendations contained in the second of these reports (hereinafter identified as "NRC Committee Report").

**The Need for New Water Science**

Although our nation faces many difficult challenges in this first decade of the 21st century, the challenge of husbanding and managing our water resources is a long-term challenge that will be with us over the remainder of this century. Water scarcity will continue to intensify. Our water supplies are basically finite although their occurrence varies over time. Long-term observations of precipitation and run-off suggest that hardly any year is an average year. The extremes of flood and drought recur periodically and there is evidence to suggest that these extremes will become more frequent. There is also evidence to suggest that for many regions of the United States, the advent of climate change may entail some general decline and changing in the timing of precipitation and run-off. Continuing deterioration of water quality will also mean less water available for many important and valuable uses. Reversing the trends of water quality declines and enhancing the aggregate level of water quality in the U.S. will be necessary to avoid further erosion in the quantities of available supply. The general water supply picture that emerges for the future suggests water supplies will be less available than they were in the past. There is less likelihood that they would remain stable and virtually no possibility that they could be made to grow.

Arrayed against such declining (or static) future levels of water supply are a number of factors which suggest that the demand for water may grow. These include:

- **Population Growth**—Some estimates suggest that U.S. population may grow by as much as 50 percent between now and 2050. Taken alone, a population increase of such magnitude will cause significant increases in the demand for water.
- **Expansion of Irrigated Agriculture**—The need to feed an increased domestic population as well as a global population that is projected to be three billion larger by the end of the century will be translated into growing demands for agricultural water everywhere. Though rain fed agriculture will play a very important role, there will be pressure to expand irrigated agriculture because it is more productive. In the U.S., for example, about one-third of the farm land is irrigated and that one-third accounts for 45 percent of the total production.
- **Protecting the Environment**—Past water development practices have entailed the transfer of water from environmental uses to municipal, industrial and agricultural uses. It is unlikely that this practice can continue for long without incur major and highly costly damages in the form of lost environmental services and reduced environmental amenities. There is some evidence to suggest that we may have to allocate more water to environmental purposes—not less—if we are to protect environmental services and amenities.

The trends of growing demands and static or declining supplies of water mean that water scarcity will intensify over the coming decades. As a consequence, competition of limited supplies of water will intensify and conflicts over the allocation of available supplies will also increase. Professor William Jury and I have recently completed work concluding that the ease or difficulty with which we adapt to this intensifying water scarcity will depend critically upon our willingness to invest in additional science. Properly focused, such an investment will considerably help identify ways to ameliorate water scarcity and reduce conflict over water allocation and use.

#### **The State of Federally Funded Water Research**

Today, the annual federal investment in water resources research is approximately \$700 million in constant 2000 dollars. This figure is the same in real terms as the annual federal investment in water research in FY 1975. Thus, we face an intensifying water scarcity in circumstances in which there has been little change in the magnitude of federal water research funding over the past 35 years. In other words, support for water science has not kept pace with population growth, growth in gross domestic product, or growth in federal budget outlays for at least the last four decades. This has occurred despite the fact that the productivity and value of water has increased even while the challenges of managing limited waters effectively and efficiently have grown.

The topical balance of the federal water research portfolio has changed significantly since the period 1965–1975 in ways that make it inconsistent with today's water research priorities. Specifically, research on water demand, water law and other institutional topics and research on water supply augmentation and conservation currently receive a smaller proportion of total water research funding than they did 30 years ago. The NRC Committee concluded that these topics currently appear to be underfunded. In addition, the current water portfolio is heavily weighted toward short-term research. Longer-term research, necessary to help address the water problems of the future and to help support the applied research that will need to be done a decade hence, is significantly under-emphasized in agency water research budgets. For all of these reasons the NRC Committee concluded that we are obtaining less for the annual \$700 million in federal water research than we should.

The major explanation for this state of water research is not necessarily that the funding is inadequate. The explanation lies more importantly with the fact that federal research is largely uncoordinated. This means that the President and Congress lack information about:

- **The size and shape of the entire federal water research portfolio;**
- **Measures of magnitude and effectiveness of individual elements in the portfolio;**
- **Any sense of national priorities of water research;**
- **Guidance about what might be an appropriate balance among research elements.**

The proposed legislation from the National Water Research and Development Initiative would, if enacted in its present form, create a strong and appropriate basis

for addressing the problems that currently characterize the Nation's water research efforts. It accurately captures a number of important recommendations found in the report of the NRC Committee. Thus, for example, the legislation would:

- **Require the establishment of a unified national water research agenda;**
- **Require coordination of water federal research, development, data collection, and information dissemination activities;**
- **Encourage cooperation among federal agencies engaged in water research and technology development;**
- **Require technology transfer, communication and information exchange with State and local governments, industry and other stakeholders;**
- **Establishes an appropriate institutional arrangement, including a requirement for budget coordination in the Executive branch, for accomplishing these four tasks.**

A further strength of the proposed legislation, as written, lies with the emphasis on the collection, management and exchange of data on water resources. The last two decades have been characterized significant disinvestment in the acquisition of water and water related data. We have fewer stream gauges now than we did 20 years ago; our monitoring and measuring of water quality is less adequate now than it was 20 years ago even though the threats to water quality have grown; and we are unable to measure water use adequately over time. There has been a notable failure to take full advantage of modern remote sensing technology to acquire water resources data. In addition, there has been little coordination or standardization of existing data gathering efforts with the result that we are getting less from those efforts than we could be getting. Without more coordination and investment in gathering, managing, and interpreting water resource data, both management efforts and needed research will be less effective than they might be.

#### **Recommendations for Improvement**

While the legislation as written has significant strengths, there are a number of ways in which it might be further strengthened:

- **Additional Funding:** First, there are a large number of federal agencies that undertake water resources research. Those agencies are more likely to behave productively in pursuing the objectives of the legislation if additional research funding were to be authorized and the availability of that funding made contingent upon the various requirements contained in the Act.

The concern here arises because the Interagency Committee authorized by the Act is not dissimilar from the Water Resources Council authorized by the *Water Resources Planning Act of 1965*. As the record shows, the Water Resources Council was largely ineffective as the member agencies focused on protecting their own turf and on little else.

The NRC Committee suggested that existing levels of federal investment in research might be adequate if the research portfolio were altered to place more emphasis on topics such as conservation, water supply augmentation and the development of institutions for managing water resources. Alternatively, the Committee suggested that additional funding on the order of \$70 million might be made available for the purposes of rebalancing the research portfolio. Those funds could also defray the operational costs of the Interagency Committee and provide incentives for productive interaction and coordination among the agencies that conduct water resources research.

- **Additional Research Outcomes:** The list of Water Research Outcomes in Subsection 2(c)(2) is reasonably comprehensive. However, a ninth category needs to be added that emphasizes the need for research on the development of water management institutions. This is critically important research area that has the potential to develop institutions which will facilitate the management of scarce water resources more efficiently and effectively in the future. This area has been identified as underfunded. Indeed, in recent years the level of federal funding for the social sciences needed to aid in the development of improved water institutions has not been significantly different from zero. The legislation would be considerably strengthened by acknowledging the importance of social science and institutional research. A tenth category

focused on understanding the hydrologic and water use implications of climate change should also be added.

- **Emphasize Modern Research Themes:** Just as it is important that all significant outcomes are included, it will also be important to acknowledge in the body of the bill, the importance of new modes of research. The report of the NRC Committee on the role of research emphasized that future water research should be carried out of necessity in modes different from the traditional reductionist mode which typifies most research over the last century. The Committee identified four modern research themes: 1) an interdisciplinary approach; 2) a broad systems perspective in the conduct of the research; 3) acknowledging and characterizing uncertainty; and 4) the importance of being adaptive. These should be acknowledged in the bill.
- **Interdisciplinary:** The need for interdisciplinary research has been widely recognized in the scientific literature. Indeed, it appears unlikely that an adequate understanding of the environmental importance of water can be developed in the absence of involvement of scientists from a number of disciplines. Thus, for example, research on aquatic ecosystems must be based on ecological and biological principles as well as the science of hydrology and an understanding of how human use transforms the quantity and quality of water.
- **Broad Systems Context:** A systems approach requires not only that the variables which contribute to a problem be identified and understood and that the linkages between these variables must be understood as well. Indeed, understanding the linkages between causal variables are now thought to be just as important as understanding the variables themselves.
- **Uncertainty:** Scientific information and the results of scientific investigation can rarely be expressed with complete certainty. Virtually every data point and virtually every finding is characterized by some degree of uncertainty. In the future, it will be incumbent upon researchers to acknowledge the existence of uncertainty and, where possible, characterize the extent of it quantitatively.
- **Adaptation:** Adaptation can be conceived as a combination of flexibility in solving problems and a willingness to shift norms and standards in response to novel circumstances and situations. Adaptation will be critical for both water researchers and managers in the coming decades as we confront water problems for which there has been no historical experience.

The proposed legislation could be strengthened by acknowledging the importance of these four themes in the framing and conduct of research. Their use cannot be mandated but agencies will need every encouragement to abandon traditional approaches to research and emphasize more modern approaches that are likely to be more acceptable.

#### **Involve the Academic Community**

A final suggestion for improvement in the legislation is based upon the need to involve academic researchers in the efforts called for in the bill. The academic community has played a large role in water research and will continue to do so in the future. Moreover, there is need to expand the proportion of long-term and investigator-initiated research in the national portfolio. The academic community is better situated to perform longer-term research since it is not tied to the operational missions of the agencies which tend to result in research agendas focused on more immediate short-term problems. There are several ways in which the academic community might be involved. Perhaps the most straightforward way would be by including the broad array of water resource research activities at the Nation's land grant Universities directly by identifying a role for the Water Resources Research Institutes, most recently reauthorized in the *Water Resources Research Act Amendments of 2006* (P.L. 109-471). One or more Water Institute Director representatives should be authorized to serve on the Interagency Committee created in Section 2(b) either *ex officio* or as regular members. This addition would be especially important since it takes advantage of established relationships between the Federal Government and the academic water research community. In this way all of the major actors in the water research community would be directly involved in the activities of the Water Research and Development Initiative Activities that would be authorized by this legislation.

In summary, then, I believe the proposed legislation to be a significant step forward. It would address the need for new and productive water research. It would provide a mechanism for establishing priorities and ensuring the results and data

are fully shared and disseminated. The legislation could be strengthened by: 1) authorizing new funding to support the coordination and agenda setting activities as well as new research; 2) including the social sciences and the development of institutions as well as climate change in the research outcomes; 3) specifically acknowledging four modern water research themes in the legislation; and 4) including academic researchers and the academic community in the research and development initiative.

Mr. Chairman, I wish to thank you again for the opportunity to appear this morning and to state my views on National Water Research and Development legislation.

#### BIOGRAPHY FOR HENRY VAUX, JR.

Dr. Henry Vaux, Jr. is Professor Emeritus of Resource Economics at the University of California, Berkeley and the University of California, Riverside. Prior to his retirement in 2004, he served for 11 years as Associate Vice President for Agriculture and Natural Resources of the University of California System. In this capacity he was the chief operating officer for all University of California programs in agriculture and natural resources. He had previously served as Director of the UC Center for Water Resources. Dr. Vaux has authored over 90 publications on the economics of water resources and is considered an expert on the economics of irrigated agriculture and water marketing. He was a member of the Water Science and Technology Board of the National Research Council for seven years and served as Chair of the Board for four years. He is also President, Emeritus, of the California-based Water Education Foundation. In 2001, Dr. Vaux was designated as a National Associate of the U.S. National Academy of Sciences and he is the recipient of the 2005 Warren A. Hall Medal, given by the Universities Council on Water Research for significant accomplishments in water resources research. He remains active in international water affairs and has been an invited speaker and participant in symposia and conferences around the world. He is also Chair of the Rosenberg International Forum on Water Policy. The Forum promotes an ongoing global dialogue to enhance economic growth and the maintenance of environmental amenities through the reduction of water related conflicts and improvements in water policy. Prior to joining the faculty of the University of California in 1970, he served on the staff of the National Water Commission and as a water resources specialist in the Office of Management and Budget. He received his education at the University of California (B.A.) and the University of Michigan (M.S.; M.A.; Ph.D.).

Chair GORDON. Thank you for those very good ideas. I am glad you read the bill.

And Dr. Peter Gleick, you are now recognized.

#### **STATEMENT OF DR. PETER H. GLEICK, CO-FOUNDER AND PRESIDENT, THE PACIFIC INSTITUTE FOR STUDIES IN DEVELOPMENT, ENVIRONMENT, AND SECURITY, OAKLAND, CALIFORNIA**

Dr. GLEICK. Mr. Chair, Members of the Committee, thank you for having me testify today. I hope at least those of us at the table have read the bill. I would like to thank the Committee for inviting me to offer comments on the bill. I also would like to note at the outset I spent some of my early time doing research at the Oakridge National Laboratory. I remember my time in Tennessee very fondly.

The water crisis around the Nation is growing. The need for better and more-coordinated responses is urgent, and I think we all understand that. We have long known that more coordination among federal agencies is going to be critical for dealing with water issues, but that coordination remains an elusive goal.

And new challenges face us. Climate change, new pollutants decaying infrastructure around the Nation. My written testimony addresses these issues. I am not going to repeat it here this morning. What I would like to do is highlight a few points.

In particular, let me start by saying that many of our water problems are local and have to be addressed at the local level, at the local level. But we do have a responsibility to develop appropriate national policies as well, and at the moment these responsibilities as you note are split among at least 25 separate federal agencies, and they don't speak well to each other, they don't speak often to each other, and the goal of this bill to improve that coordination, to develop a consistent research agenda, to use our limited resources efficiently is an excellent one.

As the bill notes, some effort in this area has been made by the SWAQ Committee, the Subcommittee on Water Availability and Quality under OSTP. I think the research results, the research recommendations produced by SWAQ in September, 2007, are an excellent step forward in setting a national agenda, and I think they have been complemented by reports from the National Research Council that Dr. Vaux talked about and from the General Accountability Office. I think those altogether provide a superb starting point for moving water research forward.

It is not clear to me that a new subcommittee or new interagency committee is necessary if the idea is to strengthen SWAQ, and I think that might be an appropriate way to move forward. But whatever approach is taken, I would urge that this committee, this organizing group have a separate research budget of its own, either to give out in a competitive grants situation or to manage itself.

Second, I think this group should include outside experts from either other federal agencies or from non-federal agencies as well, something that SWAQ has not done at the moment. The National Research Council previously concluded in its 2004, report that such outside advice would be enormously valuable.

Third, the bill calls for an interagency committee to "establish the priorities for federal water research." I actually believe those priorities are fairly well established already from SWAQ's previous work, from the NRC, from the Government Accountability Office. We know what needs to be done. What we need is the funding to go ahead and do it. And so I don't think we necessarily need to call for a new assessment. I think we should instead focus on the sections of this bill, C2C in particular, that calls for, "a strategy and timeline to achieve the desired outcomes."

Fourth, the explicit outcomes in the bill I would argue are unnecessary if we adopt the recommendations of SWAQ and the National Research Council. Conversely, if we are going to include specific research outcomes in this bill, I would offer four explicit recommendations for additions.

The first is that the call for a national water census is a great idea, but it needs to include a census of water use nationwide, not just the water resources of the Nation, but actually how we use our water resources. That was recommended by SWAQ. It didn't make it into this bill, and I think it would be easy to add.

Second, the national census is urgently needed, but I would recommend that it explicitly be called for as a census, that is every 10 years or so, and an explicit budget be provided to do the national census.

Third, missing from the water research outcomes but included in every recent call for research around the Nation is an assessment

of the implications of climate change on the Nation's water resources. And I think it would be easy to add that outcome as well.

Fourth, Section D4 calls for development of innovative technologies and tools to enhance water use efficiency. That is a great idea but it should also call for an expansion of existing tools in the water efficiency area.

Let me close by simply saying we also need, in addition to better coordination on research, we need some things not addressed by this legislation, such as a National Water Commission. H.R. 135 has been submitted at various times in the House. It has passed the House. I urge a National Water Commission be resubmitted and redeveloped as a way to move forward on things not going to be covered by the current legislation.

Thank you very much.

[The prepared statement of Dr. Gleick follows:]

PREPARED STATEMENT OF PETER H. GLEICK<sup>1</sup>

Mr. Chairman, Representatives: I would like to thank the Committee for inviting me to offer comments on the critical issue of 21st century water planning in the United States. The water crisis around the Nation is growing and the need for better and more coordinated responses is urgent. We have long known that we need coordinated federal planning for water; but such coordination remains an elusive goal. And new water challenges such as climate change, new pollutants, and decaying infrastructure face the Nation.

My written testimony will address three issues:

1. The kinds of water challenges we face the national level and the kinds of responses we need,
2. Some specific thoughts about the proposed legislation sponsored by Congressman Gordon of Tennessee (H.R. 1145, entitled the "*National Water Research and Development Initiative Act of 2009.*"), and
3. The need for additional federal policies and legislation not directly addressed by this legislation.

**Global and National Water Challenges**

Globally, the realization is growing that the failure to meet basic human and environmental needs for water is the greatest development disaster of the 20th century. Millions of people, mostly young children, still die annually—and unnecessarily—from preventable water-related diseases. Climate change is increasingly threatening water systems and water resources everywhere. Controversy is developing over the proper role of expensive dams and infrastructure, private corporations, and local communities in managing water. And international and sub-national threats to security as a result of water quality and quantity disputes have ramifications for U.S. military and diplomatic policy.

Here at home, freshwater challenges in the United States are also growing rapidly. These challenges include growing scarcity, disputes over allocations and use of water, unresolved problems of contamination from known sources and new pollutants, a clear and present danger associated with the impacts of climate change, a decaying infrastructure and data collection system, and threats to our own security at the national and international level associated with these problems in other countries.

Municipalities are faced with billions of dollars of infrastructure needs and growing disputes over the role of public and private water management. Arguments among western states over allocations of shared rivers remain unresolved, and similar arguments have now appeared in the southeastern U.S. and other regions previously thought to have adequate water resources. Tensions between cities and farmers over water rights are rising. The U.S. and Mexico have unresolved disagreements over the Colorado and Rio Grande/Rio Bravo rivers, and our Canadian neighbors remain worried about how best to jointly manage the shared Great Lakes.

<sup>1</sup>Dr. Gleick is President and co-founder of the Pacific Institute, Oakland, California and a member of the U.S. National Academy of Science. His comments reflect his own opinion and the recommended position of the Pacific Institute, Oakland, California.

Communities are facing new challenges in meeting water-quality standards and ensuring that safe drinking water is available for all.

### **Addressing our National Water Problems**

Many of our water problems are local, and must be resolved at the local and regional level. But we have a responsibility to develop and implement appropriate national policies as well. These responsibilities are not being adequately fulfilled by the diverse federal agencies responsible for them. Part of the problem is confusion over authority. Part of the problem is the failure of the Executive Branch in recent years to request sufficient funds to protect and manage our water resources, and of the legislative branch to appropriate and allocate those funds. Part of the problem is old water legislation that has not been updated to account for the realities of the 21st century and for recent advances in our scientific and technical understanding of both water problems and solutions.

Responsibility for water is spread out over many federal agencies and departments, operating with little overall coordination. In order to address this issue, the President's Office of Science and Technology Policy (OSTP), through the National Science and Technology Council's Committee on Environment and Natural Resources, reconstituted in 2003 a Subcommittee on Water Availability and Quality (SWAQ). Members of that subcommittee come from the departments of Interior, Agricultural, Defense, State, Energy, Health and Human Services, EPA, Commerce, NASA, the National Science Foundation, the Tennessee Valley Authority—altogether 25 federal agencies that are responsible for all aspects of federal water research and/or water resource management.

In September 2007, that Subcommittee released a report with detailed recommendations and priorities for improving coordination and water research in the U.S. These recommendations, combined with additional detailed suggestions from the 2004 report of the Committee on Assessment of Water Resources Research of the National Research Council (NRC) and reports on water from the Government Accountability Office (GAO) offer a superb starting point for moving water research forward.

I support the important ideas behind Congressman Gordon's newly submitted bill, H.R. 1145, which clearly draws on these previous recommendations, and I commend him for tackling the urgent challenges of water. It is time to move from recommendation to action, and the Nation needs some kind of group to define research, monitor action, coordinate diverse federal efforts, and bring outside ideas to the attention of agencies and policy-makers. I also support the idea of putting (or keeping) that agency under the guidance of the President's OSTP, because of the vital need for independent, high-quality science.

I would also like to offer some specific suggestions for strengthening the proposed bill.

First, it is not clear to me that a completely new interagency committee is necessary, as opposed to expanding and improving the efforts of the existing Subcommittee on Water Availability and Quality within the National Science and Technology Council and other collaborative efforts underway between different agencies. Whatever approach is taken, however, a coordinating body for national water research will need an explicit budget of its own, with new money. Agency budgets are already grossly underfunded for water research and they are likely to chafe at having to divert funds to a separate independent body. This group should also include water experts from outside of the federal agencies themselves—something SWAQ has not done. The National Research Council previously concluded (in its 2004 report *“Confronting the Nation's Water Problems”*) that:

“If the coordinating body is made up only of agency representatives, the overarching national perspective will likely devolve to the sum of agency wish lists. However, independence from agency agendas needs to be balanced by close interaction with agency leaders who have unique and valuable perspectives on national needs.”

Second, the Bill calls for the interagency committee to “establish the priorities for federal water research.” I believe that such priorities are clearly, and comprehensively, laid out in the NRC, SWAQ, and OMB reports already available. We know what we need to do; what is needed is the funding and effort to do it. As a result, we should not be calling for a new assessment of need, but should focus on the activities in Section (c)(2)(C) to set forth “a strategy and timeline to achieve the” desired outcomes.

Third, the explicit outcomes (Section (d)) described in the proposed Bill are unnecessary, if existing recommendations from the SWAQ and NRC reports are to be adopted. Conversely, if this Bill is to include specific Water Research Outcomes, I

offer here some explicit recommendations for modest changes: some key outcomes are missing and should be added, others need to be strengthened. In particular, while I strongly support the call for a National Water Census, that Census must also include comprehensive information on water use—as recommended by SWAQ—and a requirement that the Census be made easily available and widely disseminated. Thus, section (d)(1) should read:

“(1) Implementation of a National Water Census, which shall include the collection and dissemination of data on national water resources and all forms of water use, to create a comprehensive database that includes information on the quantity, availability, quality, and use of ground water and surface water resources.”

This National Census is urgently needed, and I further urge this bill, or supplemental legislation, include a clear call for this work to be done by the U.S. Geological Survey, which has the experience and expertise to do the science properly, an explicit recommendation that such as Census be done every 10 years, and a clear new budget of at least \$25 million for each Census. Spread over 10 years this is a tiny sum of money with potentially vast returns for the Nation.

Also missing from the Water Research Outcomes, but included in every recent call for water research, is the need to evaluate both the implications of climate change for the Nation’s water resources and appropriate technologies and water management strategies for coping with unavoidable impacts of climate change. An additional “outcome” should therefore be added to section (d) that reads:

“Improvement of the understanding of the impacts of climate change for the Nation’s water resources and appropriate strategies for adapting to those climate impacts that may be unavoidable.”

Section (d)(4) calls for development of innovative technologies and tools to enhance water-use efficiency. I fully support this effort, but this outcome should be expanded to include technologies and tools that already exist but have yet to be widely implemented. Wording for this section should be:

(4) Expansion of efforts to enhance the efficiency of water use throughout the Nation using existing technologies and tools and through the development and adoption of innovative new technologies and tools.”

Let me also offer some comments and thoughts about funding, supporting my conclusion that some new, independent funding is required to make this effort work. Federal agency research budgets are typically developed starting with a “base” of activities that change little from year to year, and adding “above base” initiatives. In the context of developing comprehensive and effective national water research, agencies are unlikely to give up any of their base, even to address higher water priorities. Furthermore, the congressional appropriations process makes it difficult to shift funds from one agency to another when these agencies are funded through different spending bills. Table 1 shows just a sampling of the different appropriations subcommittees that are responsible for some of the federal agencies that fund water. This difficulty suggests that separate funds must be appropriated for whatever body is set up to coordinate federal water policy and research. I also urge that the coordinating body’s efforts be synchronized with the schedule of federal budgeting and appropriations.

**Table 1.**  
**Partial Subcommittee Jurisdiction of the House and Senate for Selected Federal Agencies Doing Water Resources Research**

Federal Department or Agency	Appropriations Subcommittee
Department of Energy (civilian)	Energy and Water
Environmental Protection Agency	Housing and Urban Development and Independent Agencies
Army Corps of Engineers	Energy and Water
National Oceanic and Atmospheric Administration	State, Justice, Commerce
U.S. Geological Survey	Interior
U.S. Department of Agriculture	Agriculture

Adapted from The National Research Council. 2004. "Confronting the Nation's Water Problems: The Role of Research." National Academy of Sciences, Washington D.C.

#### **Additional Needs for Water Legislation, Policy, and Action**

Finally, while implementing a new and better coordinated national research agenda is critical, there are additional needs not addressed by this legislation. The United States has not had a comprehensive water commission in place for 30 years, since the 1968 National Water Commission reported to the President and Congress in 1973. Moreover, we have never had a water commission with the authority and responsibility to review and recommend on the role of the U.S. in addressing international water issues. Nor has such a commission ever addressed the new challenges of climate change. Such a commission, perhaps in the form of a "National Water Board" could be very valuable. A version of such a Board for water-related research was proposed by the National Research Council in their 2004 report "*Confronting the Nation's Water Problems.*" Indeed, it may be possible and appropriate to combine the idea of an "interagency committee" in this bill with a broader Board.

The Pacific Institute has long supported such an idea. A National Water Commission or Board would be authorized by Congress, be composed of both federal agency representatives and non-governmental water experts from across the many disciplines affected, including the sciences, economics, public policy, law, governments, public interest groups, and appropriate private sectors, would have a fixed term and specific mandate, and would serve as a neutral third party to:

1. Provide guidance and direction on the appropriate role of the United States in addressing both national and international water issues.
2. Prepare a regular survey of water research activities and priorities.
3. Advise Congress and OMB on the recommended focus of a long-term research agenda and on key water budget decisions.
4. Report to OMB, OSTP, and the Congress in a timely manner compatible with the budget and appropriations process.

The NRC concluded that such a Board could offer both Congress and OMB credible advice on improving the efficiency with which federal agencies fund and conduct water research and priorities.

Moreover such a Board could re-assess:

- **Efforts to expand supply with new thinking on water re-use, desalination, conjunctive use, and other non-traditional supply options.** In most regions, even regions with growing scarcity, increasing supplies through traditional infrastructure does not appear to be the most efficient, cost-effective, and timely response. In contrast, non-traditional sources of supply appear to offer enormous potential.
- **Efforts to improve the efficiency of water use in both the urban and agricultural sectors.** One of the greatest opportunities for addressing water scarcity and quality problems is by increasing the efficiency of water use and reducing waste. Great advances have been made, and total water use in the United States has actually decreased in the past 20 years, reducing pressure on overall supply. Much more can be done.
- **National water science and policy** and offer guidance on integrating efforts now scattered among disparate and uncoordinated federal agencies and

departments. National budget priorities should also be re-evaluated and re-structured to ensure that the national objectives are more clearly supported.

- **Revisions or better enforcement of national laws related to water**, including laws governing water quality (the *Clean Water Act* and the *Safe Drinking Water Act*), the protection of aquatic ecosystems, the financing of water infrastructure, and national standards for improving water-use efficiency and conservation.
- **Recommendations for flood and drought management**, including implementing overdue changes proposed by previous reviews.
- **The physical security of the Nation's water**, by highlighting necessary steps that could be taken to reduce overlap and streamline responsibilities of the multiple federal agencies working on water issues.
- **Recommendations for the U.S. role in identifying and addressing global water problems**, including how to significantly accelerate efforts to meet the large and devastating unmet basic human needs for water in poorer countries. These recommendations should address how best to apply the vast financial, educational, technological, and institutional expertise of the United States to these problems.
- **How to prepare the Nation's water resources systems for the risks of climatic changes.**
- **Recommendations for reducing the risks of international tensions over shared water resources**, including how to resolve concerns with our own neighbors, Mexico and Canada, over shared water systems. These recommendations would be valuable in other international river basins where our experience, international stature, and expertise can be effective.

#### **The Need for U.S. Leadership**

The time is ripe for an integrated and comprehensive national water strategy. While many water issues will remain local, to be resolved by community efforts, our national government can no longer ignore the positive and effective role it can play both here and abroad. The United States is well positioned to be a world leader in addressing water problems, yet the U.S. regularly fails to present the world community with a comprehensive, integrated, and informed set of positions necessary to play a leadership role.

I congratulate you for considering this vital issue and for helping to raise national attention on the need to re-evaluate and re-focus efforts on sustainably managing the Nation's precious freshwater resources.

Thank you for your attention.

#### BIOGRAPHY FOR PETER H. GLEICK

Dr. Peter H. Gleick is co-founder and President of the Pacific Institute in Oakland, California. The Institute is one of the world's leading non-partisan policy research groups addressing global environment and development problems, especially in the area of freshwater resources. Dr. Gleick was described by the *San Francisco Chronicle* in 2009 as "arguably the world's leading expert on water." His research and writing address the hydrologic impacts of climate change, sustainable water use, water privatization, and international conflicts over water resources. His work on sustainable management and use of water led to him being named by the BBC as a "visionary on the environment" in its *Essential Guide to the 21st Century*. In 2008, *Wired Magazine* called him "one of 15 People the Next President Should Listen To."

Dr. Peter H. Gleick produced some of the first research on the implications of climate change for water resources. He has also played a leading role in highlighting the risks to national and international security from conflicts over shared water resources. He produced some of the earliest assessments of the connections between water and political disputes and has briefed major international policy-makers ranging from the Vice President and Secretary of State of the United States to the Prime Minister of Jordan on these issues. He also has testified regularly for the U.S. Senate, House of Representatives, and State legislatures, and briefed international governments and policy-makers.

Dr. Gleick received a B.S. from Yale University and an M.S. and Ph.D. from the University of California, Berkeley. In 2003 he received a MacArthur Foundation Fellowship for his work on global freshwater issues. In 2006 he was elected to the U.S.

National Academy of Sciences, Washington, D.C. and his public service includes work with a wide range of science advisory boards, editorial boards, and other organizations. Gleick is the author of more than 80 peer-reviewed papers and book chapters, and seven books, including the biennial water report *The World's Water* published by Island Press (Washington, D.C.).

Chair GORDON. Thank you. And Mr. Modzelewski, you are recognized for five minutes.

**STATEMENT OF MR. F. MARK MODZELEWSKI, EXECUTIVE  
DIRECTOR, WATER INNOVATIONS ALLIANCE**

Mr. MODZELEWSKI. Thank you very much, Mr. Chair, and again, I thank Mr. Chair and the Members of the Committee. I am honored to have this opportunity to appear before you today as Executive Director of the Water Innovations Alliance. The alliance is the policy voice of the world's water researchers, technologists, and innovators, and our members are looking to move forward to address many of the problems that we have here today.

I would like to actually skip over the statistics which I think we all know so well and really get to the point that in order to advocate and address the problems that exist in the developing world and our significant infrastructure needs and needs with water, we must either spend hundreds of billions of dollars, some people putting the number at trillions of dollars, in order to fix it and modernize the system, or for a fraction of that we can invest in funding that will advance water technology and innovations and spend the money smartly, which is something we all need to focus on.

Unfortunately, despite many of these maxims that water is the next oil, that water equals life, nobody ever seems to put their money where their mouth is in the water sector and actually spend the funding along these lines. Corporate and government R&D spending in water compared to other industries is quite low, and I could speak to one area that I am very familiar with for formerly running the Nano-Business Alliance.

In nanotechnology every year the Federal Government spends in excess of a billion and a half dollars, corporations putting significant amounts along those lines. If you look at that in water, you really don't see those kind of funding levels hit, and you also see the funding, again, speaking with what Dr. Vaux said earlier, really puts near-term problems. You don't see a lot of mid and long-term research developed along those lines.

And in fact, we are still really treating water not that differently than we could have a couple hundred years ago where we actually put chemicals or poisons in the water, or we tried to force things through small holes. And we really haven't looked to address water in a more modern way, with more modern techniques. And the lack of funding and the lack of a funding portfolio that is spread and diverse in this effect has surely caused that and is clearly a hindrance to us being able to deal with things along those lines.

We strongly agree with the Chair's call for interagency collaboration and coordination as well as increased evaluation and funding. We strongly support the proposals here under consideration, but we do have actually a few areas that we would like to make suggestions for development in the bill and some potential changes in the bill.

One of which would be assessment. To date there have been several efforts to evaluate the state of water infrastructure and research spending in America, including the work of the National Academies and several private organizations. None has been thorough enough to create a clear picture and to develop a comprehensive response. At this time the essence we believe that it is necessary to get the tests done quickly, thoroughly, and accurately.

We suggest a natural water census which Dr. Gleick had touched upon earlier, but we would certainly agree with him that usage and regularity should be a point of development as far as that census goes. We should look at the availability of quantity, quality, consumption, recharge capacity, and threats to ground water and surface water resources as well.

Another area which we think is deeply in need of investigation is the information technology area of water. One key area where there has been a lack of innovation of water is information technology. Little has been done to create a common system in measurement, evaluation, and reporting. Common standards do not exist. Even with the current infrastructure filtration and treatment technology, overlaying an effective IT infrastructure and management system whereby we could actually evaluate what is being done and what is being used and have a common language of reporting and sharing that information by some estimates could lead to savings of 30 to 50 percent, even with the current infrastructure issues that we have.

A national smart water grid, if you will, would be an incredible way of better developing water, understanding our water use, and being able to understand what is working and what is not working as far as our new innovations and technologies that are applied.

Another area I would like to point to is NSF Centers. This is something that has been touched on before as far as research centers, and these certainly could be done in conjuncture with the current university centers or a build-out of the centers, but right now we have one at the University of Illinois, which I believe sunsets in the next three years. Having nationally-backed, long-term funding structures for the research and innovations of water would be an incredible development that we could move forward on.

The government in Switzerland, for instance, a country that is actually quite water rich and much smaller than ours, spends 100 million a year in these type of government centers and would be a model to look at for developing out our own system.

And lastly, a national water pilot testing facility. One issue that we seem to have right now is that regulation gets in the way of a lot of innovation being out there, and too often the innovation is occurring at the bench top in laboratories, rather than understanding how it would work in a larger system. So the development of such a water pilot testing facility would be integral to actually getting new innovation available and in the market.

Thank you, Mr. Chair.

[The prepared statement of Mr. Modzelewski follows:]

PREPARED STATEMENT OF F. MARK MODZELEWSKI

Chairman Gordon, Ranking Member Hall, and Members of the Committee, I am pleased and honored to have this opportunity to appear before you today as the Executive Director of the Water Innovations Alliance. The Alliance is the public policy

voice of the world's water researchers, technologists and innovators. Our role is to advocate policies that promote the aggressive development of water technologies and innovations across all sectors and users of water by creating new market opportunities, increasing funding, strengthening research and development programs, removing regulatory and market barriers, and improving education, communication and outreach efforts.

Our membership, which includes a broad spectrum of business, academic institutions, health and development activists, believes strongly in the tremendous importance of securing safe and affordable access to water resources as a cornerstone of our nation's physical health, economic prosperity, and general welfare. We share this committee's belief that federal investment in water technology R&D is essential for our nation's future—and the world's.

We are all familiar with the statistics: in 2002, 1.1 billion people lacked access to a reliable water supply, and 2.6 billion people lacked access to adequate sanitation. By 2025, over half the world's population will live in water-stressed or water-scarce countries. Twenty-five percent of global freshwater use exceeds local long-term accessible supplies. Agricultural uses are the biggest concern, with an estimated 15 to 35 percent of irrigation withdrawals in excess of sustainable limits. Industrial withdrawals of water are expected to rise by 55 percent out to the year 2025. In addition, within the U.S., population has been migrating from the water-rich North to the water-depleted sunbelt. Crumbling infrastructure means that cities such as Chicago lose upwards of 60 percent of their water in transit from treatment facilities to faucets. Over the past five years, municipal water rates have increased 27 percent throughout the United States.

In order to address the problems of access in the developing world and our own significant infrastructure needs, we must either spend hundreds of billions of dollars on current technology or invest a fraction of that funding in advancing water technology. Unfortunately, despite the maxims that "water is the next oil," and that "water equals life," nobody ever seems to put their money where their mouth is in the water sector—corporate and government R&D investment has historically been far below the level we see in less important industries. The proposed legislation is a major step toward reversing this trend. It will help develop and bring to market new technologies that allow for greater efficiencies, the ability to re-use this precious resource, and new capabilities to tap new water sources.

We strongly agree with the Chairman's calls for interagency collaboration and coordination, as well as increased evaluation and funding for water technology. Before founding the Water Innovations Alliance, I founded the NanoBusiness Alliance, where I worked extensively on the *21st Century Nanotechnology Research and Development Act*. I believe that it can serve as a great model for interagency coordination and public-private collaboration on key issues surrounding water technology.

### **General Comments on the Proposal**

While the Water Innovations Alliance strongly supports the Chairman's proposal, we do have a few suggestions for the Committee's consideration. In general, we would encourage the Committee to take an aggressive approach to water innovation that ensures speed, quality and accountability. We also urge that the Committee encourage new voices to come to the table and create opportunities for interdisciplinary research. We still deal with water technology with brute force methods that use hazardous chemicals, heat and pressure. Nearly all research has been focused on little tweaks to make these processes marginally cleaner or more energy efficient, rather than exploring game-changing new approaches. Finding and implementing these new approaches will require outside-the-box thinking and longer-term vision. In addition, we need to find ways to spur innovation among small businesses in the water sector, where innovation has the greatest chance of taking root.

### **Specific Suggestions for the Proposal**

**Assessment:** To date, there have been several efforts to evaluate the state of water infrastructure and research spending in America, including work at the National Academies and several private organizations. None has been thorough enough to create a clear picture and develop a comprehensive response. As time is of the essence, we believe it is necessary to get the task done quickly, thoroughly, and accurately. We suggest a National Water Census, the collection of water data to create a comprehensive database of information on available quantity, quality, consumption, recharge capacity and threats to ground water and surface water resources. To maintain this information resource, we recommend the development of a new generation of water monitoring techniques and technologies.

**Information Technology (IT):** One key area where there is a lack of innovation in water is in information technologies. Little has been done to create a common system for measurement, evaluation and reporting. Common standards do not exist. Even with current infrastructure, filtration, and treatment technology, the overlaying of an effective IT management system could result in annual savings of 30–50 percent. It is vital that an effort be made to create and fund a water information technology initiative through partnership with the IT industry to develop and deploy a common platform—a national “smart water grid,” if you will—within the water sector. A coordinated effort could result in a system being in place in just a few years that would save money and provide data to support bolder moves to conserve and manage water.

**NSF Centers:** The lack of water R&D progress indicates a need for federal research centers for water technology and innovation. There are 15 NSF nanotechnology centers as well as additional ones from other federal agencies including centers at a number of the DOE labs. Yet only one center exists for water R&D. That center, at the University of Illinois, is set to sunset in three years. To create new national research centers, additional long-term funding will be needed. Other nations establishing such centers commit funding for ten years at a time, with similar investments by the private sector. Switzerland, a country that is water rich and a fraction of our size, is spending approximately \$100 million per year to develop new technologies to reduce domestic water usage, particularly in its energy sector. It is likely that a greater level of funding will be needed in the U.S. to solve the larger problems we face over several major sectors and across disparate geographic regions. The Alliance strongly urges the creation of a minimum of five new NSF water centers, each tasked with a specific focus area (e.g., IT, desalination, purification) to begin to address the multitude of pressing needs in the water technology field.

**National Water Pilot Testing Facility:** In water R&D, one of the largest hurdles beyond funding has been the gap between bench-top research and real-world conditions. There are few opportunities for researchers to test their new developments under real-world conditions due to regulatory hurdles that deter experimentation and the absence of a pilot testing facility for water. The Alliance strongly encourages the Committee to consider creating a national water pilot testing facility to be housed at a national laboratory or a university. In addition, we encourage the Committee to examine the regulatory barriers that hinder innovation and testing of new beneficial solutions for the water industry.

Thank you, Chairman Gordon, Ranking Member Hall, and Members of the Committee for the opportunity to provide this testimony. I would be happy to answer any questions you may have.

#### BIOGRAPHY FOR F. MARK MODZELEWSKI

F. Mark Modzelewski is a technology entrepreneur, investor and pundit born in Naugatuck, Connecticut. He recently founded the Water Innovations Alliance, an industry association focused on developing new funding, reducing regulatory barriers, increasing collaboration and raising awareness for cutting-edge water technologies and the problems they solve. The Alliance serves the entire spectrum of the water sector: corporations, investors, engineering firms, startups, NGOs, research centers, municipalities, and others in the field. The Alliance is located in Washington, DC and Cambridge, MA.

Modzelewski is involved in co-founding and developing new technology companies. He recently launched 349Q Water Solutions, a post-industrial water purification company; and helped to found a microbial fuel cell company, Trophos Energy, a Harvard University spin-out. He is the former Managing Director and Co-Founder of Bang Ventures, an investment firm based in New York with offices in Cambridge focused on technology investments including Web 2.0, new energy innovations and medical devices. The firm was best known for launching the “You Be the VC” entrepreneurial competition.

Modzelewski co-founded New Europe Ventures, a Polish-based venture capital firm, as well as the Benet Group, Leonardo BioSystems, Lux Research (developed water technology division concept) and the NanoBusiness Alliance. He has served as a senior executive at NanoDynamics (where he launched a joint venture firm with Shell and headed water technology efforts), Opion, GolinHarris and NRW. In addition, he has consulted for companies including NanoSys, Engelhard, MasterCard, Yahoo!, eSpeed, Vivendi Water, Pixar, and DaimlerChrysler. He also taught Technology Entrepreneurship at RPI’s Lally School of Business.

Before entering the private sector, Modzelewski was an appointee in the Clinton Administration developing policy, legal and communication strategy efforts on a

range of issues including rural water and utilities and economic development as Special Assistant to Secretary Henry Cisneros of the U.S. Department of Housing and Urban Development (HUD) and Secretary Daniel Glickman of the U.S. Department of Agriculture (USDA).

Modzelewski earned an B.F.A. from Boston University and a J.D. from University of Denver College of Law where he concentrated on water law.

Chair GORDON. Thank you. And now Ms. Stoner, you are recognized for five minutes.

**STATEMENT OF MS. NANCY K. STONER, CO-DIRECTOR, WATER PROGRAM, NATURAL RESOURCES DEFENSE COUNCIL (NRDC)**

Ms. STONER. Thank you. Good morning, Mr. Chair, Ranking Member Hall, and Members—

Chair GORDON. I believe you need to put your microphone on there. There we go.

Ms. STONER. Very good. Thank you. I appreciate the opportunity to appear before you today on behalf of the Natural Resources Defense Council to discuss the changes facing U.S. water resources today and the role of scientific research in addressing those challenges. I will provide a brief summary of the issues presented in more depth in my written statement.

First, water resources in the U.S. are stressed. Population growth, urbanization, and agricultural runoff continue to pollute rivers, lakes, and coastal waters and deplete surface and ground water resources that provide safe, sufficient water for human and ecosystem needs.

There are also new stressors as my colleagues have mentioned such as climate change, which affects water first and foremost among all natural resources with increasing droughts, sea level rise, extreme storm events, and increased stream temperatures. We can't continue to use the strategies of the past and hope to overcome these and other emerging challenges. New strategies, new technologies, and even new ways of thinking are needed. That is what scientific research is all about.

Second, water is valuable. It is essential to life, to our very existence, and the foundation of every civilization. It is easily worth billions, if not trillions of dollars each year to the U.S. economy. One study by a team of economists estimates the economic value of the decline in water quality in the U.S. from 1994, to 2000, is \$20 billion. With the economic crisis that the U.S. is facing, we can't afford to throw away valuable natural resources like clean water.

Third, research and development creates jobs, jobs for scientists, lab technicians, manufacturing jobs, labor jobs, jobs that feed families and contribute to the long-term health and well-being of the Nation.

The global water and waste water infrastructure market is estimated at \$3 trillion. The U.S. needs to invest in research and development, not only to protect our own natural resources but also to bolster that sector of our economy. We are currently losing jobs to companies overseas because we are not developing and marketing state-of-the-art water and waste water infrastructure technologies. This is a market in which the U.S. can and should lead the world.

With respect to the legislation, H.R. 1145, the *National Water Research and Development Initiative Act*, it would step up and co-

ordinate science-based research in water. It would ensure that federal dollars are spent more effectively and would identify specific water research outcomes.

I want to add to those voices of my colleagues in suggesting a couple of additional outcomes. Several have mentioned already climate change water interactions. I think that is very important for a research outcome. Another that hasn't been mentioned this morning I think is advanced treatment technologies and pollution prevention strategies. Treatment may be old-school, but sometimes it is helpful, and we need new treatment technologies, particularly ones that use less energy and produce better results. That is a good area for the research agenda as well. I think it is an excellent start, though, on a holistic cross-cutting water research agenda.

I also want to second the comment made by my colleague, Dr. Gleick, about having the census address water use. Often in the U.S. we don't have information about how much ground water in particular is being used. That information is necessary in order to ensure that we have sustainable water resources for the future.

So I commend you, Mr. Chair, on this legislation, and I welcome your questions.

[The prepared statement of Ms. Stoner follows:]

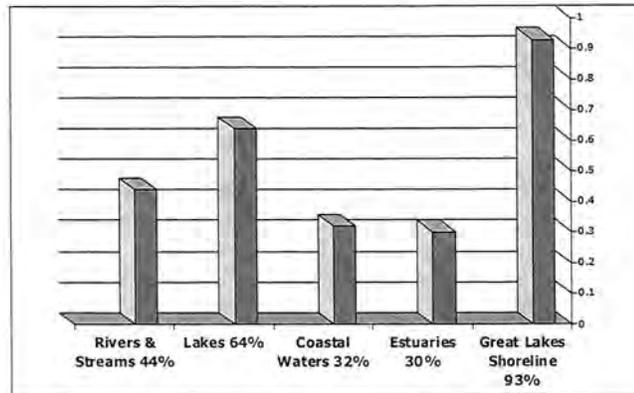
PREPARED STATEMENT OF NANCY K. STONER

Good morning, Mr. Chairman, and Members of the Committee. I appreciate the opportunity to appear before you today to discuss the challenges facing U.S. water resources today and the role of scientific research in addressing those challenges. I will also specifically address the legislative proposals under consideration by this committee to enhance water research in the U.S.

**Water Resource Challenges in the U.S. in the 21st Century**

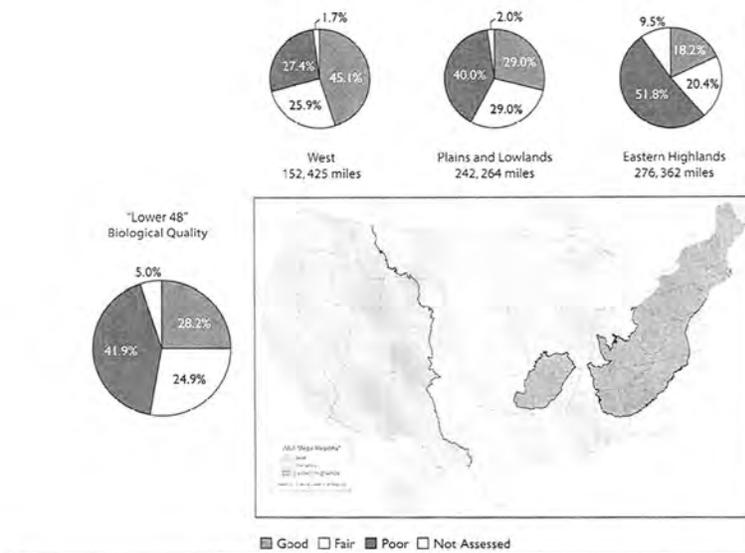
Earlier this year, EPA released its 2004 National Water Quality Inventory Report to Congress. Unfortunately, it demonstrates that very high percentage of our nation's surface waters continue to be unsafe for swimming, drinking, fishing, or other human uses.

Percentage of Assessed U.S. Waterways Impaired for One or More Uses<sup>1</sup>



<sup>1</sup> U.S. EPA, *National Water Quality Inventory: Report to Congress 2004 Reporting Cycle*.

In 2006, U.S. EPA released its first Wadeable Streams Assessment of the biological integrity of 1,392 perennial streams across the U.S. using direct measures of aquatic life. It found 41.9 percent of streams in poor condition, 24.9 percent in fair condition, and only 28.2 percent in good condition.<sup>2</sup>



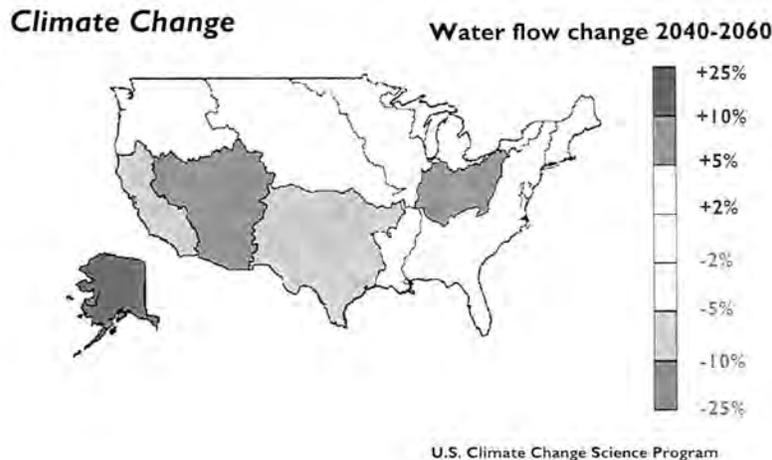
<sup>2</sup> <http://www.epa.gov/owow/streamsurvey/>

These reports focus primarily on water quality. However, our natural water systems and services are also deteriorating. Signs of stress are seen in falling groundwater levels and decreasing stream flows, degradation of aquifer water quality, disappearance of wetlands, dead zones in coastal areas such as the Gulf of Mexico, and other changes in hydrologic function.

Many of these negative changes are a result of ill-conceived agricultural, land development, and energy practices—and are symptoms of man’s overuse and contamination of water. Destruction of natural ecosystems such as wetlands, forests, and prairies to make way for sprawling cities that pave over the landscape destroying natural hydrology, and monoculture farming that requires excessive quantities of water and fertilizer have led to drying land masses and reduced evapotranspiration, as well as increases in polluted runoff. In order to assure secure and clean water supplies and healthy ecosystems, it will be necessary to redesign the Nation’s infrastructure around significantly more efficient and sustainable practices.

Climate change is exacerbating stresses on water resources. From urban and agricultural water supplies to flood management and protecting aquatic ecosystems, all aspects of water resource management are being affected by climate change. Rising temperatures, loss of snowpack, escalating size and frequency of flood events, increasingly frequent droughts, and sea level rise are just some of the impacts of climate change that have broad implications to the management of water resources. Many water supply sources (rivers, lakes, groundwater basins, etc.) are already over-allocated, suffer from degraded water quality and are often not in sufficient condition to support endangered species. The past is no longer a tool for predicting future precipitation patterns. While droughts are nothing new, climate change is not only predicted to increase the frequency and intensity of droughts but will also effectively create ongoing drought-like conditions in parts of the U.S.<sup>3</sup> In response to a U.S. General Accounting Office survey in 2003, 36 states indicated that they anticipate local, regional, or statewide water shortages by 2013.<sup>4</sup>

By elevating temperatures, increasing evaporation rates and extending dry seasons, even existing rainfall patterns will yield less in terms of real water supplies. Ironically, global warming is also predicted to increase the frequency and intensity of storm events, which will in some cases provide more overall rainfall. However, intense rain events often deliver too much water at once causing it to runoff instead of soaking into the ground, making it harder to store in reservoirs. Some areas, particularly in the West and Southeast, are predicted to get less precipitation. These climate change related effects, likely in combination, will decrease water supplies both locally and regionally throughout the country.<sup>5</sup>



<sup>3</sup>NRDC 2008. *Hotter and Drier: The West's Changed Climate*; <http://www.nrdc.org/globalWarming/west/contents.asp>

<sup>4</sup><http://www.gao.gov/new.items/d03514.pdf>

<sup>5</sup>U.S. Climate Change Science Program, <http://www.climatechange.gov/>

There is also emerging research suggesting that the drying out of land and air may also have a direct effect on the rate of climate change.<sup>6</sup> Additional research on this topic could revolutionize the drivers for water resource management internationally. Reducing greenhouse gas emissions is essential, and the water sector can be part of any solution by reducing energy use through water conservation and efficiency, rainwater harvesting, and groundwater recharge through practices such as low impact development. Greenhouse gas emissions can also be used through practices, such as reduced fertilizer use, that also reduce nutrient pollution. However, reducing greenhouse gas emissions will take time and there is a need to address today's challenges. Implementing actions now to improve water quality and supplies, protect aquatic ecosystems and improve flood management not only make sense, but early action will also help reduce future impacts related to climate change.<sup>7</sup> Adaptation is not a solution to climate change but given the importance of our water resources, immediate action is needed to avert significant societal impacts. Research into the tools that communities need to anticipate impacts of climate change to their water resources and the best set of adaptation strategies to prepare for those impacts is an immediate need.

Our nation's water infrastructure was built around the goal of public health protection through long-distance transport of clean water into cities and of wastewater away from cities. These systems were extremely successful in improving public health in the U.S., particularly during the first half of the 20th century. Now, however, these same systems are increasingly seen as out-of-date and insufficient to meet water resource and public health goals. Scarce water resources are wasted through designs that transport water and wastewater long distances for filtration and treatment and by once-and-done treatment processes that discharge treated waters into streams to be carried out to sea instead of using it for landscape irrigation, toilet flushing, cooling water, and other non-potable needs.

The National Academy of Engineering has recently listed three of the new Century's "Grand Challenges for Engineering" as related to water: restoring and improving urban infrastructure; providing access to clean water; and managing the nitrogen cycle (including nitrogen in wastewater).<sup>8</sup> The Academy recognized that an integrated approach combining energy, water, and wastes (liquid and solid) into "neighborhood systems" needs consideration. These systems will rely on telemetry and information networks, and will incorporate aesthetic designs. As the Academy suggests, "proper engineering approaches can achieve multiple goals, such as better storm drainage and cleaner water, while also enhancing the appearance of the landscape, improving the habitat for wildlife, and offering recreational spaces for people."<sup>9</sup>

The value of designing buildings and subdivisions with both energy and water considerations in mind is becoming more clear among green building practitioners. Water management, for example, is included in the recent Net Zero Energy Building report prepared by an interagency task force called the National Science and Technology Council.<sup>9</sup> Wastewater has heat that can be captured, and biogas can be generated at a local scale from sewage, along with food waste and landscaping materials. Energy costs for water line and sewer pumping stations can be avoided if water is captured, recycled and re-used within its natural or originating basin. It only makes sense, then, to provide tax incentives, public building retrofit requirements, and loan guarantees for both energy and water technology advancements within a single program. Other "market transformational" approaches, such as labeling and standards development for energy-efficient appliances and for solar and wind technologies, could also be adopted. EPA's WaterSense program provides data for consumers to choose water-efficient appliances and landscape irrigation services.<sup>10</sup> The success of this program suggests that some similar guidelines for water and wastewater re-use and stormwater management should also be developed.

Treatment approaches typically used are also insufficient to address the broad range of contaminants found in sewage, including excessive nutrients, microbials, such as cryptosporidium and giardia, and pharmaceuticals and personal care products (PPCPs) that are contaminating our waterways and have the potential to threaten public health. The problem of unintended movement of toxic and endocrine-disrupting chemicals and compounds from pharmaceuticals and personal care

<sup>6</sup>[http://www.ludiaavoda.sk/dokumenty/WATER\\_INTOLERANCY\\_KRAVCIK\\_DEF\\_FEB2007.pdf](http://www.ludiaavoda.sk/dokumenty/WATER_INTOLERANCY_KRAVCIK_DEF_FEB2007.pdf)

<sup>7</sup><http://www.nrdc.org/globalwarming/hotwater/contents.asp>

<sup>8</sup><http://www.engineeringchallenges.org/cms/8996/9221.aspx>

<sup>9</sup><http://www.bfrl.nist.gov/buildingtechnology/documents/FederalRDagendaforNetZeroEnergyHighPerformanceGreenBuildings.pdf>

<sup>10</sup><http://www.epa.gov/watersense/>

products to wastewater effluents and drinking water sources is neither new nor unique to the U.S. It is an international problem that has been documented and publicly reported by government experts and academic researchers for over two decades.<sup>11</sup> It is complicated by the fact that the contaminants come from many sources (medical waste, consumer waste, agriculture and industrial uses, etc.), have diverse toxicology profiles and biological activity, may be present in low or trace amounts (parts per trillion), and are likely to have complex and poorly understood toxic interactions (antagonistic, synergistic, additive, etc.). However, these contaminants share one very disturbing characteristic: in general, they are not effectively controlled under U.S. environmental statutes, and are usually not even subject to monitoring. Research into green chemistry, wastestream minimization, and other ways to minimize the risk to people and ecosystems from these substances must become a priority.

### **Economic benefits of clean, safe water resources**

Abundant, safe water resources are essential to a healthy U.S. economy as well as to human and ecosystem health. For example, a new report by scientists working with Restore America's Estuaries found that beach going in the U.S. contributes up to \$30 billion annually to the U.S. economy and recreational fishing contributes between \$10 and \$26 billion.<sup>12</sup> On the flipside, economists from Vanderbilt and Duke Universities estimate the annual economic value of the decline in inland U.S. water quality from 1994 to 2000 to be more than \$20 billion.<sup>13</sup> With the economic crisis that the U.S. is facing, we cannot afford to be throwing away valuable natural resources like clean water.

Directing federal research funding towards addressing the challenges facing U.S. water resources will make the U.S. stronger, our families healthier, our wildlife more abundant, and our communities safer and more resilient to future water and climate disturbances. Those research dollars will also provide immediate employment to scientists, technicians, equipment manufacturers, laborers, and other a whole host of other Americans who can feed their families today and contribute to the long-term health and well being of the Nation.

### **Investment in research and development and demonstration projects in 21st Century water infrastructure**

The U.S. has experienced a dramatic reduction in water-related research funding in the Federal Government, as has been noted by both the National Academy of Sciences and the Office of Science and Technology Policy. The 1972 *Clean Water Act* authorized \$100 million in research, which would be worth over \$500 million per year in current dollars. However, starting in the 1980s, water infrastructure-related research budgets were systematically reduced, and private sector research spending declined as well.

Because of these continuing reductions in water-related research in the U.S., academic institutions, research institutes, and consulting firms have been reducing employment as well. Dramatic signs of this under-employment include the relocation of Massachusetts Institute of Technology water researchers to Singapore, where \$300 million is being invested by that government in innovative technology development in water infrastructure, which will allow them to take a leadership role in capturing the estimated \$3 trillion dollar water and wastewater infrastructure market.<sup>14</sup> Graduate students, for lack of funding in the U.S., are accepting fellowships overseas. Science departments are being shut down, hiring freezes and layoffs are occurring at campuses across the U.S. Consulting research firms have also shed numerous workers in recent months.

By a host of measures, it would be appropriate to build research and development (R&D) funding in the water infrastructure field over a period of years to a \$500 million per year level. Any healthy industrial sector should be reinvesting one to two percent in science and new product development. One percent of the Nation's current estimated \$50 billion water and wastewater sector expenditures would be \$500 million per year, while one percent of the approximately \$100 billion per year that the water and wastewater sectors should be spending on traditional and green infrastructure approaches to meet current needs would be \$1 billion per year.

<sup>11</sup> Kolpin, D.W.; Furlong, E.T.; Meyer, M.T.; Thurman, E.M.; Zaugg, S.D.; Barber, L.B.; Boston, H.T. Pharmaceuticals, hormones, and other organic wastewater contaminants in U.S. streams, 1999–2000: A national reconnaissance. *Environ. Sci. Technol.* 2002, 36, 1202–1211.

<sup>12</sup> <http://www.estuaries.org>

<sup>13</sup> [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=1084077](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1084077)

<sup>14</sup> <http://web.mit.edu/smart/>

To begin returning water infrastructure-related research to an appropriate level of funding, at least \$100 million should be appropriated for EPA to stimulate both R&D and demonstration projects in 21st Century approaches, including water conservation, rainwater harvesting, green infrastructure, groundwater remediation, graywater re-use, optimizing energy use and water quality, monitoring for and treating emerging contaminants, and decentralized wastewater treatment and re-use. A second \$100 million should be employed for innovative water management research in the Departments of Agriculture, Commerce, Defense, Energy, Health and Human Services, Housing and Urban Development, Interior, and Transportation to look at a host of water-related issues such as ensuring safe water supply, protection of aquatic habitat, sustainable water and wastewater infrastructure in the built environment, protection of U.S. fisheries, protection of and stewardship of America's farmlands, pasturelands, and forests, protection of endangered species, and, of course, monitoring our progress in achieving water resource goals. A commitment to rigorous long-term monitoring of our nation's water ways is absolutely essential for identifying contaminants, characterizing and localizing contamination patterns, identifying sources of contamination where possible, and measuring the effectiveness of mitigation measures. In summary, high quality monitoring programs are required for Congress and regulatory agencies to allocate resources wisely and effectively.

The U.S. Geological Survey (USGS) is responsible for the two main water-quality monitoring programs for the Nation's waterways. These are the National Water Quality Assessment Program (NAWQA) and the Toxic Substances Hydrology Program. These two programs are crucial to understand water quality. Without a long-term commitment to monitoring, the Nation will lose its ability to assess trends in water quality, impacts of climate change, impacts of new and under-studied contaminants, and efficacy of policy-decisions that impact water quality. The NAWQA is the larger of the two USGS water-quality monitoring programs, and looks at environmental contaminants using established measurement methodologies for measuring (pesticides, VOCs, metals, etc.). Budget constraints over the last eight years has forced the program to cut back from 496 surface-water fixed station water-quality monitoring sites in 2000, to only 113 sites in 2008.<sup>15</sup> NRDC supports reinvestment in that program.

The Toxic Substances Hydrology (aka Toxics Program) is the smaller of the two programs. It is a water quality research and methods development program that looks at new and understudied environmental contaminants, like new pesticides, hormones, pharmaceuticals, personal care products, etc. The program develops new capabilities, new methodologies, and new information that enable the cooperative water quality programs across states and the NAWQA address new issues in an effective manner.<sup>16</sup> A new water research initiative should invest in both of these programs, which have been devastated by budget cuts in recent years.

In addition to governmental funding, cooperative efforts with utilities, research associations, and other non-governmental entities should be part of the research agenda, including such programs as the National Decentralized Water Resources Capacity Development Project at the Water Environment Research Foundation, the National Environmental Services Center at West Virginia University, and academic workshop and conference funding.

### **The National Water Research and Development Initiative Act of 2009**

The *National Water Research and Development Initiative Act* (NWRDIA) of 2009 would coordinate such a research initiative and develop a plan for identifying and prioritizing future research needs. Efforts to define research needs and projects related to 21st Century water infrastructure are already being conducted at the federal level. The U.S. EPA has directed a wide-ranging series of working groups to identify critical research needs in water infrastructure, and topics for priority research projects have been identified. Research agendas have been developed for "sustainable infrastructure," water and climate change, and green building and green infrastructure related to water systems. EPA has initiatives in related Smart Growth, source water protection, and ecological services program areas. This committee has identified research areas for water-efficiency and conservation measures in H.R. 3957. The Office of Science and Technology Policy has identified key research areas which would be developed in a revitalized water research program. The NWRDIA would be helpful in coordinating these and other agenda-setting exercises

<sup>15</sup> USGS fact sheet: Impacts of proposed FY09 budget cuts on National Water-Quality Assessment (NAWQA) program. Provided by Judy Campbell Bird. April, 2008.

<sup>16</sup> Data provided to J. Sass as personal communication with Donna N. Myers, U.S. Geological Survey, Chief, National Water-Quality Assessment Program. April, 2008.

into a cross-agency, cross-media, cross-sectorial strategy that gets past the historic siloed and disintegrated approaches that are currently failing to provide holistic solutions to our water and integrated resource needs.

It is vital for the U.S. to return to earlier patterns of investment in water infrastructure-related research. Our nation is clearly falling behind in the efficiency and effectiveness of its approaches relative to those of other countries. Research investments will be paid back in many ways, including reductions in costs of safe and clean water systems, revitalized local economies and community development, and in new economic opportunities for American businesses in designing and manufacturing solutions for emerging markets in Asia and elsewhere.

### **Conclusion**

Throughout the second half of the 20th century the U.S. led the world in developing and implementing revolutionary water management systems. This occurred because of national need but was enabled by consistent federal funding for research that built the strongest network of researchers and educators in the world. Observing the success of this approach, other countries such as Japan, the UK, and France emulated this approach in the latter portion of the 20th century, with great success. This approach continues today, especially in a variety of Asian countries which have the same compelling national need as us and who see that federal investments in water R&D are a great public investment which returns itself many times over by both meeting critical national needs but also be creating profitable national and export businesses.

The question before is us whether the U.S. is going to give up its leadership in this critical area and fail to live up to its potential to dramatically improve the quality of life in the U.S. and around the world. This is the path that we are on, but it can be reversed with a fairly modest set of actions by the Federal Government, including a substantial investment in R&D, that would be facilitated by this legislation.

### **BIOGRAPHY FOR NANCY K. STONER**

Nancy K. Stoner is a senior attorney and the Co-Director of the Natural Resources Defense Council's Water Program. She has more than twenty years of experience using the *Clean Water Act* to protect rivers, lakes, and coastal waters from contaminated stormwater, sewer overflows, factory farms, and other sources of water pollution. Nancy is a national expert in U.S. water resource issues and is also working to clean up the Anacostia River in Washington, D.C.

Ms. Stoner has been with NRDC since October 1999. From 1997–99, Nancy was the Director of the Office of Planning and Policy Analysis in U.S. EPA's Office of Enforcement and Compliance Assurance. She was a trial attorney at the U.S. Department of Justice's Environment & Natural Resources Division before that.

She earned her J.D. from Yale University Law School in 1986 and her B.A. in 1982 from the University of Virginia. She is admitted to the bars of the District of Columbia and Maryland.

Chair GORDON. Thank you very much, and Ms. Furstoss, you are recognized for five minutes.

### **STATEMENT OF MS. CHRISTINE FURSTOSS, GENERAL MANAGER OF TECHNOLOGY, GE WATER AND PROCESS TECHNOLOGIES, GENERAL ELECTRIC COMPANY**

Ms. FURSTOSS. Thank you. Chair Gordon, Mr. Hall, Members of the Committee, it is a privilege to share with you GE's thoughts on the National Water Research and Development Initiative Act of 2009. I feel that this Act would represent a very positive step forward in strengthening the planning and implementation of water research and development across the Nation. The Federal Government's role in providing structure and oversight will help accelerate new developments in a more coordinated way.

If we truly want to change how our nation thinks about water, Chair Gordon, as you so eloquently put it, sound resource water management, it is going to take a community. This is a community

of government, National labs, academia, institutes, and industry working together in unison with prioritization, with common goals, with the ability to determine which technologies will be able to be implemented, what will be supported, and if can we work together.

Companies like GE are investing in technology development for water re-use, water conservation, and water purification. But when you have a community that is both strong in cultivating and developing new ideas, and equally effective in achieving the end result, success is sure, is bound to be a sure thing.

Giving industry the opportunity to work with academia, to work with institutes in a coordinated way will surely further this initiative. I was very excited when I read in the bill some of the prioritization areas, including the water census, including very importantly standards and methods of measuring water purification, an area which I feel has been ignored as we continue to legislate, as we continue to drive more and more companies, rightfully so, to re-use water, to cleanse water. It is very important that we understand how to measure, how to achieve the levels that we are asking for.

GE is currently working on a number of different areas. For examples, our scientists and engineers are partnered with the Department of Energy to develop new technology for the treatment of impaired waters for industrial cooling applications, thus being able to use more waters in a sound way. The goal is to minimize water discharge and enhance water re-use.

We are also working with the Department of Energy to optimize a system for waste water treatment, which would help to reduce the cost of energy for systems run by municipalities and industries.

Ultimately, it is going to come down to how these technologies are deployed. Are they meeting the proper regulatory requirements? Do they measure impurities in a way that ensures water is safe? Are they minimizing energy usage so that industry can deploy these technologies in a cost-effective, environmentally-friendly way?

This last question is especially important. One of the biggest impediments to deploying new clean water technologies is the high cost of energy. This bill will go a tremendous way in helping to focus the community on those sorts of questions and answers.

In closing, it makes sense to have a fully-coordinated strategy for addressing our nation's clean water needs, and this will require more direct involvement from the government as well as industries such as GE and our competitors. There are robust R&D pipelines, but there can be more. There is not a lack of ideas for cleaning water. It is helping to prioritize them and determine how can we help the universities, the small companies, or the large companies like mine to get them into the marketplace in a way that is reliable and sustainable.

Working together with the government and other key stakeholders we will have the community we need to successfully carry out a National Clean Water Research and Development Initiative.

Chair Gordon, Mr. Hall, Members of the Committee, thank you for the time and the opportunity to provide our comments.

[The prepared statement of Ms. Furstoss follows:]

### **Introduction**

Chairman Gordon and Ranking Member Hall and Members of the Committee, it is privilege to share with you GE's thoughts on the "*National Water Research and Development Initiative Act of 2009.*"

### **Background**

GE is a diversified global infrastructure, finance and media company that provides a wide array of products to meet the world's essential needs. From energy, water, and transportation to health care and security, we deliver advanced technology solutions through a broad business portfolio to promote cleaner, more efficient energy alternatives, increase the availability of clean, safe water, improve access to quality health care and enhance the safety and security of the public at-large.

As General Manager of Technology for GE Water & Process Technologies in Treviso, Pennsylvania, and as a former senior technology leader at GE's Global Research Center in Upstate New York, I know first-hand the considerable stake and investment that GE has in clean water research and development.

GE Water and Process Technologies is a leading global supplier of water treatment, wastewater treatment and process systems solutions. Our treatment systems provide clean, safe drinking water to millions of people in water-scarce regions around the world. They also are a critical resource for helping industries minimize water usage in support of their operations.

GE's Global Research Center, located outside of Albany, is one of the world's largest and most diversified industrial research labs and the first to be established in the U.S.

From the light bulb, medical x-ray and the first U.S. jet engine to more recent product breakthroughs such as digital x-ray, the GE-90 and GENx aircraft engines and the best in-class Evolution Locomotive, the Center has a long and proud heritage of developing the breakthrough technologies that enabled these revolutionary products to be introduced into the marketplace.

Today, the Center has a world-class team of scientists and engineers working on the next generation of technology solutions to make water more accessible and more affordable. From reducing the cost of desalinated water to tap abundant saltwater resources to maximizing our ability to treat and re-use wastewater, we believe that technology holds the key to successfully addressing an increasing water scarcity epidemic.

Congressman Gordon, we applaud your efforts to establish a national initiative focused on clean water and research development. It could not come at a more critical time for our nation and for the world. According the United Nations, 2.8 billion people around the world already live in water stressed regions. By 2025, this number is expected to nearly double to 5.3 billion—more than two-thirds of what the forecasted population will be at that time.

With shifts in population and our existing water resources being constrained, the U.S. is feeling this impact as well. In the southwest U.S., freshwater aquifers have been depleting at a time when population in the region has been growing. In New England, groundwater contamination is a growing issue. At the Colorado River Basin, competition for water access has become a real source of political and economic tensions. Also, Washington D.C.'s drinking water supplies continue to be threatened by lead and other contaminants.

### **Comments and Recommendations**

"*The National Water Research and Development Initiative Act of 2009*" would represent a positive step forward to strengthen the planning and implementation of water research and development across the Nation. The Federal Government's role in providing structure and oversight will help accelerate new developments in a more coordinated way. But beyond structure, we believe the bill should be more inclusive to ensure that industry has an equal seat at the table with the other key stakeholders.

If we want to truly change how our nation thinks about water, it is going to take a community of government, the National labs, academia and industry working together in unison.

Companies like GE are on the front lines of the water scarcity epidemic. We have a keen understanding of where the water stressed areas are located and the unique challenges each faces. Most importantly, we have product solutions in the market

today and advanced technologies in the pipeline for tomorrow to address our nation's water problems.

We understand how to industrialize research. It's part of our livelihood to take new technologies and find ways to commercialize them in the marketplace where they can add value and solve problems for our customers.

When you have a community that is both strong in cultivating and developing new ideas and equally effective in achieving an end-result, success will be a sure thing. Giving industry an equal seat at the table will ensure that promising ideas translate into real commercial product solutions.

GE knows first-hand the value that can be added when you have a community of government, industry, academia and other stakeholders all working together. It is a key foundation of our ecomagination initiative. Ecomagination, first launched in May of 2005, represents GE's commitment to drive the development of green products and technologies to solve the world's toughest environmental challenges.

As part of this commitment, GE is doubling its level of investment in clean research and development from \$700 million in 2005 to more than \$1.5 billion by the year 2010. Since ecomagination was first launched, we have increased the number of green products from 17 to more than 60 products today. GE's success has been due, in large part, in our ability to coordinate with government, with our customers and with other industry partners to promote key technology developments.

Included within our portfolio of ecomagination products are a dozen products related to water treatment and purification. And we have new technologies in desalination, wastewater treatment, water re-use and advanced membranes at GE's Global Research Center to promote new clean water developments for the future.

In fact, we are currently working with the Federal Government and other partners on various clean water projects. For example, scientists and engineers at GE Global Research are partnering with the U.S. Department of Energy (DOE) on a project to develop new technologies for the treatment of impaired water for industrial cooling applications. The goal is minimize water discharge and enhance water re-use. We also are working with the DOE to optimize a system for wastewater treatment, which would help reduce the cost of energy for systems run by municipalities and various industries.

Encouraging more water re-use through the treatment of impaired water and improvements to wastewater treatment systems are great examples of how we are developing new and better ways to clean water. Beyond what industries like GE are doing, we also are seeing innovative technology being developed by our universities and National labs to maximize the use of our precious water resources.

Ultimately, it will come down to how these technologies get deployed. Are they meeting the proper regulatory requirements? Do they measure for impurities in a way that ensures water is safe? Are they minimizing energy usage, so that industry can deploy these technologies in a cost-effective, environmentally friendly way? This last question is especially important. One of the biggest impediments to deploying new clean water technologies is the high cost of energy. With GE's experience in designing systems, developing technologies and optimizing systems for minimized energy usage, this last goal is well within our reach. Again, that is why it will take a community.

In closing, it makes sense that having a fully coordinated strategy for addressing our nation's clean water needs will require more direct involvement from private industries like GE. We have a robust R&D pipeline and a direct path to market for new solutions. Working together with Federal Government and the other key stakeholders, we will have the community we need to successfully carry out a national clean water research and development initiative.

Chairman Gordon and Members of the Committee, thank you for your time and the opportunity to provide our comments and recommendations on this bill.

#### BIOGRAPHY FOR CHRISTINE FURSTOSS

As General Manager of Technology for GE Water and Process Technologies, Christine leads approximately 350 technologists working on critical chemical, membrane, device and processing technologies aimed at providing water treatment, water re-use and efficient process system solutions. Her team is located across North America, Europe, and Asia.

Prior to being named to this position in January 2008, Christine held a variety of positions in the technology organizations of GE, including materials engineer, product program manager, manager of development groups, business program manager, and global technology leader. She also was in a leadership position in GE's Six Sigma quality initiative. In addition to Water and Process Technologies, Christine has worked at GE Energy and GE's Corporate Global Research businesses.

Christine likes to bring high energy, technical breadth and strong customer relationships to her roles to motivate and mentor others, build strong, integrated teams, and develop great technology!

Christine joined GE in 1989 in the Materials and Processes Engineering Department of GE Energy. She received her B.S. and M.S. degrees in Materials Engineering from Rensselaer Polytechnic Institute (RPI). Christine is married and has one son.

#### DISCUSSION

Chair GORDON. Thank you and for all our panelists for being here.

Now, at this point we will open our first round of questions. The Chair recognizes himself for five minutes.

Dr. Vaux, in your testimony you indicated that the importance of obtaining and managing and exchanging data on water resources, in addition to my bill H.R. 1145, there is legislation pending in the House, S. 22, that authorizes additional funds for the USGS Stream Flow Network and for expanded monitoring of ground water resources. It seems to me that the coordination of agencies' efforts directed by H.R. 1145 and the expansion of these two key data resources and S. 22 are complimentary.

Would you like to make a comment on that by virtue of the research you have already done?

Dr. VAUX. Well, I would agree that they are complimentary, and I would agree that they ought to go forward in a fashion that is coordinated again and not independently so. The U.S. Geological Survey is the agency with the most experience in terms of data collection, data management, and making the data available to users.

And one regrettable characteristic of our data acquisition program is that there has been a significant disinvestment in it over the last two decades. These bills with appropriate authorizations and follow-on funding would go some ways toward rectifying that disinvestment by investing further. My only concern is that it does not proceed independently of what you are trying to do, Mr. Chair.

Chair GORDON. Thank you, Dr. Vaux. Mr. Baird or Dr. Baird will be very happy to know that you wanted to include the social sciences and the various categories.

And you had also mentioned additional funding for the coordinating agency. What are you envisioning there?

Dr. VAUX. An off-the-wall estimate would be simply \$2 or \$3 million annually to support the efforts of the coordination effort. My experience has been or my observation has been when you ask the agencies to take the costs of these kinds of coordination efforts out of existing funds, they lack enthusiasm, and I think by providing a little money one would generate more enthusiasm to achieve the goals and objectives of the bill. And also there may be a need to provide some additional research money along the lines that Dr. Gleick suggested.

Chair GORDON. Thank you. That is very good advice.

And Mr. Modzelewski, you had mentioned that 30 to 50 percent savings could be made in water consumption by using IT. That is a pretty extraordinary number. Can you go through that a little bit more with us?

Mr. MODZELEWSKI. Sure.

Chair GORDON. Some examples.

Mr. MODZELEWSKI. Sure. And some said it is more, some certainly said it is less, but that tends to be the range. Really right now there is not really a common understanding of how to communicate water, communicate about water. Having a sensors' network that would be able to give us far more in-depth understanding of the usage, matched against something like a census would allow us to know how much we are using, how much we are wasting, and to be able to address those problems quickly.

You have the issues right now with say, a city like Chicago, where some of the estimates are that Chicago is losing as much as 60 percent of its water before it gets to the faucet. If you look at a situation like that where you had a smart network and smart grid in place, you would be able to assess where you are losing it, what the cost benefit analysis is of doing that, and address it. Not to mention usage that is going through streams as it is being used in finding beneficial uses along those lines.

Right now from an IT perspective we don't, again, have common standards. Often where we are doing readings we have different systems doing different readings but yet in the exact same place. You can find a box in a stream that maybe five communities have put together various water monitoring and analysis systems instead of sharing that data. And the ability to potentially overlay a smart system where we know where it is, be able to speak to each other about it, and be able to assess how much damage is being done, how much we are losing, and to be able to address those at a pinpoint fashion would come from an IT system or, again, using a term that has become fanciful right now, a smart-water grid, that overlays.

Chair GORDON. All right. So are you talking about implementing existing technology, or haven't you developed new technology?

Mr. MODZELEWSKI. It wouldn't really need a huge jump from technology we currently have available. It would certainly be a need to be adapted to a water system, and everyone would have to agree upon the measurements and what all the wording means and what all the reporting would mean within it. But there is nothing about the actual code, if you will, the actual writing of this that would be new. The only other thing that would be new is actually probably a far more intensive sensor network to be, actually take readings far more aggressively throughout a system.

Chair GORDON. Ms. Furstoss, since you have come out of this division, do you have a comment on that?

Ms. FURSTOSS. The idea of a smart water grid, the idea of being able to implement I think is a wonderful idea. It does provide challenges as was mentioned in the sensor technology and being able to have reliable data. I think the data management techniques, the ability to measure for water usage is there. The ability to easily implement it, I think, will take a much more-coordinated effort.

Again, as was mentioned, how is it measured, how often, the standards, but I do think that the ability to measure water usage, the technologies do exist.

Chair GORDON. My time has expired.

Mr. Hall, you are recognized for five minutes.

Mr. HALL. Thank you, Mr. Chair. Mr. Modzelewski, I appreciate your concern for amounts of money because that is something we

have to take into consideration and would pass any bill. And it is kind of extraordinary for folks like you to come here that are that considerate of our problems.

You know, we have a present President that is throwing money like mad, the stimulus, and the President and my friend that just left us is back in Dallas right now with his bailouts, you know, bailed \$700 or \$800 billion and \$350 billion of it just went completely quickly, and where it went we don't know or what happened to it, and all they said was uh-oh, and we don't know, you know, about that.

So I thank you for being that considerate. I wanted to just say that.

But my question is to Mrs. Furstoss. Legislation was introduced and passed in the House, this Congress and last Congress, to explore ways to utilize and maybe treat the water produced from drilling for oil. That is a big problem for us, and we have some legislation. The Chair and this entire committee helped us pass those bills, knowing the importance of them.

Has GE done any research in this area?

Ms. FURSTOSS. Yes. We have done research and are continuing at the moment to do research looking at produced waters from the oil industry. We are working with, in addition to our research and development center, we are working very closely with some of the oil-producing companies to understand how we can purify the waters that are being drawn, the oily waters. Very difficult technology because of the temperatures that the waters are at, because of the consistency when the oil comes out of the ground with the water or the water that is used to help promote the drilling and really bringing up the oil.

These waters are very oily. They have a significant amount of solids, they have a significant amount of contamination. Anything that could be in the ground is going to come up with the waters.

Mr. HALL. Would you feel like they are worth the cleansing process?

Ms. FURSTOSS. I think that for sustainability we need to. We need to figure out how can we clean these waters to be able to reduce the water usage, to be able to re-use them, but currently with the oil content it is very difficult. It is one of our main area of research right now within GE water and process technology.

Mr. HALL. None of these waters have been cleaned enough to get to the faucet.

Ms. FURSTOSS. Not to get to the—

Mr. HALL. One of the—

Ms. FURSTOSS. Yes. Not to get to the faucet to my knowledge. Perhaps in some isolated areas they are. Again, we are focusing also on being able to re-use these waters, again, so these operations require much less water usage.

Mr. HALL. So they are generally relegated to re-use in the oil patch?

Ms. FURSTOSS. Yes.

Mr. HALL. I thank you. I yield back.

Chair GORDON. Mr. Miller, I don't see you. Oh. Okay. I didn't see—okay. All right. Okay. Ms. Fudge is recognized for five minutes.

Ms. FUDGE. Thank you, Mr. Chair.

I am from Cleveland, Ohio, so I live on one of the Great Lakes, Lake Erie. We don't have a problem with access to water. What I would like to know, and any of the panelists might answer the question for me or a number of you, but as you talk about the need to, for the Federal Government to provide more money towards water research and you talk about the smart grids and how we determine how much water we actually use, if we provide these resources and do this research, how do we then keep the cost of water usage down? Because in our area where we really don't have any problem with access to water, our water rates are going up significantly. I don't know if it is the technology to read meters. I am not sure about that, but could you just give me your thoughts on what we could do over time with the research to reduce the cost of providing clean water?

Dr. VAUX. I will take a first cut at that. I am an economist, and the pricing of water is near and dear to my heart, and I think that the bad news from the point of view of your constituents is that the price of water is likely to rise in the coming decades, and there is virtually nothing that can be done to make it go down. What can be done is research that will attenuate the rate of increase.

Water is now and has historically been under-priced, and one of the things that is going to happen as scarcity intensifies is that the price will rise. The price will also rise because the cost of securing a clean water supply that is safe and healthful will also rise. And I think the fact of the matter is that the citizens of the United States have enjoyed a healthful water supply for over 200 years at less than full cost, and that the reasonable expectation ought to be on the part of citizens that costs more nearly approaching the true cost of water are going to have to be paid in the future.

I am sorry I can't be more optimistic.

Dr. GLEICK. If I could add two points to that. One is the costs are likely to go up in addition because we expect we are going to have to spend more money to provide clean water. That is a question of reliability, it is a question of availability, and it is a question of quality. There are new contaminants that we don't regulate for. There are new contaminants that we don't remove, and we are going to have to develop technology and apply technology to remove them. And that is going to cost more.

On the other side, though, and some of the other speakers have mentioned this, there is a lot of effort going into figuring out how to use water more efficiency. We actually use less water in the United States today for everything than we used 20 years ago. We are becoming more efficient, and as we become more efficient, either in the home, through better appliances, or in industries with better processes, the cost of water can do down, the total cost of water can go down.

So we have to match this growing cost for improved reliability of supply and improved quality with the potential to improve the efficiency and reduce our overall demand for water.

Chair GORDON. Thank you, Ms. Fudge, and Mr. Rohrabacher, you are recognized for five minutes.

Mr. ROHRABACHER. Thank you very much, Mr. Chair, and appreciate you holding this hearing. I come from southern California,

and we know how important water is. I am very proud to say that my own county, Orange County, is on the cutting edge of technological development, especially in reclamation of water and conservation of water, and I have been very supportive of those efforts with earmarks for my district. I just wanted to make sure people got that.

And we also have supported, I have also supported efforts there to make sure that we have the reporting of the purity of the—or not the purity but the safety of the water which the surfers surf in and people have their children swimming in. So I am very proud of our local area.

Let me note, however, just a little slight disagreement. We have not had 200 years of water safety in our country. Water was really in bad condition up until about 50 years ago. I remember when I was young they wouldn't let me put my finger in the Potomac because my fingernails would fall out, and I remember that song back when I was younger, maybe some of my colleagues remember this song. My fellow—or colleague from Cleveland may be too young to remember this, but it was, "burn on big river, burn on." And so we have a lot to be proud of in terms of what we have accomplished for water, and I would support the idea of a water census to make sure that we understand the overall goals that we should have as a country, as well as standards for purity.

I would like to ask a little bit about some of these other things. We do have limited resources, and I think

Mr.—and I am—how do you pronounce your name?

Mr. MODZELEWSKI. Modzelewski.

Mr. ROHRABACHER. Modzelewski. Did make a point that maybe perhaps investment in technology might be better than just putting more money into research. And if you could do new technologies, for example, if we could make water desalinization a little more efficient. We do have problems in the, in our area with water desalinization being opposed by environmentalists because the little fishes might be trapped and then the pelican might not be able to eat the meal that day or something like that. We have to balance those considerations off; pure water versus the pelican getting his meal.

But with that observation could you give me a little bit about this? Where would you put, rather than just research into water, where would you put the money that would actually start making things better? What technologies would you focus on?

Mr. MODZELEWSKI. Well, rather than necessarily getting highly specific on that, what we tend to be doing right now if you look at it is the technology portfolio as we tend to figure out tweaks. We tend to figure out how to make a little bit better membrane, a little bit better type of filtration.

Mr. ROHRABACHER. Yes.

Mr. MODZELEWSKI. A chemical that might not be as hazardous or a means of cutting out something in the system, and it is very bizarre compared to other areas of technology where you look at a wide range of things. Look at energy, for instance, where it is everything from improving how we handle oil to doing something like focusing solar cells to work better and that kind of thing. And we really don't have that in water.

There are very few research efforts that are being done on mid to long-range, and that ranges from more efficient desalinization, which right now there is actually a new research effort at Yale on something called forward osmosis, which would be less energy intensive than reverse osmosis. There is a researcher out of Duke University who is actually using biotech techniques for purifying water so you don't have to use chemicals, and she is actually using RNAI to actually turn off the bacteria and pathogens in water rather than having to put chemical treatments in it that would harm, be harmful and need other treatments and other energy and other usages to get them out.

A lot of the times what we are doing in water is we are actually putting bad things in. It is sort of like chemotherapy. You are using something horrible to try and kill the disease quicker than the treatment kills you.

Mr. ROHRABACHER. Well, let me note we also not only have to develop the technology, we have to provide our businesses with the incentive to actually utilize that. I visited a plant just two days ago in southern California where the owner of this very small company, you know, it was a medium-sized company, had invested \$800,000 in a piece of equipment that purified the water before it went into the, you know, from the plant before it went into the system. That was \$800,000, but the depreciation schedule on that was the same for anything else. And we have a depreciation schedule in our country that puts us at a disadvantage compared to the Japanese and others.

Perhaps, Mr. Chair, we could support legislation that would say that for water or other environmental technologies that we can agree upon, that the depreciation schedule for the actual putting of that technology into practice at businesses, that we would have an advanced or a shorter depreciation schedule than just for other technologies. That might work very well, and thank you very much for this hearing.

And if I could maybe ask on last question, maybe our last witness would like to answer the question about what technologies we should most focus on.

Ms. FURSTOSS. Thank you for the opportunity. I think that there are a number of technologies if we step back and per your last comment, look at the system level and understand the total cost to treat of water. There is amazing work going on at institutes, National labs, universities. I am very aware of some of the work in forward osmosis and so forth.

But I think also we need to step back and say how can we drive down the total energy need for water purification. There has been very minimal investment in energy recovery devices, in devices to look at how can we get more water through with less energy, whether it be pumps, whether it be devices that can take the pressure differential and turn that into energy, or whether it be totally new materials that allow the membranes to work in a totally different way.

Mr. ROHRABACHER. Thank you very much, and let me note, again, with an earmark I provided funds for Long Beach Water District to develop a new system that is 25 percent more energy efficient.

Chair GORDON. Thank you, Mr. Rohrabacher. You can be on our next panel.

And Ms. Edwards is recognized.

Ms. EDWARDS. Thank you, Mr. Chair, and thanks to the panelists. It is really good to see Peter Gleick. I have read every one of your bi-annual water reports, so I appreciate meeting you.

About 25 years ago I spent some time at the World Bank, really working on tracking the big infrastructure, you know, projects, the dam projects, et cetera, that the bank was funding at the time, purportedly to make sure that we had a world that had a clean water supply. And I don't think we are any closer to a clean water supply now with the expenditure of billions and billions of dollars across the country.

One of the questions that I have for you and perhaps from Ms. Stoner as well, is to, is about what we might do in our own research assessment here in the United States that takes into consideration what the impact in the world's water supply is and strategies for addressing the world's water supply.

And I think Dr. Gleick, as you pointed out a number of times, you know, the connection between security and water supply is really, it is deep. We are seeing that right here in our own hemisphere, and so I wonder if you might address ways that we can make investments in research that look at things like global, like climate change and its impact on water and the relationship between neighboring states, and our use of water, and if there may be things that we could explore in terms of strategies here in the United States that could have a positive impact on the world's water supply.

Dr. GLEICK. Congresswoman, thank you very much for that question. It is a huge question. I don't expect to be able to answer it fully.

It is long past time that the U.S. reevaluated not just our own national water policy but our national water policy in the context of international water issues. We have enormous resources here, intellectual resources, technological resources, financial resources, even given the current financial crisis, to help address the billion people worldwide that don't have access to safe drinking water. I think there is a lot that can be done.

In my written testimony I recommended expanding perhaps not this particular bill but certainly bills in Congress to address how the U.S. spends its money and its resources and its efforts at the international level as well. I think it is time for, it is past time for reassessment, and the good will that we could generate internationally with those resources is enormous.

I am not sure it necessarily requires new technology as much as it may require doing more of what we do here in the United States in other places; rethinking how we give foreign aid. Instead of spending \$1 billion at the World Bank on a water project, the World Bank and other agencies need to think about how to spend \$1,000 in a million places. In many parts of the world \$1,000 can be enormously effective at bringing clean water to schools, bringing hygiene education programs, a whole set of things that we really know how to do in order to solve world water problems but just haven't done yet.

I would be happy to—I could go on and on about this but perhaps another time.

Ms. EDWARDS. Thank you, and Ms. Stoner, I am curious as well if you could both address this and the relationship between what we are doing here on climate change and how that impacts what is happening with our water and water supply and particularly the management of it.

Ms. STONER. I appreciate the opportunity to do that. With respect to your first question, one thing that occurs to me is the development of decentralized waste water treatment technologies. In lots of places, other countries, they don't have centralized sewer systems and many, that is why many of the people don't have adequate sanitation, and that is, you know, why so many people die from drinking polluted water overseas.

And we also about a third of the new buildings, new homes built in the United States actually use decentralized waste water treatment technologies, and there are lots of benefits to doing that in terms of hydrology and so forth, but often those technologies are not sufficiently advanced to address the full range of water quality issues. For example, nutrient pollution.

And so if we were to develop those technologies better in the United States, we would have markets overseas that we could use those for. So we could sort of take advantage of the fact that they are looking at those technologies as a resource for them as well. So that would be one idea and an area that I would like to see research into advanced decentralized waste water treatment technologies in the U.S.

As far as climate change goes, I think that we have a lot of good information on impacts of climate change on water resources that I referenced in my technology, in my testimony, but a lot of it is at a global level. The models are not particularly precise as they bring it down to the community level where decisions need to be made about infrastructure investments and so forth. So that is one area.

A second area would be in how to adapt to those changes, how to have more resilient water resources in the face of climate change. That is a new area of research that I would urge us to invest in.

Chair GORDON. Ms. Stoner, if you don't mind, we will let you provide the rest of that for the record, because we have a lot of folks here, and we would like to try to get them through their questions today, too.

Ms. STONER. I would be glad to do so.

Chair GORDON. I will be neutrally discourteous to everybody as we try to move a little bit faster.

Mr. Smith.

Mr. SMITH. Thank you, Mr. Chair. I'm from Nebraska certainly water is important and the economics of water, irrigation, municipal and otherwise.

I know that there is huge costs with many things, but Dr. Vaux, if you could elaborate when you say that the price of water has not been accurate regarding the cost. What do you think has been left out?

Dr. VAUX. We talk about both urban users and agricultural users who typically pay the cost of capturing, transporting, and treating the water but not the scarcity value of the water. In other words, typically in the United States the scarcity value of water is assigned at zero, and the mistake that that entails is that it signals to consumers that water is plentifully available when all of us know that it isn't.

So it is the failure of our water pricing structure to reflect the scarcity value which is what is missing.

Mr. SMITH. What value would you add to that?

Dr. VAUX. What would the scarcity value be? It would be very location specific. Generally speaking what our studies show is that the scarcity value of water, of urban quality, would be higher than the scarcity value of water for agriculture because it has to be treated to such a high degree, and it is, therefore, scarcer, therefore, the price is higher.

Mr. SMITH. But is there a percentage that you would offer?

Dr. VAUX. No. I am very reluctant to generalize about it because it is going to differ as between Orange County and New Jersey or Orange County and New York City. I am very reluctant to generalize because I think it is going to be a different value depending upon where you are.

Mr. SMITH. Okay. Would you agree that many advancements have been made, for example, in irrigation techniques, no-till farming, and other efforts?

Dr. VAUX. Absolutely. Absolutely. I mean, agriculture is as a generalization a more efficient user of water today than it was a decade ago or two decades ago, and I anticipate that it will become an even more efficient user of water in the future as the competition increases and as farmers figure out ways to be more innovative managers of water.

Mr. SMITH. I appreciate that. I concur with that. Just the observations, rather anecdotal on my part, I am very impressed with the advancements that have been made just with irrigation practices alone, not to mention other crop rotation and what have you.

So I appreciate that. I am encouraged and inspired by what we can still accomplish, and I appreciate your efforts. Thank you. I yield back.

Chair GORDON. Thank you, Mr. Smith.

Mr. Tonko, I am not picking on you, but if there is no objections, I would like for folks to try to maybe keep it to four minutes rather than five minutes so that we can, again, try to let everybody have a chance. So, Mr. Tonko, you are recognized.

Mr. TONKO. Thank you, Mr. Chair. I am sorry. My question is to Ms. Furstoss.

As one who represents Schenectady and a lot of GE activity, I am interested in the fact that you mentioned being a leader, GE being a leading supplier for water treatment, waste water treatment, process system solutions. Where are these deliveries being made? What countries are we reaching? Is it spread across the globe? Is there a concentration in a certain region?

Ms. FURSTOSS. It truly is global. We have a significant portion of our sales, and I apologize, I don't know the exact number but can provide that, in North America, in the United States, specifi-

cally in the central region, where there is a majority of heavy industry, and we look to help them on water usage, to minimize their water usage, to purify the waters that are used in everything from steel melting to plastic injection molding, to help them to purify those waters so they can be safely discharged. We do have a large presence also in the Canadian areas, and we are global.

So I believe that the majority is in North America, but I would have to be able to get you that exact figure.

Mr. TONKO. And also I would ask like I believe that the President and Congress recently with the passage of the Investment and Recovery Act showed great wisdom in investing in pure R&D, clean R&D.

Ms. FURSTOSS. Yes.

Mr. TONKO. Can you share with you, you doubled, I believe, more than doubled in the last five years at GE—

Ms. FURSTOSS. We have more than—

Mr. TONKO.—investment.

Ms. FURSTOSS. Yeah. We have more than doubled our investment in what we use as the phrase, eco-imagination. So clean technologies, technologies that are focused at energy efficiency, at cleaner water. We have doubled that investment too, as a company to over 1.5 billion, and we currently have over a dozen products in that portfolio that are directly aimed at clean water.

Mr. TONKO. So in terms of the investment in R&D what percentage would water be? How—can you guess of the 1.5?

Ms. FURSTOSS. It is a very small percentage at this point. I, again, don't know the exact number, but it is more on the order of about 50 million.

Mr. TONKO. Would you happen to know how much of all of the clean R&D is done here in the United States?

Ms. FURSTOSS. The technology development, the R&D done by General Electric is done, the vast majority in the United States. Well over three quarters.

Mr. TONKO. Thank you. Mr. Chair, I will yield back my time.

Chair GORDON. Thank you. And Mr. Inglis is recognized.

Mr. INGLIS. Thank you, Mr. Chair. We in South Carolina are becoming more and more acquainted with water shortages with a drought and before that we had been, especially in the lower part of the state, starting to experience some salt water intrusion into the aquifers that we were gathering a lot of water for places like Hilton Head's development. And so now in the upstate of South Carolina we are becoming more and more aware of just how precious the resource is, in part because Georgia wants water out of the Chattooga, and so they had a little problem down in Atlanta, and I guess that is why they want more water out of the Chattooga.

So the folks at the Strom Thurmond Institute at Clemson are looking at preparing a water budget for the state, and I wonder if you might comment on whether this bill would, that we are discussing here today, would be helpful in that regard, or is it, is that a local matter, or is this something that may be assisted through this bill?

Maybe I should ask the Chair about that, but it is a panel. The Chair might have an answer. He will yield himself some time

maybe to answer the question, but anybody on the panel want to address local water budgets and whether those might be assisted by this bill?

Dr. GLEICK. I will be happy to answer quickly. In general water is often a very local issue. If the local expertise is available to evaluate the hydrology, to look at the resources that are there, to look at water use, do it locally.

But we need a national assessment everywhere. You don't, you are not the only ones with these kinds of problems. These kinds of problems are coming up everywhere, even places we thought water was plentiful, we realized it no longer is. And so we need a comprehensive assessment of water use and water availability nationwide, which is what the census calls for.

The other problem is the political boundaries we have rarely match the hydrologic boundaries we have. We have watersheds that permit conflicts to arise between Georgia, Alabama, and Florida, or Georgia and South Carolina, or Georgia and—I am not picking on Georgia. But the hydrologic boundaries we have and the political boundaries don't match. And that is another reason why it might be useful to get away from local assessments to national assessments that really do these kinds of things at the watershed boundary so we understand the hydrology and then perhaps we combine it with the politics.

Mr. INGLIS. Anyone else want to comment on that?

Mr. MODZELEWSKI. Actually I will just pick up on that. It is, one, it is the actual bodies of water, for instance, in the sense of a watershed that you have to look at something like an aquifer system in the southwest. It tends to go over many states with a level of covenant between them, but they tend to have very different laws on how that is operated on. You have a riparian system, you have hybrid systems, et cetera, and what that really gets down to is each state that is drawing from the water has a very different idea of what appropriate use is and how to assign that use to people.

And so the water, as the water moves through that watershed you have very different usage levels, very different sense of security in the sense of health issues and things along those lines. Until a lot of that is understood or codified or standardized, you are going to continue to have conflict as well.

Mr. INGLIS. Yeah. I suppose one of the outcomes of developing a budget or a comprehensive kind of approach like we are talking about here would be mostly, well, one of the key outcomes would be valuing water highly, and that means not wasting it. Right? Which is probably what all of us do a lot. So that will be one of the outcomes of this.

Thank you, Mr. Chair.

Chair GORDON. Thank you, Mr. Inglis. And there has been a couple of members of the panel that have suggested universities should be a part of this, and we will look at that if we could do it in some way.

Ms. KOSMAS is recognized for five minutes or less.

Ms. KOSMAS. Thank you, Mr. Chair. I think it will be less. I want to say that I appreciate the panel's being here today and also appreciate this bill that you are moving forward.

I wanted to ask this question of Ms. Stoner. You stated in your testimony that the 1972 *Clean Water Act* authorized \$100 million in research and that in the '80s, research and development was systematically reduced as it was argued that the private sector would pick up the slack. In fact, in '84, President Reagan stated that it was time for the states and private industry to take over the job.

So my question would be, how has the private sector fared in shouldering this burden without significant federal assistance?

Ms. STONER. Thank you. I noticed that my colleagues had some different estimates in terms of the R&D spending over the time-frame, so I don't know if we had looked at different types of investments or not, but I did notice that they indicated that they also thought additional investment was needed, but that they didn't think that the absolute number had decreased. So I call that to your attention.

You know, I think that if we had the right markets and could help particularly bridge the gaps through a federal investment between the development of the technologies and their implementation, I think that would help a lot to trigger private investment. So the social science research that we mentioned earlier identifying how to make the investment smarter on a watershed basis so that every dollar is expended better and that public support is developed by showing what the value of the investments are.

I think that the needs are out there, so what we need to do is to link up the needs with the development of the new technologies and bridge those two.

Ms. KOSMAS. Okay. Thank you. And so I guess the bottom-line question is do you think that additional federal funding needs to be placed in research and development, or do you think then that the private sector is doing its share to bridge the gaps that you have just described?

Ms. STONER. Well, I agree with my colleague, Dr. Gleick, that there are things that are done better at the federal level.

Ms. KOSMAS. Yes.

Ms. STONER. Even though everyone is interested in their own local water body, if you don't assess how things can be done on a watershed basis and look at a broad, from a broader scope, I think you miss synergies also, looking at the energy water nexus, other ways of evaluating investments in water that can also help with energy, climate change, even air pollution. I think those are often things that we miss that can help save money in the long run, provide better environmental benefits, and provide markets for industry.

Ms. KOSMAS. Thank you very much. I yield back my time, Mr. Chair.

Chair GORDON. Thank you. Since Mr. Rohrabacher double-dipped last time I am sure he would like to yield to Ms. Dahlkemper.

Mr. ROHRABACHER. I would be very happy to, and I apologize for hogging that extra minute, knowing we are under a schedule problem.

Ms. DAHLKEMPER. Thank you, Mr. Chair, and thank you, Mr. Rohrabacher. I appreciate this hearing very timely. I, like Ms. Fudge, live also on Lake Erie. I am just a little bit further to the

east in Pennsylvania. Abundance of water. Waste of water I would say for many, many years. My neighbors sometimes clean their driveways with the hose for over half an hour, and they will leave their sprinklers on all night long. So, yeah, we see a Great Lake out there, and people don't think about the impact that their use is having.

And so I guess what my question is when it comes to water use, you know, what segments of water do you see cause the most concern in terms of water use? How would population growth and migration impact such water use over time?

Of course, we think we will become the place where everyone wants to live eventually because we have water. But—and also I guess tied into that, what portion of the present use or the present water waste could be resolved by reasonable household conservation?

And so I guess I just open this up to whoever would like to answer.

Dr. GLEICK. Let me take a first crack at that. I would note that of all the people who are most concerned about your neighbors' use of water and looking out over the Great Lakes are probably the Canadians—

Ms. DAHLKEMPER. Yes.

Dr. GLEICK.—who worry quite a bit about that, and I know there is a new agreement between the U.S. and the Canadians on the Great Lakes.

At the Pacific Institute we have done a lot of work at, on this question, specifically on water use efficiency. The quick answer is our estimate is that current urban use of water could easily be reduced by 30 or 35 percent from today's level with existing technology cost effectively. Better toilets, better washing machines, better dishwashers, more effective and efficient outdoor watering. In many parts of the country outdoor watering is the majority of residential use. Better industrial use. Thirty to 35 percent.

In the agricultural sector as we have already heard enormous progress has been made, but enormous progress remains to be made. We did an estimate for California looking at the potential of a five to fifteen percent improvement in agricultural water use efficiency, permitting us to grow the same amount of food with less water.

And because agriculture consumes 80 percent of the water that is consumed in the U.S., that small percentage of improvement is a lot of water. So the potential for efficiency improvements is enormous.

Ms. DAHLKEMPER. Would anyone else like to comment?

Dr. VAUX. Let me make one comment about the water quality and the preservation of water quality. There has been a lot of discussion here about the role of technology and about the importance of technology. The missing point has been this one. Virtually every economic study shows that it is cheaper to prevent water contamination in the first place than it is to clean it up once it has occurred.

And in seeking a balanced approach to our water quality problems, which will be important in terms of determining how much

water supply is available, it will be critical to recognize that prevention must play an important role.

Dr. GLEICK. And one thing on the technology front as far as that goes is we have to start looking at just our use of water differently. I mean, the driveway analogy is a great one. You didn't need the top-quality water from the house that was all clean and went through all the systems to treat that. If we started looking at how we develop technologies where we can re-use and create gray water within our own homes or within neighborhoods or within cities and use another quality of water to handle things like watering lawns and cleaning cars and things along those lines, we would make a great jump in being able to preserve water. And there are other countries who have been very aggressive at that; the Israelis, the Swiss, Singaporeans have all moved very aggressively on water re-use.

Ms. DAHLKEMPER. Thank you. I yield back my time.

Chair GORDON. Thank you, Ms. Dahlkemper. Okay. Mr. Hall passes so Mr. Luján, you are recognized for five minutes or for four minutes.

Mr. LUJÁN. Thank you, Mr. Chair. I won't take much time. Thank you to each of you who are here today. I know that there are at least a few of you who have a lot of familiarity with New Mexico and some of the work that has been happening out there, and so I would like to, you know, pose my question specifically to you.

With the creation of the Water Resource Research Institutes in each of our states and territories across the country, specifically the work that is being done in New Mexico or in different regions of the country, the importance of supporting those institutes, if you could explain that.

But as well is there coordination that is taking place with our universities, our local governments, with those that oversee, you know, state engineers that oversee small public water utilities as an example, coordination with the League of Cities and the National Association of Counties? What specifically is working there, and is this a good place to target some of the support when we are talking about the importance of looking at how we can maximize and localize the research and to be able to get the data that we need to be able to make good decisions?

Dr. VAUX. I have been associated with that program in one way or another since 1965, and I think the program does not get very substantial level of funding, about \$6 million annually. What it is doing most effectively right now is the communications task and keeping the water resources expertise at all the colleges and universities in each state knit together in ways that I think the Chair envisions for his bill here in the Federal Government.

The research budget is, of course, starved, so that the communications task is the primary one that the institutes are executing effectively. Not only within the states as I just described but among the states because there isn't a national association. An institute needs State and the trust territories and those people communicate with each other, and there is now an annual three-year review of those programs which generates a lot of information about what they are contributing.

So I and my testimony indicates that I think the institute program is a useful way to fold in the academic community to this initiative and ensure that the portfolio which is out of balance with respect to short-term and long-term research gets rebalanced, because the academic community is really in a better position to do the long-term research.

Chair GORDON. Mr. Luján, would you yield to Ms. Giffords for our last question, and then we, by House rules, are going to have to end this hearing.

Ms. GIFFORDS. Thank you, Mr. Chair. Thank you for coming to testify. I just said earlier this morning in a speech that I think the future wars will be fought not over oil but over water, and this is a very serious topic, and I am glad that the Chair is addressing this.

Generally, like Mr. Luján, I come from the west, the State of Arizona. We have a booming population. In terms of a national water policy, we are, I am not interested in moving to Ms. Dahlkemper's district. Those of us that want to stay in the west, that like the southwest, realize that we are going to have to have different policies that affect us compared to different states.

So, you know, could members of the panel talk about how we implement a national water policy when the west is going to be disproportionately affected because of climate change?

Dr. GLEICK. There are things that we have to do at the national level, and there are things we have to do at the local or regional level. Certainly better management of water in the west when you talk about an Integrated Colorado River System, for example, which affects Arizona enormously, is a regional issue with national pieces to it. But we don't want 50 state standards for water quality. We don't want 50 state standards for the efficiency of appliances. So the important thing to do here, and I think one of the important things this bill tries to address, is to decide what needs to be done at the national level and to do it as efficiently as possible, to integrate the research across the 25 or so federal agencies that do research in an appropriate way, and to leave the rest of the stuff for the local level and the State level.

There are things that the western U.S. is going to have to do on its own. There are things that the U.S. Government ought to do differently in the west as well. It depends on the issue, depends on the region. But I think that separation is critical.

Chair GORDON. Thank you very much. The joint session is just about to begin, so I want to thank our witnesses for appearing before the Committee this morning. The record will remain open for two weeks for additional statements from the Members and for answers to all the follow-up questions the Committee may ask of the witnesses. You can see this is an issue of interest.

And this committee is now adjourned.

[Whereupon, at 10:59 a.m., the Committee was adjourned.]

## Appendix 1:

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ANSWERS TO POST-HEARING QUESTIONS

## ANSWERS TO POST-HEARING QUESTIONS

*Responses by Henry Vaux, Jr., Professor Emeritus, University of California, Berkeley;  
Associate Vice President Emeritus, University of California System*

**Questions submitted by Representative Ralph M. Hall**

*Q1. Dr. Vaux, you contend that the problems associated with the current state of federal water research are NOT due to funding, but rather a lack of coordination and strategy. If such coordination and strategies were instituted, could we get the water research information for less than the \$700 million we currently spend?*

A1. Current levels of spending—\$700 million in constant 2000 dollars—is identical to what the Nation spent on water research in the early 1970s. Given that the magnitude of our water problems is much greater now than it was then, it is hard to argue that we should spend less than \$700 million. The point that I was trying to make is that the need for coordination and a strategic approach is greater than the need for additional dollars. Elsewhere in my testimony I suggested that perhaps an additional \$70 million for water research be authorized to provide appropriate incentives for the coordinating and strategic actions that are envisioned in the bill.

*Q2. If the interagency committee authorized in the Act is so similar to the Water Resources Council authorized by the 1965 Act, how do we prevent the same ineffective outcomes and turf battles between agencies as we saw in the Council?*

A2. As I suggested in my testimony, it might make sense to authorize an additional \$70 million in appropriations to support additional research under the coordinating and strategic activities promoted by the bill. This would give the agencies an incentive to improve coordination and strategic planning rather than to continue bickering and turf protecting.

*Q3. You made several suggestions on the section of the legislation that outlines the National Water Availability Research and Assessment Plan Outcomes. Given your suggestions, should these outcomes be determined by the interagency committee instead of being explicitly outlined in the legislation?*

A3. The two additional outcomes identified in my testimony should be included in the legislative language (or as a last resort, in the Committee Report). Research in the social sciences related to water have been neglected for the last two decades. Such neglect is likely to continue in the absence of Congressional prodding. Research on the implications of climate change is simply so important that it needs to be mentioned.

*Q4. Are the four broad themes you list in your testimony the only modern themes appropriate for federal water research? Can traditional research approaches be used in addition to these frameworks? Are there likely to be any more themes identified in the future?*

A4. Traditional approaches can be used but they should explicitly acknowledge and consider modern themes, including the four identified in my testimony. It is possible, of course, that new themes will emerge with time.

**Questions submitted by Representative Bob Inglis**

*Q1. Witnesses in our previous hearing state that the improved horizontal cooperation among federal agencies should also be coupled with vertical coordination at the State, regional and local levels.*

*Q1a. Would you recommend that this vertical integration be a part of the research strategy? Or would you be concerned that this could bog down the effort?*

A1a. Vertical integration should be included and acknowledged. It is clear, however, that the states, regions and localities are unable to support much water research financially. Therefore, they should be included in strategic discussions and research agenda setting activities as stakeholders. Ultimately, the financial decisions should be made by those who pay.

*Q1b. Should the coordination of local and State resources be underway before the federal agency coordination in order to better determine the structure that responds to the needs of the State and local resources?*

A1b. State and local activities are never going to be very well coordinated in the absence of leadership at the federal level. Leadership at the federal level should acknowledge the importance of State and local contributions and incorporate State and local views in strategic research planning.

Q2. *You state in your written testimony that Water Resources Research Institutes are uniquely situated to assist in the National Water Initiative. Do you think that these Institutes should continue under their existing mandate as authorized in the Water Resources Research Act? Or should their role be expanded under this Initiative due to your national reach and State focus?*

A2. The significant potential of the Water Resources Research Institutes has not been realized in nearly three decades. The Institutes are uniquely situated to bring the views and priorities of states, regions and localities to bear on an integrated national initiative to identify a strategic research agenda. The Institutes are also well-situated to bring the considerable research capability of the Nation's universities and colleges to bear on the research itself. I would suggest that the role of the Institutes be expanded to involve them in national agenda setting and in the execution of long-term water research and whatever applied research might be appropriately assigned to the academic community.

I would emphasize that the Institutes have a strong record in education and public communication about water resources. The fact that the Institutes are situated in the U.S. Geologic Survey adds additional strength inasmuch as the Survey as extensive education and communication programs itself in all of the States and trust territories. As one of the two largest water research agencies programmatically and in terms of funding makes the combined education and communication activities of the Institutes and the Geological Survey the strongest available nationally.

#### **Questions submitted by Representative Adrian Smith**

Q1. *Would a top-down research agenda meet the needs of local water demands? Or, would any research agenda need to be an amalgamation of a bottom-up and top-down approach? How would that work?*

A1. The research agenda setting would need to be an amalgamation of both approaches. One way to ensure that such an approach will work is to give states, regions and localities as well as the academic research community places as significant stakeholders in the agenda setting process. All water problems are inherently local or regional so it would be very important to do this.

#### **Questions submitted by Representative Dana Rohrabacher**

Q1. *Dr. Vaux, in your testimony you state that there is virtually no possibility that water supplies in the future can be made to grow. What about technological advancements that allow for previously unusable water to be cleaned up and available for new use? Isn't the purpose of treating ocean water or brackish water to make it available for some future use?*

A1. Virtually all of our water supplies are already allocated as among municipal, industrial, agricultural and environmental uses. This means that there is virtually no surplus that can be allocated to new and growing uses. It means that we need to look to reallocation mechanisms to ensure that new and growing uses can be served. It is true, as you suggest, that wastewater treatment technologies and desalination technologies can make additional supplies available. The former do this by recycling water that has already been allocated and used while the latter truly do bring new water supplies to the scene. The difficulties with ocean water desalination have been detailed in a recent report from the National Research Council. The two most important potential difficulties are the environmental implications of brine water disposal and the fact that the technologies are very expensive in comparison with the costs of most existing supplies. The fact that desalination and wastewater treatment technologies are energy intensive is also cause for concern, given that energy prices are likely to rise in the future.

## ANSWERS TO POST-HEARING QUESTIONS

*Responses by Peter H. Gleick, Co-Founder and President, The Pacific Institute for Studies in Development, Environment, and Security, Oakland, California*

**Questions submitted by Representative Ralph M. Hall**

*Q1. Dr. Gleick, as you may be aware, Dr. Vaux has commented that the problems arising from the current state of federal water research are due to coordination and strategy issues, and that the level of funding is not inadequate. How do you reconcile his position with your statement that the federal priorities have already been outlined and all we need is the funding and the effort to do the research?*

*A1. I believe that the lack of coordination among federal agencies on water research is well documented and I strongly support improving that coordination. I also believe that several very valuable federal assessments have been done on federal priorities, including the SWAQ, GAO, and National Academy studies. This in no way contradicts Dr. Vaux's position, but rather supplements it. Moreover, there is no federal funding, or inadequate federal funding, to support all of the recommendations in these studies, which suggests the need for additional financial support, or at a minimum, a re-allocation among priorities.*

*Q2. Witnesses in our previous hearing states that the improved horizontal cooperation among federal agencies should also be coupled with vertical coordination at the State, regional and local levels.*

*Q2a. Would you recommend that this vertical integration be a part of the research strategy? Or would you be concerned that this could bog down the effort?*

*A2a. I believe this could be a valuable effort, but it must be carefully done to avoid duplication of effort and the appropriate allocation of cost and responsibility to the appropriate agencies.*

*Q2b. Should the coordination of local and State resources be underway before the federal agency coordination in order to better determine the structure that responds to the needs of the State and local resources?*

*A2b. I have no strong opinion about how such coordination would be most effectively accomplished.*

*Q3. Please share any concerns you might have about the advisory board that the legislation includes. Would this serve the purpose you mentioned in your testimony about bringing outside water experts to the table? Why or why not?*

*A3. I would prefer to see outside water experts directly involved, rather than just as an "advisory board." My experience is that such boards are often either never consulted, or ignored.*

*Q4. One of the recommendations in your testimony is that if there is to be a National Water Census it should include comprehensive information on water use. Why do you feel such information is vital? Do you think such information might lead to restrictions on uses of water?*

*A4. This is indeed vital: without good information on how we use water and what we do with it, it is impossible to formulate good water policy. In fact, I believe such information would help reduce the risk that there will be inappropriate "restrictions on water use." The more we know about how we use water, the more likely it is that we will properly prioritize in times of shortage.*

*Q5. With the recent passage of the American Recovery and Reinvestment Act of 2009 along with the Omnibus and the President's budget, do you still fill that new money is necessary for the establishment of a coordinating body for national water research? Do you still believe that agency budgets remain underfunded and therefore agencies will be against diverting funds to a separate interagency committee?*

*A5. The ARRA of 2009 will only help this problem if (a) agencies choose to divert funds committed for other purposes or (b) separate funds are specified by Congress. I do not know whether agencies will divert funds to the purpose of coordinating national water programs.*

**Questions submitted by Representative Bob Inglis**

*Q1. Your testimony calls for any research on the implications of climate change to include “appropriate strategies for adapting to those climate impacts that may be unavoidable.” Is there currently research being done in this area? Which agency would you task with such research and how much funding would you dedicate to such research?*

A1. In a memo I prepared for the Administration’s transition team, I recommended an annual budget of only \$1 million to conduct a comprehensive analysis of climate impact and adaptation, but this must be a regular budget for an ongoing program. Such as assessment could be done, or at least coordinated, by OSTP or CEQ.

*Q2. Dr. Gleick, you mentioned in your testimony that “many of our water problems are local, and must be resolved at the local and regional level.” Back in my home State of South Carolina, the Strom Thurmond Institute is prepared to launch a complete water budget analysis of the Upstate of South Carolina. The goal of their efforts is to create an analysis prediction tool that will assist people like us in understanding the availability of water currently and in the future so that local, regional, and federal officials can make better planning decisions.*

*Q2a. Will H.R. 1145 support these types of regional and local efforts?*

A2a. I do not know; I believe that local assessments should be conducted locally, perhaps with some federal funds to permit diverse local assessments to contribute to a national assessment, such as recommended in the Census provisions of H.R. 1145.

*Q2b. Are there changes we could make to improve the bill in this area?*

A2b. No answer given.

**Questions submitted by Representative Adrian Smith**

*Q1. In your testimony you include several suggestions for improving H.R. 1145 as introduced. You indicate that you do not endorse the idea of a new interagency committee but instead would rather see an expansion of the Subcommittee on Water Quality and Availability, which would include outside agency experts.*

*Q1a. Why do you believe a new committee is unnecessary?*

A1a. I believe SWAQ has excellent representation of diverse federal agencies; their work has been valuable. Why reinvent the wheel, so to speak. The flaw of SWAQ is the lack of outside (non-federal agency) representation.

*Q1b. Which outside water experts would you include and how would you ensure against conflicts of interest?*

A1b. A range of other interests, from research groups, to academics, to business groups, to consumer groups, to environmental groups all have interests in national water challenges. Standard methods are available to prevent conflict of interest.

*Q2. Why do you feel that establishment of a National Water Board is more effective at addressing water issues than the entity proposed in the bill?*

A2. I do not know if it would be more effective. I am arguing, however, that the entity proposed in the bill would not address as broad a set of problem as a National Commission/Board might be.

**Questions submitted by Representative Dana Rohrabacher**

*Q1. In your testimony, you state that we do not need a new committee to lay out the priorities because the priorities have already been established by several other reports.*

*Q1a. Do all the reports share the same opinion about what goals need to be accomplished and how to best achieve those goals? If not, where do they differ and how would you choose which priorities and methods were correct?*

A1a. There has been remarkably unanimity about the major goals that should be tackled. Where there are differences, the Committee can choose how to move forward.

*Q1b. Is the technology readily available to accomplish these goals or will that require additional research?*

*A1b.* I believe our problem is not lack of technology, for the most part. Even with desalination, the National Academy concluded that improvements in environmental protection and economics were more critical to the success of desalination than improvements in technology.

## ANSWERS TO POST-HEARING QUESTIONS

*Responses by F. Mark Modzelewski, Executive Director, Water Innovations Alliance*

**Questions submitted by Representative Ralph M. Hall**

*Q1. You reference in your testimony utilizing the 21st Century Nanotechnology Research and Development Act as a model for interagency coordination and public private collaboration on key water technology issues. Which elements of the Act do you see as particularly useful in addressing key water technology issues?*

A1. The National Nanotechnology Initiative (NNI) and its enabling legislation positioned the United States as the leader in nanotechnology research and development, and kicked off a global nanotechnology race. The NNI has been emulated both within the Federal Government and in foreign countries that wish to compete with the United States. The most useful elements of the bill included the following:

- The establishment of the National Nanotechnology Coordination Office, with a director and full-time staff, to ensure that the NNI ran smoothly;
- The active involvement of the business and academic sectors;
- The focus on translational research and applications (including outreach to start-up companies);
- A broad advisory panel that could provide insightful real-world feedback;
- External review;
- The creation of nanotechnology centers throughout the Nation; and
- Adequate funding.

Finally, although it may seem like a small matter, the symbolism involved in a bill that called for “ensuring United States global leadership in the development and application of nanotechnology” was vital. In addition, a large part of the success of the NNI has been due to dynamic leadership, something that can’t easily be initiated via legislative language.

*Q2. Do you regard the investment made by GE in water R&D and technological development in the same light as your testimony generally states about corporate investment in R&D? Would you consider GE to be a leader, the average, or one of those who don’t “put their money where their mouth is” corporations compared with other companies you are familiar with?*

A2. While I cannot speak definitively about internal GE programs, as an outside observer it appears that GE is indeed spending a great deal on clean-tech research. However, very little of this appears to be for the water category. This is likely due to a few factors. First, GE is new to water. They only developed GE Water within the past decade, and that division of the company is made up of many recently acquired assets. Hence creating a business and culture around these new pieces has clearly been—and should be—“Job One.” I would expect GE’s investment in water innovation to increase significantly over the coming years. Second, the water field as a whole is not very innovative, as was repeatedly noted during the hearing. It is focused on incremental improvements to pipes, pumps, filters and chemicals, rather than large-scale, game-changing innovations. There are individual professors at UT, MIT and elsewhere with more patents than the world’s largest water company, Suez. While there are innovative start-ups, mid-sized firms, and even municipal water departments, out of the large industry players only Siemens has put a premium on developing innovation. Ultimately it would be difficult to point to any company as a great role model for innovation and technology development in the water industry.

*Q3. In your testimony you stress that nearly all research has been focused on little tweaks to make current water processes and technologies marginally cleaner and more energy efficient without exploring game-changing approaches. Could you please provide us with some examples of potential game changing approaches and what elements including funding would permit them to develop into common practice?*

A3. My vocation in life is as an entrepreneur and investor. I spent the past three years looking for a water technology worth developing and investing in at university and government labs across America and across the world for that matter. I can honestly say I was horrified by the utter lack of innovation in this critical field. This finding was a key factor that led a group of us to form the Water Innovations Alliance.

I can say without hesitation that Australia, Israel, and Singapore are attacking water technology at a rate far surpassing the U.S., as are others. The reason is that the U.S. not only lacks research funding at the corporate and government level, but also that to date it has found other ways of addressing any disasters when they happen. Other nations have felt the impact of global water issues sooner. In addition, water research in the U.S. is still done by environmental engineers and materials scientists working independently, rather than as part of cross-disciplinary efforts with biologists, physicists, and others.

That point made, the following are examples of potentially game-changing innovation:

**Forward Osmosis:** FO is an osmotic process that, like reverse osmosis, uses a semi-permeable membrane to effect separation of water from dissolved solutes. The driving force for this separation is an osmotic pressure gradient, such that a “draw” solution of high concentration (relative to that of the feed solution), is used to induce a net flow of water through the membrane into the draw solution, thus effectively separating the feed water from its solutes. In contrast, the reverse osmosis process uses hydraulic pressure as the driving force for separation, which serves to counteract the osmotic pressure gradient that would otherwise favor water flux from the permeate to the feed. The creation of hydraulic pressure for RO requires a lot of energy and accounts for about 50 percent of the cost of RO desalination.

**RNAi Water Purification:** Disclosure, I am assisting the researcher of this technology in her efforts to further develop and commercialize it some day. Dr. Claudia Gunsch at Duke University is truly one of our nation’s brightest young researchers. She has little experience setting up a company and getting funding or executives in place so I am working with her to make this happen as I find her discovery to be nothing short of extraordinary. What Dr. Gunsch has done is use RNAi, a biotech technique that won the Nobel Prize a few years back, to silence the genes in bacteria, viruses and algae in water. What she has effectively done is create a “green” biocide—no chemicals or extensive energy usage.

The issue with both of these innovative technologies is difficulty getting funding to advance them from lab to marketplace. For instance, the RNAi research falls between the gaps of biotechnology research and environmental engineering. Because grants are awarded through a peer review system of leading specialists, and because neither biotechnologists nor environmental engineers understand the effort enough, the technology has difficulty attracting grant funding. The technology is early, so its difficult to get the private sector (especially in this economy) involved. These factors could in fact doom research in what many people believe to be the most groundbreaking discovery in the field in more than 50 years.

*Q4. Is there any movement in the industry to create common IT standards? Many of these types of standards have, in the past, come from industry collaboration or cooperation; however you suggest that it be coordinated by the government? Does the fact that this effort is not currently being driven by industry suggest that information technology as a tool to monitor and manage is still a nascent concept to those in water management?*

A4. There was been an organizing effort over the past year lead by IBM, SAP, several NGOs and municipal water organizations. It is at a very early stage and the Water Innovations Alliance is taking over managing this effort this quarter.

Unlike many other areas in IT, water is closely tied to government. From quality standards to municipal waste management, to public lands and waterways, government is in charge of the sector. In addition, such oversight cuts across Federal, State and local government regimes as well as different agencies—even foreign treaties come into play.

Because of this, while I would note that the government does not necessarily have the expertise to develop the standards, government needs to be involved front and center. Government also can provide incentives to cooperate, which are needed here—as is the government’s ability to bring people to the table.

It is my recommendation that the federal water initiative group that this legislation develops quickly convenes a working group on water IT and that it bring to the table IT leaders, as well as traditional water industry players, municipalities, NGOs and of course State, federal and government leaders. The group needs to develop a scope, measurable goals and timelines for the creation of a common standards, measures and reporting using existing infrastructure capabilities and lay out a plan for developing out new measurement and monitoring systems and linking them together to essentially create a national water smart grid.

*Q5. The concept of a national “smart water grid” is mentioned in your testimony. Could you be more specific about just what such a “grid” would encompass?*

*A5.* I will note that while many people in the water field agree on the need to create a water IT system for better management, there are many different ideas as to what it means to have a smart grid in place, and my vision is merely one of many. In general, everyone agrees that an enterprise IT system can help to manage the water supply & demand equation (on a local level) because the smart grid sees the whole picture of water availability and water demand—including how it relates to energy (NOTE: approximately 35 percent of a typical municipality’s energy budget is allocated to municipal water use and treatment—and many times more than this in a place like Los Angeles). This implies the need to be able to prioritize and optimize the multiple demands (and even to potentially automate some of the decisions related to demand). It also implies that information about a water system is available, is shared openly and can be analyzed to look for patterns. Once we see patterns, we can use the data to look for similar trends and create some predictive capability, which means potential problems can be anticipated, and maybe even eliminated in some cases.

A smart water grid should have the ability to understand and manage an entire water system. At a micro level it would enable managers to know the quality, usage levels, breaches, and discharges in clean and wastewater running through pipes in a city. At a macro level it would allow for modeling against the weather, or for better energy savings in processing waste water, or how drought in a watershed two states away is affecting river water and what that will ultimately mean for a city’s water quality, use and even energy production.

We already have all the technology in place to create a smart water grid. What we don’t have is a common standard of evaluation or reporting. Nor do we have the data-collecting nodes in all the places we need them to feed data into systems (EX: a sensor system through out a municipal system of pipes). Additional research would be needed to do justice to any fiscal estimates.

#### **Questions submitted by Representative Bob Inglis**

*Q1. You suggest that a new generation of water monitoring techniques and technologies be developed to assist with the creation of a National Water Census database. Are you aware of any techniques or technologies being developed in other countries that could be readily adopted in the U.S. to speed up such an assessment?*

*A1.* Singapore, Israel and Switzerland all have superior systems in place when it comes to monitoring, regulating and managing water. None of them has a cohesive smart water grid, but they are moving towards it.

For instance Singapore requires the re-use of wastewater. This obviously is a tricky business where by constant and accurate quality monitoring is needed through a greater system, not just at the plant level. In addition Singapore “imports” water from Malaysia and that effort also requires very specific monitoring to manage cost effectively and ensure treaty compliance and ensure human health. To make this effort more robust and increase management capabilities, Singapore has contracted with MIT for a bold new international research program led by MIT’s Professor Andrew Whittle that involves several dozen researchers from MIT and two Singaporean universities. These researchers are developing pervasive environmental sensor networks to collect data on water quality from many sources, and use these data to provide accurate, real-time monitoring, modeling and control of the environment.

#### **Questions submitted by Representative Adrian Smith**

*Q1. How does the Water Innovations Alliance work with large scale industrial and agricultural users of water? For example, does the Water Innovations Alliance work with energy producers, goods manufacturers, farmers and ranchers to develop water use and efficiency strategies?*

*A1.* The Water Innovations Alliance is a young organization having formed in Q3 2008. We are continuing to refine our mission all the time in order to bring real change and innovation to the water sector via education, creative partnerships, information gathering, working to reduce regulatory barriers to innovation, increasing collaboration and raising awareness for cutting-edge water technologies and the problems they solve.

The Alliance serves the entire spectrum of the water sector: corporations, investors, engineering firms, start-ups, NGOs, research centers, municipalities, and others in the field. Our first big initiatives are pushing awareness around the importance of water IT, ensuring that research efforts increase around energy efficient desalination, and gathering data on where cutting edge water research is being done, by whom and linking it to where it is most needed.

We are looking to tie together working groups and consortiums around these issues that will indeed bring together all key stakeholders from industrial and agriculture interests, to technology providers, investors, NGOs and government as well as users.

### Questions submitted by Representative Dana Rohrabacher

*Q1. How would the research centers you advocate in your testimony differ from the Water Resources Research Institutes that exist in every state and territories? Would the work be so different that we couldn't just use the current institutional infrastructure to conduct this research? Why should NSF be the agency in charge of these centers as opposed to another agency?*

*A1.* The Water Resources Research Institutes program has been a fine program. The issue is they tackle a narrow set of tasks much to the mission of USGS, such as the environmental monitoring of rivers, streams and coastal systems. These Centers have not been places for developing technologies for consumer, municipal, agricultural and industrial systems—the engineering and management issues if you will. For instance they don't work on water filtration systems, the membranes, the engineering, or the energy usage methods. For those efforts you have just a few water technology research centers, such as UC-Irvine, UCLA, CO School of Mines, and the NSF center at U. IL. These technology centers are frankly not very well funded when compared to other scientific research efforts—especially given the stakes and the impact. The NSF Center, in addition, will be sunsetting in just a couple of years.

*Q2. I am intrigued by your concept of a National Water Pilot Testing Facility.*

*Q2a. Do you believe a facility like this would have encouraged faster adoption of water technologies than was achieved through local ordinances?*

*Q2b. Could you provide the Committee with examples of the regulatory barriers that hinder innovation and testing of new solutions for the water industry?*

*A2a,b.* Yes, mainly because there are so many overlapping jurisdictions in water. For example, San Francisco Bay has water regulations from all the towns on the Bay, those affected by its waters, a dozen federal and State agencies, and special water districts, not to mention issues where activists involve the courts. Any attempt to try a new purification system technology in say Oakland would lead to years (a decade is a reasonable estimate) of paperwork and untold costs with no budget to speak of to tackle these burdens. It puts systems in a position to always use old ways that are “good enough.” And is a big reason while a huge number are out of compliance with current federal standards.

Because water has so many human safety impacts, a new technology essentially has to be proven before being tested—a paradox that nearly eradicates the ability to try any game-changing technologies. Instead, municipalities and the companies they contract with make only minor tweaks or face the impossible task of getting permission to try the new innovation.

A pilot facility would allow for the testing of drinking and wastewater systems that used new methodologies as well as ones that allowed for energy savings. It would also allow for simulation of multiple conditions and factors so as to ensure human health and compliance with federal and State/local regulations.

In addition, if managed properly, such a facility could indeed become self-sustaining financially by charging reasonable fees to corporate users.

*Q2c. Could you provide the Committee with examples of the regulatory barriers that hinder innovation and testing of new solutions for the water industry?*

*A2c.* It is not a case of a single regulation as much as the number of regulatory bodies and the different standards for evaluation, reporting, compliance and permitting procedures that each jurisdiction requires. Some jurisdictions have rules for stormwater, septic tanks, nutrients, fertilizer, pet waste, and so on. Others do not. So it's the bureaucracy more than this regulatory verbiage versus the next one.

## ANSWERS TO POST-HEARING QUESTIONS

*Responses by Nancy K. Stoner, Co-Director, Water Program, Natural Resources Defense Council (NRDC)*

**Questions submitted by Representative Ralph M. Hall**

*Q1. Ms. Stoner, you mention in your testimony that many of the negative changes to our water are a result of ill-conceived agricultural, land development, and energy practices. Is the move towards biofuels contributing to these negative impacts to water?*

*A1.* In part to help combat dangerous global warming, policy-makers in recent years have become more interested in increasing the degree to which U.S. consumers rely upon renewable fuels for their motor vehicles. However, policies that simply encourage the use of more biofuels such as ethanol from corn could result in an increase in the size of the dead zone, because corn cultivation typically involves larger amounts of fertilizer than other crops. Experts expect rapid growth in grain-based ethanol production in the coming years; this potentially will have major implications for the dead zone, unless there is a significantly greater focus on conservation practices in agriculture in general and the performance of biofuels production specifically.

Corn prices have increased dramatically, driven by energy prices, growing international demand, and increasing demand for ethanol. Not surprisingly, as prices have gone up, so has the number of acres in corn production: "Corn acreage in the United States rose to nearly 93 million acres in 2007 (a 17 percent increase), a level not seen since 1944." According to the Renewable Fuels Association, the trade group for the ethanol industry, "ethanol soared to 6.5 billion gallons in 2007, a 32 percent increase from the 4.9 billion gallons produced in 2006." Looking forward, the Association estimates that the industry's production capacity will rise from 7.8 billion gallons in 2007 to 13 billion gallons once the biorefineries currently being constructed or expanded come online. The vast majority of this new ethanol production is likely to come from corn.

Legislation also drives increased corn ethanol production. The Energy Independence and Security Act of 2007 will greatly expand biofuels production; it sets a target of at least 36 billion gallons of biofuels per year by 2022. Although the law states that a minimum of 21 billion gallons must be "advanced" (derived from plants' cellulosic material rather than corn grain, for instance), it still leaves room for at least 15 billion gallons of corn-based ethanol that year. This law does include important minimum global warming pollution standards and land use safeguards, but it does not explicitly require better fertilizer management or overall water quality or quantity performance improvements.

Last October the National Research Council issued a report titled "*Water Implications of Biofuels Production in the United States*." This review makes it clear that, without additional safeguards, increased biofuels production can be expected to increase water pollution from agriculture and intensify many regional and local water shortages. It reaffirms that "[e]xpansion of ethanol production . . . will drive increased corn production until marketable future alternatives are developed." The report even addressed the particular concern of the dead zone:

All else being equal, the conversion of other crops or non-crop plants to corn will likely lead to much higher application rates of nitrogen. Given the correlation of nitrogen application rates to stream concentrations of total nitrogen, and of the latter to the increase in hypoxia in the Nation's water bodies, the potential for additional corn-based ethanol production to increase the extent of these hypoxic regions is considerable.

A recent scientific review reached a similar conclusion. To roughly estimate the scale of increased nutrient loading associated with ethanol production, the EPA Science Advisory Board used predicted corn acreage increases in the next several years and estimated that the cultivation of the corn could lead to the increased runoff of 238 million pounds of nitrogen per year in the Mississippi River Basin.

These outcomes are not inevitable. Addressing water pollution and consumption should be integrated into policies and programs that promote biofuels production, such as tax credits and other incentives. In particular, management practices that help reduce nutrient pollution should be part of a suite of minimum standards applicable to energy crop producers. (For NRDC's roadmap to responsible biofuels production, see *Getting Biofuels Right: Eight Steps for Reaping Real Environmental Benefits From Biofuels*, available online at [www.nrdc.org/air/transportation/](http://www.nrdc.org/air/transportation/)

*biofuels/right.pdf*.) More generally, as pressure builds on farmers and foresters to increase output and cut costs, farm bill programs to promote soil, water, and wildlife conservation need to grow dramatically larger and more effective.

Q2. *Ms. Stoner, in your testimony, you suggest that EPA should be appropriated \$100 million at a minimum to stimulate both R&D and demonstration projects and that another \$100 million be appropriated to be split among the Departments of Agriculture, Commerce, Defense, Energy, HHS, HUD, Interior and Transportation for innovative water management research.*

- a. *Why do you believe that this funding approach will assist the U.S. in tackling its many water problems?*
- b. *Do you believe that EPA is the most qualified to conduct R&D and demonstration projects?*
- c. *How does this compare with other issues in which EPA participates in a multi-agency research effort?*

A2. My recommendation is that EPA should be funded to do R&D and demonstration projects for water, stormwater, and wastewater infrastructure, including the integration of these types of infrastructure, because EPA has ultimate authority for those systems under the *Clean Water Act* and would best be able to integrate the results of such demonstration projects into existing programs. There is a tremendous need for innovation in water-related services delivery. Most treatment technologies current in use in the U.S. were developed in the early 20th century and are no longer adequate for today's population or for the stressors affecting water resources today, including climate change. The systems themselves are also based on antiquated once-through treatment notions and are inconsistent with current thinking about maintaining and restoring hydrology. There should be funding for other agencies' research as well, however, to focus on the particular ways in which the activities they regulate affect and are affected by water resources. I know that EPA participates in other multi-agency research efforts, but am not familiar with the structure of those efforts myself.

Q3. *Your testimony did not include a separate recommendation for funding for USGS to conduct the two main water-quality monitoring programs it is responsible for. What would be an appropriate funding level for those programs?*

A3. The most recent information I have been able to find suggests a need for a \$70 million budget for NAWQA and a \$30 million budget for the USGS toxics program. The \$70 million is essential to restore long-term trend monitoring at river and stream sites. A letter that NRDC recently sent to Congress on the NAWQA budget is attached. This is one of the most important projects of NAWQA since most monitoring is not long-term and is not systematic enough to provide trend data. Similarly, \$30 million are needed for the Toxics program to regain the strength that it reached in the 1990s. The program investigates emerging issues and develops the methods and protocols for sampling and analysis for chemicals as they come into use. The program is essential to developing the data to investigate new issues and problems that are uncovered. I urge you to provide sufficient funding that NAWQA can continue both surface and groundwater trend data for as many monitoring stations as it has.

Q4. *You mention intense rain events not being of help but rather delivering too much water at once. How can we adapt and manage intense rain events so as to capture the water for a beneficial purpose? What technologies and tools could be developed to farther such a goal?*

A4. I recently testified in House Transportation and Infrastructure's Subcommittee on Water Resources and Environment concerning "Efforts to Address Urban Stormwater Runoff." I have attached excerpts from my testimony, which provide a detailed response to your question about strategies for managing rainfall.

### **Background**

Many communities, ranging from highly developed cities to newly developing towns, are looking for ways to assure that their rivers, streams, lakes, and estuaries are protected from the impacts of urbanization and climate change. Traditional development practices cover large areas of the ground with impervious surfaces such as roads, driveways, and buildings. Once such development occurs, rainwater cannot infiltrate into the ground, but rather runs off site at levels that are much higher than would naturally occur. The collective force of all such rainwater scours streams, erodes stream banks, and causes large quantities of sediment and other pollutants to enter the waterbody each time it rains.

The last few decades of wet weather management have resulted in the current convention of control and treatment, strategies that are largely hard infrastructure engineered, end-of-pipe, and site-focused practices concerned primarily with peak flow rate and suspended solids concentrations and other pollutant control. Conventional practices, however, fail to address the widespread and cumulative hydrologic modifications within the watershed, including increased stormwater volumes and runoff rates, excessive erosion and stream channel degradation, and decreased groundwater recharge.

While this approach works to drain each site, continued expansion of dispersed, low-density developments over the past years means that too much water, carrying too much pollution, is flowing into waterways. The results are poor water quality, especially at drain outlets, and a dramatic drop in the refill rate of aquifers and streams. The 20 regions in the country that developed the most land over the period 1982 to 1997 now lose between 300 and 690 billion gallons of water annually that would otherwise have filtered through the Earth and been captured as groundwater.<sup>1</sup>

In addition to the problems caused by stormwater and non-point source runoff, many older cities (including many of the largest cities in the United States), have combined sewage and stormwater pipes which periodically and in some cases frequently overflow due to precipitation events. In the late 20th century, most cities that attempted to reduce sewer overflows did so by separating combined sewers, expanding treatment capacity or storage within the sewer system, or by replacing broken or decaying pipes. However, these traditional practices can be enormously expensive and take decades to implement. Moreover, piped stormwater and combined sewer overflows (“CSOs”) may also in some cases have the adverse effects of upsetting the hydrological balance by moving water out of the watershed, thus bypassing local streams and groundwater. Many of these events also have adverse impacts and costs on source water for municipal drinking water utilities.

Climate change is already stressing aquatic ecosystems, infrastructure, and water supplies. While impacts vary regionally, in much of the U.S., more frequent heavy rainfall events overload the capacity of sewer systems and water and wastewater treatment plants, as well as result in more stormwater runoff, exacerbating water pollution from sediments, nutrients, pathogens, pesticides, and other pollutants. In addition, decreased summer precipitation and other changes to the volume and timing of flows reduce stored water in reservoirs and reduce groundwater levels. Sea-level rise will adversely affect groundwater by causing an increase in the intrusion of salt water into coastal aquifers. All of these impacts will make less freshwater available for human use.

To ameliorate these problems, a set of techniques, approaches and practices can be used to eliminate or reduce the amount of water and pollutants that run off a site and ultimately are discharged into adjacent waterbodies. We refer to these collectively as “green infrastructure.” As cities move towards sustainable infrastructure, green infrastructure can be a valuable approach.

“Green infrastructure” is a relatively new and flexible term, and it has been used differently in different contexts. Thus, to date, there is no universally established definition of the term. For example, some writers have defined it broadly as “an interconnected system of natural areas and other open spaces that conserves natural ecosystem values and functions, sustains clean air and water, and provides a wide array of benefits to people and wildlife.”<sup>2</sup> The Green Infrastructure Statement of Intent signed by U.S. EPA, NRDC, the Low Impact Development Center, the National Association of Clean Water Agencies (NACWA) and the Association of State and Interstate Water Pollution Control Administrators (ASWIPCA) uses the term “green infrastructure” to generally refer to systems and practices that use or mimic natural processes to infiltrate, evapotranspire (the return of water to the atmosphere either through evaporation or by plants), or re-use stormwater or runoff on the site where it is generated.<sup>3</sup>

### What Is Green Infrastructure?

Green infrastructure involves management approaches and technologies that utilize, enhance and/or mimic the natural hydrologic cycle processes of infiltration, evapotranspiration and re-use. Green infrastructure is the use of soil, trees, vegetation, and wetlands and open space (either preserved or created) in urban areas to capture rain while enhancing wastewater and stormwater treatment. Green infra-

<sup>1</sup>American Rivers, NRDC, and Smart Growth America, *Paving Our Way to Water Shortages: How Sprawl Aggravates The Effects of Drought* (Smart Growth America: 2002).

<sup>2</sup>Benedict and McMahon, *Green Infrastructure* (2006).

<sup>3</sup><http://cfpub.epa.gov/npdes/greeninfrastructure/gisupport.cfm>

structure approaches currently in use include green roofs, trees and tree boxes, rain gardens, vegetated swales, pocket wetlands, infiltration planters, porous and permeable pavements, vegetated median strips, reforestation/revegetation, and protection and enhancement of riparian buffers and floodplains. Green infrastructure can be used almost anywhere soil and vegetation can be harnessed or worked into the urban or suburban landscape. Green infrastructure also includes decentralized rainwater harvesting approaches, such as the use of rain barrels and cisterns to capture and re-use rainfall for watering plants or flushing toilets. These approaches can be used to keep rainwater out of the sewer system so that it does not contribute to a sewer overflow and also to reduce the amount of untreated runoff discharging to surface waters. Green infrastructure also allows stormwater to be absorbed and cleansed by soil and vegetation and either re-used or allowed to flow back into groundwater or surface water resources.

#### **Green Infrastructure Benefits<sup>4</sup>**

Green infrastructure has a number of environmental and economic benefits in addition to reducing sewer overflows and stormwater discharges, including:

- *Cleaner Water*—Vegetation, green space and water re-use reduce the volumes of stormwater runoff and, in combined systems, the volume of combined sewer overflows, as well as reduce concentrations of pollutants in those discharges.
- *Enhanced Water Supplies*—Most green infiltration approaches involve allowing stormwater to percolate through the soil where it recharges the groundwater and the base flow for streams, thus ensuring adequate water supplies for humans and more stable aquatic ecosystems. In addition, capturing and using stormwater conserves water supplies.
- *Reduced flooding*—Green infrastructure both controls surface flooding and stabilizes the hydrology so that peak stream flows are reduced.
- *Cleaner Air*—Trees and vegetation improve air quality by filtering many airborne pollutants and can help reduce the amount of respiratory illness. Green infrastructure approaches that facilitate shorter commute distances and the ability to walk to destinations also reduce vehicle emissions.
- *Reduced Urban Temperatures*—Summer city temperatures can average 10°F higher than nearby suburban temperatures. High temperatures are also linked to higher ground level ozone concentrations. Vegetation creates shade, reduces the amount of heat absorbing materials and emits water vapor—all of which cool hot air. Limiting impervious surface, using light colored impervious surfaces (e.g., porous concrete), and vegetating roofs also mitigate urban temperatures.
- *Moderated Impacts of Climate Change*—Climate change impacts and effects vary regionally, but green infrastructure techniques provide adaptation benefits for a wide array of circumstances, by conserving and re-using water, promoting groundwater recharge, reducing surface water discharges that could contribute to flooding. In addition, there are mitigation benefits such as reduced energy demands and carbon sequestration by vegetation.
- *Increased Energy Efficiency*—Green space helps lower ambient temperatures and, when incorporated on and around buildings, helps shade and insulate buildings from wide temperature swings, decreasing the energy needed for heating and cooling. Also energy use associated with pumping and treating is reduced as stormwater is diverted from wastewater collection, conveyance and treatment systems. Energy efficiency not only reduces costs, but also reduces generation of greenhouse gases.
- *Source Water Protection*—Green infrastructure practices provide pollutant removal benefits, thereby providing some protection for both ground water and surface water sources of drinking water. In addition, green infrastructure provides groundwater recharge benefits by putting stormwater back into the ground and enhances surface water quality by redirecting the high volume and velocity flows that scour streams and muddy drinking water sources.
- *Wildlife Habitat*—Stream buffers, wetlands, parks, meadows, green roofs, and rain gardens increase biodiversity within the urban environment.
- *Community Benefits*—Trees and plants improve urban aesthetics and community livability by providing recreational and wildlife areas. Studies show that

<sup>4</sup><http://www.nrdc.org/water/pollution/rooftops/contents.asp>

property values are higher, homes, sell faster, and crime is reduced when trees and other vegetation are present.

- *Health Benefits*—Studies show that people who have access to green infrastructure in their communities get more exercise, live longer, and report better health in general. Exposure to green infrastructure (even through a window) improves mental functioning, reduces stress, and reduces recovery time from surgery.
- *Green Jobs*—Designing, installing, and maintaining green infrastructure creates new jobs for architects, designers, engineers, construction workers, maintenance workers, plumbers, landscapers, nurseries, etc.
- *Cost Savings*—Green infrastructure saves capital costs associated with paving, curb and gutter, building large collection and conveyance systems, and digging big tunnels and centralized stormwater ponds; operations and maintenance expenses for treatment plants, pumping stations, pipes, and other hard infrastructure; energy costs for pumping water around; cost of treatment during wet weather; and costs of repairing the damage caused by stormwater, such as streambank restoration.

In terms of the technologies and tools that need to be developed, there are several very important areas for federal investment in my view. First, I'd suggest funding watershed, sub-watershed, or sewershed level investment in green infrastructure with monitoring to evaluate results. Most of the performance data is at the site level, not aggregated at the watershed or sewershed level. There are models available to predict results in an aggregated fashion, but those models need both refinement and validation with actual monitoring results. Second, we need investment in alternative ways to use water. All water is valuable. None of it is really "wastewater," as it has been called in the past, but waters of differing qualities are needed for different uses. More research is needed into the alternative methods of delivering water for beneficial use/re-use, and the associated risks and environmental and economic benefits (hydrology, cost savings, energy, greenhouse gas emissions, etc.) that can be achieved.

#### Questions by Representative Bob Inglis

*Q1. Based on our experiences in the last 10 years or so, there is a growing concern about the effectiveness of interagency collaborative efforts. Although some have been successful situations such as the one we have been witnessing in the multi-agency satellite programs with NOAA, Air Force and NASA had made us a little wary of such endeavors. Does the NRDC have any recommendations that would help us strengthen this legislation such that the National Water Research initiative does not devolve into another turf war?*

*A1.* Legislating culture is very difficult as your question suggests. I would urge you to consider structures that enable agencies to advocate for good research topics and specific projects irrespective of whether they are housed in that agency. My understanding is that DOD and the VA have a Joint Incentive Fund that follows this approach. Each agency contributes a specified amount of funding to the joint fund each year, then a committee consisting of members of both agencies select the projects to be funded. While nothing is perfect, a similar structure would be beneficial in providing agency representatives with incentives to think big picture about what research is really needed. Another possibility would be to have a standing Federal Advisory Committee to provide recommendations to the Federal Government about research needs.

*Q2. Do you believe that the Office of Science and Technology Policy is best suited to lead this interagency effort or would another agency, such as EPA, be better situated based on their past work in water research?*

*A2.* It is preferable to have the White House chair an interagency effort such as this one to provide oversight and management. Either CEQ or OST could provide such oversight, and I am not sure which would be better in this instance.

## ANSWERS TO POST-HEARING QUESTIONS

*Responses by Christine Furstoss, General Manager of Technology, GE Water and Process Technologies, General Electric Company*

**Questions submitted by Representative Ralph M. Hall**

*Q1. Ms. Furstoss, we have heard in previous hearings that water-related R&D can lead to new opportunities for U.S. companies instead of foreign ones.*

*Q1a. Would you regard this as an accurate statement?*

*A1a. Yes.*

*Q1b. Would foreign companies' access to U.S. research through databases such as RADIUS negate this advantage?*

*A1b.* My personal opinion is that there can be many levels of databases. While a community of global innovators should have access to fundamental information to promote sharing and collaboration, access to databases containing detailed information on U.S. research and development priorities and results does have the potential to reduce domestic competitiveness. By knowing specifics behind what is being worked, and, very importantly, what areas may not be competitive and/or what major issues are in approaches, then an open database containing that information would allow any company to know where they can focus and who the major players are.

*Q1c. Do you gain new opportunities by research conducted in other countries, such as Israel?*

*A1c.* GE believes, that when appropriate, partnering with organizations that are leaders in technology is beneficial to both sides. When countries, either through initiatives, incentives, or priorities, encourages research of its companies, research institutes and universities to be focused in a particular area, then it is natural that the likelihood of increased innovation and breakthrough technology is increased. We have seen such an example in Israel, where many small companies have made large strides in thinking about water treatment and re-use in new ways. Interactions with such companies have been beneficial, not only from a potential partnership opportunity, but also in making us think differently about approaches.

*Q1d. In GE's experience, how would you define the efforts of other industrialized countries in the area of water research?*

*A1d.* In my experience and knowledge, efforts of other industrialized countries in water research is by-and-large in its infancy relative to other technical fields. While some countries such as Singapore, Israel, western Canada and various entities across the Middle East have made water research a priority, others are still looking to universities, research organizations and private industry to lead the charge. I have not encountered any entities that have discouraged this area of research; it is more a matter of priority and focus to drive rapid advancement. That is why I am encouraged by this bill, and the discussion of including multiple types of organizations to participate as part of it. In that way, a community with shared goals and priorities, as well as increased sharing and speed of discovery will emerge.

*Q1e. Does GE participate in collaborative efforts with either foreign companies or other governments in order to develop the appropriate or necessary water research? How about for development of technologies?*

*A1e.* GE has participated in efforts ranging from advisory discussions on broad councils sponsored by governments, to partnering with government agencies and country university systems on water treatment research and technology development. GE Water is also working with several large multinational companies to help address water issues and reduce their water footprint; one example is GE's relationship with ConocoPhillips in developing a Water Sustainability Center in Doha, Qatar. Similarly, we have relationships with major corporate multi-nationals in the food processing area, and large power companies where we are working to reduce their water consumption and help re-use their waste water.

*Q2. How would you address the assertion by Mr. Modzelewski that corporate R&D investment is low despite the importance of water to life?*

*A2.* I would agree with that statement, but have been encouraged over the past year in the attention being paid in this area. There are many small companies and

start-up companies that have good ideas to help reduce the cost of water treatment, and treat more water problems.

*Q3. The legislation before us today calls for an establishment of an interagency committee as well as an advisory board to such committee to work on water resource issues including technology and research. What role would you envision for the private sector in working with these entities? How would an Interagency Committee use the knowledge and expertise residing in American industry groups and non-governmental organizations?*

A3. These groups should be smaller and focused on the task at-hand. If the panels become too large, they can have difficulty rapidly developing and deploying technology. Industry focuses on the “voice of the customer” every day, understanding how to bring technology to the market effectively and efficiently.

*Q4. The legislation includes an advisory board for the interagency committee on water resources. Who would you recommend be included on such a board?*

A4. In addition to government officials, industry groups and academia, I would recommend a Chief Technology Officer from industry, as well as industry representatives who are used to rapidly developing and deploying technology.

*Q5. There has been a great deal of discussion in the past few years regarding effects of climate change on water supplies. Is GE exploring any adaptation strategies to address these effects?*

A5. GE is investing in technologies that will assist in water-stressed areas, such as brackish water treatment/desalination and advanced technologies to enable significant increases in water re-use and recycling.

*Q6. What improvements could be made to this legislation to ensure it results in the research and development necessary for technology development? What areas of water R&D are most in need of further attention that would allow industry to develop new types of technologies? Are there any technology pathways right now that are closed off due to the lack of basic R&D?*

A6. In my opinion, there are several companies with good viable products that can help reduce the cost of water treatment. These companies can make impact on energy costs, operational costs, and capital costs. The risk and cost to bring a technology from lab to industrial application can be very prohibitive. I feel that government support or center(s) that focused on scale-up of technologies and field testing with representative water chemistries, flows and variability would greatly enhance the state of the industry development. While difficult to single out any one technology area most in need or closed off, the difficulty in taking innovations from lab to application is currently a bottleneck in fast-tracking the application of novel technologies.

*Q7. Has GE done any comprehensive mapping of available water resources in the U.S. or other countries?*

A7. GE has contributed to, and utilized, water availability and quality maps that have been produced and published by global research and consulting entities. We have not done exhaustive mapping on our own.

#### **Questions submitted by Representative Adrian Smith**

*Q1. How much interaction does GE have with local and regional managers and decision-makers? Has this type of interaction driven technology development to address particular concerns?*

A1. I believe that we have a great deal of interaction; we have been working with local and regional decision-makers at the State level on a state-by-state basis, as well as regional water authorities. GE believes that this type of engagement is essential to understanding the types of challenges that communities are facing across the Nation. GE is also open to working with communities to collaboratively develop solutions that meet both their treatment and cost needs. Collaborations that we have with entities such as New Mexico State University, which is intimately tied to many decision-makers, are key to both our understanding of not only the needs, but how communities need to make decisions (their drivers, priorities, and critically, their “boundaries”—what they can and can’t do and afford). This greatly helps us prioritize and more fully understand technology needs.

**Questions submitted by Representative Dana Rohrabacher**

*Q1. In your testimony, you indicate that GE scientists and researchers have been at the forefront of developing many new technologies in the areas of water conservation and use as well as a number of other areas. What incentives exist for GE to continue to explore these areas? Are there any additional incentives you believe would encourage companies to explore these areas?*

A1. As regulations on water quality, discharge and re-use emerge, GE feels that being able to provide a portfolio of solutions for customers to choose from to meet their complex needs is a sound strategy. To my knowledge, there are no direct incentives directly related to technology investment. There are multiple funding agencies with water programs, and GE is participating in a few of them. These programs greatly help us accelerate our activities, as well as explore more approaches and areas. Going forward, in my opinion, having a more unified set of priorities across agencies with larger programs available for participation, will allow more companies to participate, or participate at an enhanced level, for they will understand how these activities fit into policy and future directions. I also personally feel that having more focus on industry standards on measurements for regulatory requirements on water quality is a wise investment—many contaminants and discharge limits can be measured in a variety of ways (or not measured reliably today). Clarity in this area will help all.

*Q2. GE is a global company and as such must be aware of global trends in research and development. Which countries do you believe are ahead of the US in this area? What steps have these countries taken to improve water quality or be more efficient in their use of water? Can any of these strategies be adapted for use in the United States?*

A2. I feel that Israel has encouraged companies to invest in water technologies, and that has led to some unique innovation. Singapore encourages water research to be conducted there, and initiatives to develop fundamental technologies to reduce energy consumption in water treatment and also reduce the cost of water treatment. Various entities in the Middle East are encouraging companies to work with them on systems and pilots that are novel in their approach to working with impaired waters. Finally, the Alberta government, due to their water challenges, is sponsoring joint industry-university-agency research that includes pilot testing. These entities have clearly identified their priorities and participated in forming relationships to help drive technology in focused areas. I personally feel that a prioritized agenda that all parties can work toward, as well as support of scale-up/piloting facilities would be beneficial for the water community.

## Appendix 2:

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ADDITIONAL MATERIAL FOR THE RECORD



111TH CONGRESS  
1ST SESSION

# H. R. 1145

To implement a National Water Research and Development Initiative, and  
for other purposes.

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IN THE HOUSE OF REPRESENTATIVES

FEBRUARY 24, 2009

Mr. GORDON of Tennessee introduced the following bill; which was referred  
to the Committee on Science and Technology

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## A BILL

To implement a National Water Research and Development  
Initiative, and for other purposes.

1 *Be it enacted by the Senate and House of Representa-*  
2 *tives of the United States of America in Congress assembled,*

3 **SECTION 1. SHORT TITLE.**

4 This Act may be cited as the “National Water Re-  
5 search and Development Initiative Act of 2009”.

6 **SEC. 2. NATIONAL WATER RESEARCH AND DEVELOPMENT**  
7 **INITIATIVE.**

8 (a) INITIATIVE AND PURPOSE.—The President shall  
9 implement a National Water Research and Development  
10 Initiative (in this Act referred to as the “Initiative”). The

1 purpose of the Initiative is to improve the Federal Govern-  
2 ment's role in designing and implementing Federal water  
3 research, development, demonstration, data collection and  
4 dissemination, education, and technology transfer activi-  
5 ties to address changes in water use, supply, and demand  
6 in the United States, including providing additional sup-  
7 port to increase water supply through greater efficiency  
8 and conservation.

9 (b) INTERAGENCY COMMITTEE.—

10 (1) IN GENERAL.—Not later than 3 months  
11 after the date of enactment of this Act, the Presi-  
12 dent shall establish, or designate, an interagency  
13 committee to implement the Initiative under sub-  
14 section (a). The Office of Science and Technology  
15 Policy shall chair the interagency committee.

16 (2) COMPOSITION.—The interagency committee  
17 shall include a representative from each agency that  
18 conducts research related to water or has authority  
19 over resources that affect water supply, as well as a  
20 representative from the Office of Management and  
21 Budget.

22 (3) FUNCTIONS OF THE INTERAGENCY COM-  
23 MITTEE.—The interagency committee shall—

1 (A) develop a National Water Research  
2 and Assessment Plan (in this Act referred to as  
3 the “plan”) in accordance with subsection (c);

4 (B) coordinate all Federal research, devel-  
5 opment, demonstration, data collection and dis-  
6 semination, education, and technology transfer  
7 activities pertaining to water;

8 (C) encourage cooperation among Federal  
9 agencies with respect to water-related research,  
10 development, and technological innovation ac-  
11 tivities to avoid duplication of effort and to en-  
12 sure optimal use of resources and expertise; and

13 (D) facilitate technology transfer, commu-  
14 nication, and opportunities for information ex-  
15 change with non-governmental organizations,  
16 State and local governments, industry, and  
17 other members of the stakeholder community  
18 through the office established in paragraph (4).

19 (4) NATIONAL WATER INITIATIVE COORDINA-  
20 TION OFFICE.—

21 (A) IN GENERAL.—Not later than 3  
22 months after the date of enactment of this Act,  
23 the President shall establish a National Water  
24 Initiative Coordination Office (in this Act re-

1 referred to as the "Office"), with full-time staff.  
2 to—

3 (i) provide technical and administra-  
4 tive support to the interagency committee;

5 (ii) serve as a point of contact on  
6 Federal water activities for government  
7 agencies, organizations, academia, indus-  
8 try, professional societies, and others to ex-  
9 change technical and programmatic infor-  
10 mation; and

11 (iii) communicate with the public on  
12 the findings and recommendations of the  
13 interagency committee based on the activi-  
14 ties conducted pursuant to the Initiative.

15 (B) FUNDING.—The operation of the Of-  
16 fice shall be supported by funds contributed  
17 from each agency represented on the inter-  
18 agency committee.

19 (c) NATIONAL WATER RESEARCH AND ASSESSMENT

20 PLAN.—

21 (1) PLAN DEVELOPMENT.—The plan required  
22 under subsection (b)(3)(A) shall establish the prior-  
23 ities for Federal water research, including federally  
24 funded research, and assessment for the 4-year pe-  
25 riod beginning in the year in which the plan is sub-

1       mitted to Congress. In the development of the plan,  
2       the Committee shall consider and utilize rec-  
3       ommendations and information in reports that have  
4       addressed water research needs, including the 2007  
5       report issued by the Subcommittee on Water Avail-  
6       ability and Quality (SWAQ) of the National Science  
7       and Technology Council's Committee on Environ-  
8       ment and Natural Resources and recommendations  
9       of the National Academy of Sciences.

10       (2) SPECIFIC REQUIREMENTS.—The plan  
11       shall—

12               (A) identify each current program and ac-  
13               tivity of each Federal agency related to the Ini-  
14               tiative;

15               (B) identify funding levels for the previous  
16               fiscal year for each program and, if applicable,  
17               each activity identified in subparagraph (A);

18               (C) set forth a strategy and a timeline to  
19               achieve the outcomes described in subsection  
20               (d) and shall describe—

21                       (i) each activity required of each  
22                       agency responsible for contributing to each  
23                       such outcome;

24                       (ii) the funding levels necessary to  
25                       achieve each such outcome; and

1 (iii) the distribution of funds between  
2 each agency based on such agency's role in  
3 carrying out such activity;

4 (D) be subject to a 90-day public comment  
5 period and shall address suggestions received  
6 and incorporate public input received, as appro-  
7 priate; and

8 (E) be submitted to Congress not later  
9 than 1 year after the date of enactment of this  
10 Act.

11 (d) WATER RESEARCH OUTCOMES.—The plan shall  
12 outline and direct agencies under the interagency com-  
13 mittee to work to achieve the following outcomes:

14 (1) Implementation of a National Water Cen-  
15 sus, which shall include the collection of data on na-  
16 tional water resources to create a comprehensive  
17 database that includes information about the quan-  
18 tity, availability, and quality of ground water and  
19 surface water resources.

20 (2) Development of a new generation of water  
21 monitoring techniques.

22 (3) Development of technologies for enhancing  
23 reliable water supply.

1           (4) Development of innovative technologies and  
2 tools to enhance water-use efficiency and tools to en-  
3 courage public acceptance of such technologies.

4           (5) Development of tools and processes to facili-  
5 tate resolution of conflicts over water resources.

6           (6) Improvement of understanding of water-re-  
7 lated ecosystem services and ecosystem needs for  
8 water.

9           (7) Improvement of hydrologic prediction mod-  
10 els and their applications.

11           (8) Analyses of the energy required to provide  
12 reliable water supplies and the water required to  
13 provide reliable energy supplies throughout the  
14 United States.

15           (e) **ADVISORY COMMITTEE.**—The President shall es-  
16 tablish, or designate, an advisory committee to advise the  
17 interagency committee established under subsection (b).

18 **SEC. 3. BUDGET COORDINATION.**

19           (a) **IN GENERAL.**—The President shall provide guid-  
20 ance to each Federal agency participating in the Initiative  
21 with respect to the preparation of requests for appropria-  
22 tions for activities related to the plan.

23           (b) **CONSIDERATION IN THE PRESIDENT'S BUDG-**  
24 **ET.**—The President shall submit, at the time of the Presi-  
25 dent's annual budget request to Congress, a description

1 of those items in each agency's budget which are elements  
2 of the plan or help to achieve the outcomes of the plan.

3 **SEC. 4. ANNUAL REPORT.**

4 Concurrent with the annual submission of the Presi-  
5 dent's budget to Congress, the President shall submit to  
6 Congress a report that describes the activities and results  
7 of the Initiative during the previous fiscal year and out-  
8 lines the objectives for the next fiscal year. The report  
9 shall include detailed information on all programs and ac-  
10 tivities involved in the Initiative, including an analysis of  
11 progress towards achieving the outcomes listed in section  
12 2(d).

○

SECTION-BY-SECTION ANALYSIS OF  
H.R. 1145, THE NATIONAL WATER RESEARCH AND  
DEVELOPMENT INITIATIVE ACT

**Title:** *National Water Research and Development Initiative Act*

**Purpose:** To improve the Federal Government's role in water research, development, demonstration, data collection, education, and technology transfer activities to address changes in water use, supply, and demand in the United States.

**Section 1: Short Title**

The National Water Research and Development Initiative Act of 2009

**Section 2: National Water Research and Development Initiative**

Section 2 directs the President to implement a National Water Research and Development Initiative to improve federal activities on water, including: research, development, demonstration, data collection and dissemination, education, and technology transfer. As part of the Initiative, the President shall establish or designate an Interagency Committee with representation from all federal agencies dealing with water and the Office of Management and Budget. The Office of Science and Technology Policy will chair the Committee.

The Committee is charged with developing a National Water Availability Research and Assessment Plan, coordinating all federal activities on water that include research, development, demonstration, data collection and dissemination, education, and technology transfer, and promoting cooperation among agencies with respect to water research. The Committee is also responsible for facilitating technology transfer, communication, and opportunities for exchange with non-governmental organizations.

The President is directed to create a National Water Initiative Coordination Office to provide technical and administrative support to the Committee. The Office will disseminate information to the public and serve as a point of contact for the Initiative.

The National Water Research and Assessment Plan establishes priorities for federal water research and assessment and shall utilize the recommendation from a 2007 Report issued by SWAQ (Subcommittee on Water Availability and Quality of the National Science and Technology Council) and recommendations by the National Academy of Sciences. This section also identifies required elements of the Plan. The Plan lists a number of water research outcomes to be achieved by the agencies participating in the Initiative.

The Plan will be subject to a 90-day public comment period and must be submitted to Congress within one year of enactment.

Section 2 also requires the President to establish or designate an advisory committee including non-governmental experts to provide guidance and recommendations to the interagency committee governing the Initiative.

**Section 3: Budget Coordination**

Section 3 directs the President to provide guidance to each federal agency in the Initiative with respect to the President's annual budget request. The President is required to describe and list the items in the request that are intended to achieve the outcomes of the Plan.

**Section 4: Annual Report**

Section 4 directs the President submit an annual report to Congress describing the activities and results of the Initiative.



## COUNCIL OF SCIENTIFIC SOCIETY PRESIDENTS

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March 3, 2009

House Committee on Science & Technology

**RE: Hearing on 21<sup>st</sup> Century Water Planning: The Importance  
 of a Coordinated Federal Approach**

Chairman Gordon, members of the Committee, we thank you for the opportunity to comment on the subject of the national scale coordination of water planning.

The Council of Scientific Society Presidents (CSSP) represents over 1 million scientists in over 100 research disciplines. CSSP expressed its deep concern on this issue and in 2002 concluded that we must shift our historic paradigm from primarily seeking more water, to primarily managing demand and to ensuring the high quality of our nation's water.

We concluded that we need to shift U.S. water research and policy from managing supply to understanding water cycles and related interactions, conserving supply, and managing demand. To do this we will need to support coordinated frontier research that can enhance water quality, distribution, and efficient use by industries, agriculture, and people, and discover and deploy many new ideas and technologies into widespread use for equitable, sustained support of both people and our land and water ecosystems.

**Many Factors Ensure Enduring Conflict on Water Issues**

Chairman Gordon rightly notes that 20 federal agencies oversee water research policy, ensuring a diversity of perspectives. Added to that are at least a dozen committees and subcommittees of the entire Congress that each separately oversee parts of our national water policy. On top of which, we have a handful of different systems of water rights, developed as we settled the nation from east to west—British Crown rights, Louisiana Purchase culture, Industrial priority, cropland priority, livestock rules, mining law and Spanish systems. Add to that a failure of congruence between national population distribution and migrations and water supply. Of course, water doesn't respect state borders, but we must add our belief in states rights as granted by our Constitution. As we combine all these competing factors, the real complexity of water coordination becomes more apparent.

**HR1145 Is Necessary, But Is It Sufficient?**

In addition, when we consider missing information and research, this challenge of national coordination and management for the national interest, becomes daunting. HR1145 is a necessary and important step, a serious recognition of the coordination issues before us as we face growing, competing demands for clean fresh water and a growing uncertainty of future supply. It fills a needed gap in national level action. Disjointed reacting to crisis has been a poor alternative.

Yet, there are still two other crucial tasks we need to accelerate in order to meet our 21<sup>st</sup> century water needs. One of these is to develop a functioning, integrated national perspective on water issues; the other is to fill our knowledge gaps about water so that future policy is driven by real data, and logical conclusions that derive from it.

CSSP on 21 Century Water Planning  
 March 3, 2009  
 Page Two

### Past Is Not Prologue

The historical patterns of water availability and use are changing rapidly before us. As the impacts of climate instability unfold, rain will increase in some areas and drought will be more severe in others. As climate changes shift life-cycles of interacting species, those species that can't adapt will collapse, others will wreak havoc.

In the 20<sup>th</sup> Century, we experienced a 7-fold increase in water use and saw almost 100,000 new chemicals dumped into our water supplies. This pattern cannot be the blueprint we follow for the 21<sup>st</sup> century. Our mining of geological groundwater is not sustainable. Water quality and/or quantity governs our health, yield of food and fiber, power generation, manufacturing, animal agriculture, fish and wildlife, recreation, ecosystem health and some transportation and many household uses.

Energy production is the largest non-consumptive use of water in America. If we continue to make food into biofuels, the consumptive use will also grow rapidly larger. We have not yet minimized the energy costs of obtaining clean fresh water from water sources that are neither clean nor fresh. Agriculture is the largest consumptive user of fresh water, and perhaps the largest scale polluter of natural surface, shoreline and other water supplies.

### Sustainable Systems Require Knowledge and Will

As we move the nation toward a sustainable society, we will have to know, for example, the environmental GHG/carbon footprint of all our economic processes, and the corresponding water footprint, with both footprints integrated across all components of each full system. In the absence of these data, we will continue to make major decisions and huge investments that will fail when we gather enough knowledge to recognize that they were unsustainable.

Along with unreliability of water supply, many factors also impact water quality: human-made disasters, domestic use wastewater, solid waste, industrial waste, bioactive chemicals, agricultural chemicals and waste, and curtailing free water scrubbers: natural wetlands.

A report by the NAREEE Board of the USDA to Congress in 2006 ( "**Water Quality and Quantity**" **National Agricultural Research, Extension Education and Economics (NAREEE) Advisory Board**), called for a national scale reporting system on water quantity and quality that could report with high frequency, expanded research, economic and education programs on water conservation, and on preventing unsustainable water use. With this system in place, we could see and plan to act on changes as they were occurring, evaluate in real time the impacts of new policy ideas and economic experiments, and anticipate many changes caused by climate instability.

Because of constraints in recent support of the development of environmental scientists, the age demographics of the current cohort of such scientists, and the economic decline at present, it is not certain that the nation will have the present and future science and research workforce to achieve its needed growth in knowledge about water without a focused stimulus in this direction.

The nation faces many grand R&D challenges around its ensuring a sustainable supply and efficient use of clean fresh water. Central planning by government is not the only alternative. Building an online network, [similar to the dispersed network that built Linux], of a spectrum of knowledgeable experts to define these R&D challenges in the greatest depth in the shortest time is a worthy task—but not necessarily best run by government—and should be supported and facilitated by communities of scientific experts that are not constrained by past federal practices, turf battles, or issues encircled by any political or geographic boundaries.

The results of this experiment might serve to assist the Congress in building broader contact with the science community on future conundrums.

CSSP on 21 Century Water Planning  
March 3, 2009  
Page Three

### Think National Interest First

Large scale water management regularly fails, yet management on a regional-watershed and eventually, a national scale, is an imperative.

A century of national water policy gridlock needs to end now. Congressional and Agency/ Department policy suffers from unclear and conflicting goals, being jolted back and forth in political winds. Resolving the gridlock and conflicts requires addressing fundamental changes in understanding dynamic issues, and building new institutional processes.

To add to the model of coordination proposed in HR1145, we propose that another parallel activity be put into place for a period of approximately 2-3 years. It is to design and create, and implement a **National Water Commission** that will weigh the known knowledge against the long-term national needs, and working beyond the boundaries of many current conflicts, propose rational and logical solutions in the national interest. To be truly credible, the Commission would be large enough to encompass most relevant major knowledge networks, but small enough to ensure its members engage each other productively. It would be constructed by experts in water law, water economics, water and ecosystem science, and water technology, with no external political interference anywhere in its development or operations.

The commission would go first through a planning phase to define and agree upon the challenges and questions and issues, and then an implementation phase to pursue them. The process proposed here differs from the proposed commission in prior legislation. This commission is not hampered by starting with or jockeying for political consensus; instead, it seeks a basis connecting science, technology, law, business, economics, hydrology, climate change, agriculture and other domains to create the most imaginative options and opportunities for the national future. Each expert will educate the others—all will reach a common background in green chemistry, water treaties, economic water incentives and pricing models, watershed scale planning, sustainable use of aquifers, climate change models, agricultural runoff, riparian water rights, ecological economics, and wastewater reuse, and more.

The Commission would generate its own agenda after starting with such topics as preventive anticipative risk management, water sharing possibilities, zero sum game markets, remote sensing, monitoring and rapid public reporting of water pollution, national assessments of water availability and use, snowpack dynamics, ecosystem/wildlife water requirements, quantity of water and rate of change in all major aquifers, surface water-aquifer dynamics, satellite monitoring potentials, climate models, population dynamics, conflicting laws among states, aquaculture, and R&D capabilities.

The history of commissions completely outside the political sphere is that they can achieve their goals to provide solutions. Not all recommendations are politically palatable, nor easily achieved; however, almost all are able to provide new, logical, imaginative solutions, when the constraints of operating within the federal system are removed. Some, such as the military base closing commission, achieved in a short time what was truly unattainable by almost any other means for decades.

After a century of self-imposed federal gridlock on long-term solutions to the nation's water issues and another crisis larger than any we have faced before, it is time to take bold and decisive action.

I will be pleased to respond to your questions and comments.

Sincerely,



Martin A. Apple, PhD  
President  
Council of Scientific Society Presidents  
[cssp@acs.org](mailto:cssp@acs.org)



## COUNCIL OF SCIENTIFIC SOCIETY PRESIDENTS

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### CSSP ISSUE: SUSTAINABLE WATER QUALITY AND QUANTITY

**CSSP POSITION:** Shift U.S. water research and policy from managing supply to understanding water cycles and related interactions, conserving supply, and managing demand. Support coordinated frontier research to enhance water quality, distribution, and efficient use by industries, agriculture, and people. Discover and deploy many new ideas and technologies into widespread use for equitable, sustained support of both people and our land and water ecosystems.

**Background:** A safe and adequate supply of water is essential to survival of humanity and of both water and land ecosystems. Quality and quantity of water, a fragile and greatly undervalued resource, largely define human habitation, determine distribution and survival of plant and animal species, govern production of food and fiber. They greatly influence human health, survival, where we live, and the yield of our food crops and livestock.

**All life on earth depends on liquid water.** The world's water supply is finite. Although 70% of Earth's surface is covered with water, less than 1% is fresh and liquid, and less than 0.0008% is renewable annually for use by people and land and water species. Every three weeks, the entire atmospheric content of 575,000 km<sup>3</sup> of water exchanges between the atmosphere and Earth's surface, providing fresh water as precipitation, but 460,000 km<sup>3</sup> of it falls over oceans. Exchange is slower with groundwater that may be stored over thousands, even millions, of years but exhausted by human use much more rapidly, even in a few generations. Most human water use transfers it from one ecosystem to another.

**The 20th Century saw a seven-fold increase in freshwater use by people and 100,000 new chemicals discharged into the water,** creating a myriad of crucial, unmet challenges for the future. Evaporation of water from land plants to the atmosphere is an essential component of the water cycle. Land use thus modifies water outputs from the land.

**Worldwide, fresh water is becoming limiting** due to 1) increased requirements for drinking water, agriculture, and industry by a growing population; 2) shrinking supplies of groundwater; and 3) loss of quality of available water from the impact of human activities. Strategies must be developed and implemented promptly to protect water quality and distribution to sustain humanity and the local and global environments in which we live.

- **Water is a direct human need, serving us in transportation, industry, recreation, aquaculture and irrigation.** Production of food and fiber and maintenance of our global and local ecosystems depend most on water. Agriculture takes > 80% of the water that we use, offering many opportunities for improved conservation.
- **Safe and adequate supply of drinkable water is essential for human survival and habitation.** Contaminated water kills 5 million people per year (killing more every year than war in the 20th Century) and makes 30 million ill worldwide. Contamination of water resources by nutrient excess and other pollutants changes both water and land habitats and their biological components and compromises food and environmental safety. Regional-scale water cycling is connected in complex ways to human health and spread of infectious diseases by mosquito populations, fungi, bacteria and viruses. Research on these dynamics is essential to develop sound management practices and protection from chemical and biological agents. Ecosystem health already is a major determinant of human health.
- **Uneven distribution of both growing populations and availability of drinking water in the US and abroad places demands on local water supplies that cannot be met by continuing current practices:** For example, in the depletion and rising salinity of Southwestern American rivers and the grand redirection and drying of major rivers in China.
- **Mining of geological groundwater at rates above recharge is not sustainable.** For example, current use lowers groundwater levels in much of West Texas by over a foot per year, whereas recharge from precipitation occurs at a rate of only a few tenths of an inch to a few inches per year.
- **Over 97% of the water supply on earth is in oceans and is too salty for human consumption or agricultural production.** Desalinating ocean water for human use currently significantly increases monetary and energy costs and results in by-products that require special handling to prevent contamination of land sites.
- **Water management has been practiced largely on the local scale.** Much more research is needed at the watershed scale and beyond to understand how the land, rivers, lakes, and reservoirs interact to control supply and quality of our most crucial natural resource.

**CSSP CONCLUSION:** Challenges of water quality and quantity occur at multiple scales. International research and cooperation are essential if effective solutions are to be found and implemented. As a leader in the global community, we must develop and implement sustainable water management policies that meet the needs of people and of the ecosystems of this nation and the world and sustain the economic well-being and the health and safety of our people. The USA must end the fragmented policies and uncoordinated water resources research of the past century. A committed, enlarged, and focused research and development program is essential to meet needs for daily existence, avoid mass migrations and the collapse of regional economic systems, ensure food and water security and safety, and enable human use of water without destroying the ecosystems upon which we depend. Water is such an important issue that we urge coordinated efforts across all of Congress now to address, act on and solve these problems.

May 2002

For further information contact Dr. Martin Apple, President, CSSP    Tel: 202-872-4452    [cssp@acs.org](mailto:cssp@acs.org)    [www.scspres.org](http://www.scspres.org)



25 March 2009

The Honorable Bart Gordon  
 Chair, Committee on Science & Technology  
 2306 Rayburn House Office Building  
 U.S. House of Representatives  
 Washington, DC 20515-4206

Dear Mr. Chairman:

On behalf of the Institute of Electrical and Electronics Engineers-United States of America (IEEE-USA), I would like to commend the House Science and Technology Committee for considering H.R. 1145, the *National Water Research and Development Initiative Act of 2009*. This legislation will strengthen the federal government's role in coordinating research and development into technologies and processes to enhance water-use efficiency and water conservation.

The IEEE Water for the World project under the IEEE Committee on Earth Observation in conjunction with the IEEE-USA Committee on Aerospace and Transportation Policy has been working on worldwide water concerns for the past two years and we applaud the Science and Technology Committee's initiative in increasing the U.S. water supply via improved efficiency and water management techniques. Although our research and development activities are focused on using earth observation techniques to identify new sources of unpolluted water, we have learned of the critical shortage of potable water throughout the world and we believe that your legislation could serve as a model for all countries to improve their unfortunate lack of water.

A safe and adequate supply of water is vital to preserving the health and environment of all Americans. We thank the committee for addressing this important issue and urge prompt passage of H.R. 1145.

IEEE-USA advances the public good and promotes the careers and public policy interests of more than 215,000 engineers, scientists and allied professionals who are U.S. members of the IEEE. IEEE-USA is part of the IEEE, the world's largest technical professional society with 370,000 members in 160 countries. See <http://www.ieeeusa.org>. For more information, please contact Bill Williams at (202) 530- 8331, or at [bill.williams@ieee.org](mailto:bill.williams@ieee.org).

Sincerely,

Gordon W. Day  
 IEEE-USA President

GWD/ww:mcs

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25 March 2009

The Honorable Ralph M. Hall  
 Ranking Member, Committee on Science & Technology  
 2405 Rayburn House Office Building  
 U.S. House of Representatives  
 Washington, DC 20515-4304

Dear Representative Hall:

On behalf of the Institute of Electrical and Electronics Engineers-United States of America (IEEE-USA), I would like to commend the House Science and Technology Committee for considering H.R. 1145, the *National Water Research and Development Initiative Act of 2009*. This legislation will strengthen the federal government's role in coordinating research and development into technologies and processes to enhance water-use efficiency and water conservation.

The IEEE Water for the World project under the IEEE Committee on Earth Observation in conjunction with the IEEE-USA Committee on Aerospace and Transportation Policy has been working on worldwide water concerns for the past 2 years and we applaud the Science and Technology Committee's initiative in increasing the U.S. water supply via improved efficiency and water management techniques. Although our research and development activities are focused on using earth observation techniques to identify new sources of unpolluted water, we have learned of the critical shortage of potable water throughout the world and we believe that your legislation could serve as a model for all countries to improve their unfortunate lack of water.

A safe and adequate supply of water is vital to preserving the health and environment of all Americans. We thank the committee for addressing this important issue and urge prompt passage of H.R.1145.

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Sincerely,

Gordon W. Day  
 IEEE-USA President

GWD/ww:mcs

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The Honorable Bart Gordon  
 Chairman, Committee on Science and Technology  
 U.S. House of Representatives  
 2321 Rayburn House Office Building  
 Washington, D.C. 20515

March 17, 2009

Chairman Gordon:

On behalf of Food & Water Watch, a Washington DC-based consumer advocacy organization, I am writing to express our strong support for passage of HR 1145, the National Water Research and Development Act.

While many studies have cited a need for comprehensive national water use and availability data, no comprehensive database of water quantity exists. While the United States Geological Survey has attempted to compile this information, large gaps remain. At current funding levels it would take twenty to thirty years to complete a nationwide groundwater mapping. For example, the Groundwater Atlas of the United States provides locations and descriptions of the major aquifers in the U.S., yet the extent of groundwater declines has not been monitored on a regular basis, and the most recent study of the topic was conducted in 1983.

To remedy this situation, USGS has proposed, and HR 1145 mandates, a national water census. Food & Water Watch believes that this census essential for confronting the growing crisis of water availability in the United States.

We urge the committee to amend HR 1145 to include mandated water use data collection. While it is important to know the quantity of water available and the amount being used, if we are to develop programs that prioritize national water use, we must also know for what purposes our water resources are being extracted.

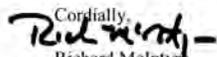
We suggest that the committee adopt the following language inserted in Sec. 2 (a) after "changes in water use,":

"monitoring and reporting water mining and removals from primary aquifers in the continental United States,"

And, in Sec. 2 (d) (1) after "availability,":

"mining and removal,"

We look forward to working with you in support of HR 1145.

Cordially,  
  
 Richard McIntyre  
 Water Program Director



P.O. Box 216 Klamath Falls, Oregon 97601

March 16, 2009

The Honorable Bart Gordon, Chairman  
 The Honorable Ralph M. Hall, Ranking Member  
 Committee on Science and Technology  
 U.S. House of Representatives  
 Washington, D.C. 20515

Dear Chairman Gordon, Ranking Member Hall and Members of the Committee:

Thank you for holding a hearing on HR 1145, *The National Water Research and Development Initiative Act of 2009*. The Family Farm Alliance has prepared the following statement on HR 1145 and the important need it seeks to address: the coordination of national research and development efforts on water to ensure adequate water supplies in the future. I respectfully request that this statement be included in the record for the hearing on HR 1145 held on March 4, 2009.

The Family Farm Alliance (Alliance) advocates for family farmers, ranchers, irrigation districts, and allied industries in seventeen Western states. The Alliance is focused on one mission - To ensure the availability of reliable, affordable irrigation water supplies to Western farmers and ranchers.

In general, HR 1145 includes many provisions that the Alliance supports, and we fully agree that predicted droughts will be exacerbated by climate change and increases in population and energy demand. However, we have concerns about the legislation's lack of attention to agriculture, an enormously important part of the American economy that vitally depends on water for irrigation. We also believe that, from the outset, the proposed interagency committee be expanded to include state and stakeholder interests, and that all water supply enhancement actions –not just conservation measures – be viewed with equal priority.

**Western Irrigated Agriculture is Vital to the National Economy**

Western American water policy, over the past one hundred years, is one of the great success stories of the modern era. Millions of acres of arid Western desert have been transformed into the most efficient and productive agricultural system in the world.

The Bureau of Reclamation (Reclamation) operates about 180 projects in the 17 Western States. Reclamation projects provide agricultural, household, and industrial water to about one-third of

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the population of the West. About 5 percent of the land area of the West is irrigated, and Reclamation provides water to about one-fifth of that acreage. Reclamation is also a major American generator of electricity. All of this has been done for a total federal investment of \$11 billion. A 1998 study by Dr. Darryl Olsen and Dr. Houshmand Ziari, estimates that the annual return to the economy from the \$11 billion investment in the federal system is \$12 billion annually. In other words, the economy of the United States receives a greater than 100% return each year on this investment.

**Agriculture: The (Default) Reservoir of the Modern West**

Henry Vaux, Jr., from the University of California, Berkeley, testified at the March 4 hearing that the expansion of irrigated agriculture would continue to cut into the nation's dwindling water supplies over the next century. Mr. Vaux's written testimony expresses a concern that the need to feed an increasing domestic population as well as a burgeoning global population will be translated into a growing demand for agricultural water everywhere. Because it is more productive than rainfed (dry-land) agriculture, Mr. Vaux predicts that there will be pressure to expand irrigated agriculture in this country.

Mr. Vaux's concerns about the link between population growth and agricultural production are well-founded. However, rather than an expansion of irrigated agriculture, we are seeing the exact opposite in the Western United States where agricultural lands are actually being converted to other uses at an alarming rate. For example, in Mr. Vaux's state of California, the Department of Conservation indicates that more than 1 million acres of farmland in the state was converted to new residential and commercial uses between 1988 and 1998. In 2005, California's population officially topped 37 million, a growth rate of 1.4 percent, representing 500,000 new residents in the last fiscal year. With the state's population growing rapidly and developers responding with new housing subdivisions and commercial centers, farmers and ranchers are getting pinched, particularly in the Central Valley. In some of California's most productive farm counties, these pressures have eroded the agricultural land base and impacted dwindling water supplies.

In California and in other Western states, new environmental water demands imposed by regulatory agencies or courts also first look to agricultural supplies. This is happening in every Western state experiencing population growth, emerging environmental demands, and cyclical drought conditions.

We cannot continue this sort of ad-hoc water "management" that focus primarily on continued conservation and downsizing of Western agriculture. Our Nation demands a stable domestic food supply, just as it demands a stable energy supply. The post 9/11 world of terrorist threats makes the stability and security of our domestic food supply even more pressing.

Allowing or forcing the movement of water away from agricultural uses is not enlightened water management; it is a short-sighted, short-term pseudo-solution that will devastate rural economies

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and undermine the nation's food security. A prime example of where this is happening right now is detailed further in the attached *Sacramento Bee* article about the current crisis faced by Central Valley communities in California.

In this time of economic uncertainty, it is vital that any effort involving the study, management or oversight of American water resources be done in a way that provides full recourse to, and solicits constructive input from Western irrigated agriculture.

#### **HR 1145 Background**

We understand that HR 1145 builds on previous efforts to coordinate federal research on water resources by permanently establishing an interagency committee—the Subcommittee on Water Availability and Quality (SWAQ) of the National Science and Technology Council. The bill proposes to codify this subcommittee and provides it explicit Congressional authorization. The bill also incorporates recommendations from the 2004 report by the National Academies of Science entitled, *Confronting the Nation's Water Problems: The Role of Federal Research*.

#### **The Role of the Federal Government in Western Water Resources Management**

There is certainly a need for improved coordination of water supply activities and water resources management at the local, state and/or national levels. However, the system that has evolved over the past 150 years in the West assuredly does not need to be rebuilt by federal intervention. The United States should defer to States, Tribes, and local government decisions regarding water allocation and use, and should advocate constructive ways in which the federal government can support and facilitate those decisions. For example, many federal, state and local entities already collect and disseminate data on water resources that includes information on the quantity, availability, quality, and use of groundwater and surface water resources. Rather than establish a new, expensive and potentially duplicative federal water census process, as some have advocated for, efforts should focus on better understanding, coordinating and enhancing existing programs that are in place in every Western watershed.

Right now, when it comes to the planning, development, and management of water resources, there are too many overlapping federal regulations and responsibilities. We must work together to reduce the gridlock that characterizes federal water policy decisions. This will require streamlining and coordinated application of the federal regulations that are involved in those decisions.

The federal role in this area must be re-examined to determine if a reorganization or consolidation of water management agencies would allow processes to move forward and create solutions acceptable to all stakeholders. The roles of federal agencies should be narrowly defined so as to preclude intrusion upon state allocation procedures. Rather than impose objectives for water quality, species protection and land management by fiat, the federal

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government should actively engage with state governments to integrate those objectives into existing state systems in a manner which does not unnecessarily or unreasonably impact vested water rights.

#### **Water Supply and Climate Change**

Addressing climate change appears to be a prominent theme in HR 1145, a priority that is also important to our membership. A 2007 Western Governor's Association report and other studies suggest that more spring runoff, coming off the mountains in a shorter time period, is the general predicted impact associated with climate change<sup>1</sup>. Water resources experts throughout the West realize that new surface water storage projects may be necessary to capture more rapidly melting snowmelt or water from other sources.

There are several reports that suggest existing reservoirs will not be capable of safely accepting the earlier, more intense snowmelt. A report released three years ago by the State of California<sup>2</sup> predicts that climate change will result in a drastic drop in the state's drinking and farm water supplies, as well as more frequent winter flooding. The report suggests that warmer temperatures will raise the elevation of the snowpack in California mountains, producing a smaller snowpack and more winter runoff. This means more floodwaters to manage in winter, followed by less snowmelt to store behind dams for cities, agriculture, and fish.

Modern, integrated water storage and distribution systems can provide tremendous physical and economic flexibility to address climate transformation and population growth. This flexibility, however, is limited by legal, regulatory, or other institutional constraints, which can take longer to address than actually constructing the physical infrastructure.

These issues and others were identified in a Family Farm Alliance white paper that addresses the important issue of climate change, its possible impact on Western water supplies and irrigated agriculture, and recommendations on how to plan and provide stewardship for this change. The report was prepared by an Alliance climate change subcommittee, our Advisory Committee, and water resources experts from around the West. That document - titled *Water Supply in a Changing Climate: The Perspective of Family Farmers and Ranchers in the Irrigated West* - was released in September 2007.

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<sup>1</sup> Bittleman, Sarah (Director, Washington, D.C., Office of Oregon Governor Theodore Kulongoski) 2007. Testimony Submitted on Behalf of The Western Governors' Association to U.S. House Committee on Science and Technology. May 3, 2007.

<sup>2</sup> California Climate Change Center, 2006. Our Changing Climate – Assessing the Risks to California, Summary Report.

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The Alliance called further attention to climate change impacts and other water challenges in a report we released in October 2008 titled *Western Water Policy: Challenges and Opportunities of our Times – Our Legacy for the Next Generation*. The Alliance report expresses a belief that the West can find solutions to our water conflicts which assure that we continue to lead the world in agricultural production, while finding ways to accommodate urban growth, recreational demands, and environmental requirements. Solutions will not come easily. They will require visionary leadership and a firm commitment to a balanced, workable policy. Printable versions of both Alliance reports can be downloaded from our website: [www.familyfarmalliance.org](http://www.familyfarmalliance.org).

Both reports emphasize that climate change could further strain fresh water supplies in the American West. We must begin to plan for that now, and not wait until we are forced to make decisions during a crisis. HR 1145 could provide a catalyst to start that planning process.

#### **Positive Attributes of HR 1145**

We support HR 1145's provisions that encourage cooperation among Federal agencies with respect to water-related research, development, and technological innovation activities to avoid duplication of effort and to ensure optimal use of resources and expertise. Our country has tremendous, but limited, resources available to fix our problems, so we must prioritize and sequence our actions, including those authorized or facilitated by HR 1145.

We have long promoted provisions like HR 1145's emphasis on developing innovative technologies and tools to enhance water-use efficiency. Before Congress and in other forums, we have advocated for a better understanding of ecosystem needs for water;<sup>3</sup> improved hydrologic prediction models and their applications;<sup>4</sup> and the need to analyze the energy required to provide reliable water supplies and the water required to provide those supplies throughout the U.S.<sup>5</sup>

In our view, HR 1145 offers one approach that may promote coordination of federal agencies and resources in assessing, monitoring, and planning for future water supply impacts and trends - an important first step in developing an adaptive approach to climate change and water. The Alliance supports this approach because it provides additional authorities for federal agencies to

<sup>3</sup> *Request for Correction of Information in the Draft Effects Analysis of the Biological Opinion on the Continued Long-Term Operations of the Central Valley Project and the State Water Project*, Family Farm Alliance transmittal to H. Dale Hall, Director U.S. Fish and Wildlife Service, December 14, 2008.

<sup>4</sup> Testimony of Patrick O'Toole, President, Family Farm Alliance Before the Energy and Natural Resources Committee, United States Senate, Regarding S. 2156, the SECURE Water Act of 2007, December 11, 2007.

<sup>5</sup> Testimony of Dan Keppen, Executive Director, Family Farm Alliance Before the Select Committee on Energy Independence and Global Warming, United States Senate, Oversight Hearing on "Global Warming Effects on Extreme Weather" July 10, 2008.

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offer grants and agreements for demonstration, research, or methodology development in this coordinative effort. However, such partnerships with local water authorities, universities, and local governments could be enhanced if these parties were initially provided a seat on the interagency committee proposed in HR 1145.

#### **Issues of Concern and Recommendations**

Large-scale multi-disciplinary/multi agency programmatic approaches to resource challenges can provide great opportunities for progress. However, great care must be taken in the formulation and management of programs like this, as there is no “one size that fits all” and every approach has elements of both success and failure. We offer the following observations and recommendations on the bill.

1. HR 1145 should avoid duplicating and direct the coordination of existing programs already in place at the local, state and federal level.
2. HR 1145 should be modified to address the critical need to develop enhanced water supplies through development of new water infrastructure. There must be more water stored to increase supplies to Western farms, cities, and the environment. Maintaining the status quo simply is not sustainable in the face of unstoppable population growth, diminishing snow pack and other climate change effects, increased water consumption to support domestic energy, and increased environmental demands. It strains credibility to believe that conservation alone will supply enough water for the tens of millions of new residents expected to arrive in Western cities during the coming decades while maintaining a stable food supply and a healthy environment.

Many sustainable water projects are ready and waiting to be developed in the West. While conservation and recycling programs have done a tremendous job of meeting new growth, still, only a small amount of new water has been developed in the past 30 years. We cannot continue to “conserve just a little more” forever. It is time to start developing and implementing the water infrastructure needed to cope with a changing climate, meet the needs of a burgeoning population, protect the environment, and support a healthy agricultural economy in the West.

3. HR 1145 should be modified to include state and stakeholder involvement (including representation for irrigated agriculture) on the interagency committee. Efforts like this lend themselves well to a private-public partnership that would add non-governmental farming organizations, state agencies and academic institutions to the committee.
4. We are concerned that agriculture and its critical relationship to water resources are being overlooked in the context of the bill. In fact, the words “agriculture”, “farming” and “ranching” cannot be found anywhere within the current draft. This concern can be

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addressed, in part, by ensuring that Western agricultural water users are provided representation on the interagency committee.

5. We were also concerned to learn that there were no agricultural witnesses on the agenda for the March 4<sup>th</sup> House Science Committee hearing. We are, therefore, appreciative of this opportunity to submit written testimony for the record, and we encourage the committee to seek the views of Western water users as the bill moves forward.

**Summary and Conclusion**

Thank you for this opportunity to comment on HR 1145. This bill is important to all Americans – including the family farmers and ranchers of our membership, and our suggested revisions are intended to help create a revised bill that they will embrace.

If you have any questions, I encourage you or your staff to contact me at (541)-850-9007

Sincerely,



Dan Keppen  
Executive Director



NATURAL RESOURCES DEFENSE COUNCIL

March 16, 2009

The Honorable Bart Gordon  
Chairman, Committee on Science and Technology  
2306 Rayburn House Office Building  
Washington, DC 20515

RECEIVED  
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COMMITTEE ON SCIENCE  
& TECHNOLOGY

Dear Chairman Gordon:

On behalf of our 1.2 million members and activists, we write to express our support of HR 1145, the National Water Research and Development Initiative Act of 2009, which would coordinate such a research initiative and develop a plan for identifying and prioritizing future research needs. Efforts to define research needs and projects related to 21st Century water infrastructure are already being conducted at the federal level. The NWRDIA would be helpful in coordinating these and other agenda-setting exercises into a cross-agency, cross-media, cross-sectoral strategy that gets past the historically siloed and disintegrated approaches that are currently failing to provide holistic solutions to our water and integrated resource needs.

Directing federal research funding towards addressing the challenges facing U.S. water resources will make the U.S. stronger, our families healthier, our wildlife more abundant, and our communities safer and more resilient to future water and climate disturbances. Those research dollars will also provide immediate employment to scientists, technicians, equipment manufacturers, laborers, and a whole host of other Americans who can feed their families today and contribute to the long term health and well being of the nation. It is vital for the U.S. to return to earlier patterns of investment in water infrastructure-related research. Our nation is clearly falling behind in the efficiency and effectiveness of its approaches relative to those of other countries. Research investments will be paid back in many ways, including reductions in costs of safe and clean water systems, revitalized local economies and community development, and in new economic opportunities for American businesses in designing and manufacturing solutions for emerging markets in Asia and elsewhere.

We have a couple of suggestions for improvement to the bill as well. We urge you to include climate change/water resource interactions and enhanced treatment and pollution prevention approaches among the research goals identified in section 2(d). The climate change goal should include research on climate change impacts (such as improving the models used to predict climate change impacts regionally and locally), adaptation strategies (such as strategies for making water resources more resilient in light of climate change impacts), and mitigation strategies (ways in which water resource management can contribute to or reduce climate change). We would also urge you to include water use, including both groundwater and surface water, in the census required by Section 2(d)(1).

We look forward to working with you to make these improvements as the bill moves forward.

Sincerely,

  
Nancy Stoner  
Co-Director, Water Program  
NRDC

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Glenn English  
Chief Executive Officer

March 24, 2009

Honorable Bart Gordon, Chairman  
Committee on Science and Technology  
United States House of Representatives  
Washington, DC 20515

Dear Chairman Gordon:

I would like to express the National Rural Electric Cooperative Association's (NRECA) support of the National Water Research and Development Initiative Act of 2009.

NRECA is the not-for-profit national service organization representing 930 not-for-profit consumer-owned rural electric cooperatives that serve members located in 47 states. NRECA's consumer-owned cooperatives serve more than 42 million members in 2,500 of the nation's 3,128 counties.

Approximately 10% of the electricity that rural electric co-ops distribute to their customers is hydroelectricity. The bill's goal of establishing a National Water Research and Assessment Plan ("the Plan") to create a database regarding ground and surface water resources and to develop more effective water monitoring techniques will generate significant information, and such information will benefit our efforts to distribute hydroelectricity.

Moreover, information regarding the water required to provide reliable energy supplies throughout the United States will assist co-op efforts to build new generation plants. Such plants are necessary to ensure that the country's future capacity needs are addressed sufficiently.

Sincerely,

A handwritten signature in black ink that reads "Glenn English". The signature is fluid and cursive, with the first name being particularly prominent.

Glenn English





Testimony for the Record for the House Science Committee Hearing  
"21st Century Water Planning: The Importance of a Coordinated Federal Approach"  
*offered by the*  
Water Environment Research Foundation  
Glenn Reinhardt, Executive Director

March 4, 2009

The Water Environment Research Foundation (WERF or the Foundation) is a nonprofit organization that has been managing wastewater and stormwater research for twenty years. With a portfolio of over 300 research projects, many supported by U.S. federal agencies and other government entities, we offer our strong support for a collaborative effort that will coordinate and facilitate water research. Our experience in managing scientific and technical inquiry confirms the assumption that collaboration produces better science and more cost effective solutions.

We appreciate this opportunity to provide some specific suggestions on Chairman Gordon's bill, the National Water Research and Development Act of 2009 (H.R. 1145), and to offer some broader thoughts on coordinating federal water research that may be of interest to the Committee. The Foundation applauds the effort by the Chairman and the Committee to spotlight the need for better coordination and, more generally, to reinvigorate the federal commitment to water quality research. Of the four functions of the Interagency Committee, coordinating all research, education and technology transfer (see Section 2(b)(3)(B)) will likely prove to be the most challenging. Simply corraling the information will be massive, let alone coordinating it all. The undertaking will require the support and cooperation of private research organizations as well as government agencies, so we strongly suggest that the legislation provide for a transparent and accountable process, perhaps modeled on [recovery.gov](http://recovery.gov), the website created to explain to the public how the monies under the American Reinvestment and Recovery Act are being spent.

The Committee might want to extend the window of time for the evaluation of priorities established in the National Water Research and Assessment Plan. Section 2(c) of the bill currently calls for establishing priorities for "the 4-year period beginning the year in which the plan is submitted to Congress." Many research programs extend for 5 to 7 years, or longer, and restricting the priorities to a four year period may discourage far-reaching and innovative work. We suggest that the plan extend to blocks of eight years, with a provision for renewing or revising every four years. That would provide a longer research window, but maintain some flexibility for changing circumstances.

Additionally, if this effort is going to be sustained over the next eight years, or longer, the provision requiring consideration of the 2007 SWAQ report should be revised. That report may be appropriate for

an initial 4-year plan, but it may lose its relevance as the plan evolves over the years. The Committee should additionally consider the recommendations from a wider range of organizations, including private research organizations such as the Foundation's, which can bring new perspectives on emerging bodies of work. WERF's five-year research plan would be one such source of useful and relevant information.

As research managers, WERF recognizes the immense importance of getting research results to the people who need it. We would suggest adding a requirement under 2(c)(2)(C), or in a new subparagraph of Section 2(c)(2), that the plan shall also describe the methods by which research results are communicated to the appropriate stakeholders. H.R. 1145 should authorize sufficient resources for a national water quality organization like the Foundation to ensure that the results of the Interagency Committee's work are effectively communicated to water and wastewater stakeholder organizations nationwide. Ensuring that the Committee is aware of and understands that community's research agenda, and vice-versa, is crucial and is a prerequisite to the full use of any new scientific information that will be generated under the Plan. WERF recommends that \$5 million annually for 10 years be authorized for that purpose.

The National Water Initiative Coordination Office will have their hands full in meeting the challenges of this initiative. The legislation might include a provision that would allow the Office to tap nongovernmental expert resources to assist, perhaps through a process similar to arrangements finding success under USAID programs. USAID contracts with NGOs to successfully coordinate initiatives in climate change, forest protection, food availability and water conservation – and although some may argue that USAID's outsourcing has been carried to an extreme, the basic tenet of contracting with experts to undertake projects within their expertise is sound.

The "Water Research Outcomes" listed in Subsection (d) are extensive. However, to be more inclusive of the practical research needed by municipalities and other water quality agencies, we would recommend that Subsection (d)(3) – development of technologies for enhancing reliable water supply -- be expanded to "development of technologies and processes for protecting, treating and enhancing reliable water supplies." This would include the research needed by the 16,600 publicly owned wastewater treatment plants and the 23,000 industrial facilities in the U.S. that have significant pretreatment programs.

We applaud the inclusion of Subsection (e) in the Chairman's bill which establishes an advisory committee to assist the Interagency Committee. On their own, Government Committees tasked to coordinate among themselves are rarely able to breakdown agency-specific silos in order to realize efficiencies and create additional value for taxpayers. Assigning, through leadership on an advisory committee, that coordinating role to a specialized non-profit such as WERF may be appropriate. Requiring that each agency or department provide the funds and resources necessary to carry out the task would make it possible.

One model for utilizing outside experts in Governmental Committees was developed under the Trade Act of 1974. That Act included a formal mechanism for agricultural advisory committees, to ensure that

U.S. trade policy and trade negotiation objectives adequately reflect U.S. commercial and economic interests. The Chairman's bill can reflect some of the lessons learned in developing that successful mechanism:

- Rather than ask dozens of experts to advise on issues that are not within their realm of experience or expertise, it may be useful to allow for technical advisory committees (TACs). Using the agricultural trade model, and to make the task more manageable, eight TACs can assist with the eight water research outcomes provided in the bill. TAC members would be recognized leaders in their fields.
- The TACs would operate under the umbrella committee (called the "policy advisory committee," or PAC, in the agricultural trade arena) that is envisioned as THE advisory committee in this bill. The PAC would be comprised of the head of each TAC, plus water generalists who have research expertise.

The Foundation believes that the critical objectives of H.R. 1145 must be supported by an authorization of appropriations sufficient to carry out the significant work of the Interagency Committee. Accordingly, WERF recommends an authorization of \$150,000,000 over ten years.

Finally, WERF also believes that the Committee on Science could usefully examine the opportunity to coordinate the purposes and provisions of H.R. 1145 with H.R. 135, a bill to create a "21st Century Water Commission" which was introduced in the 110<sup>th</sup> Congress by Rep. Linder and reported out of the Committees on Natural Resources and Transportation and Infrastructure with numerous co-sponsors but never voted on by the House.

National coordination for water research is a huge task, but it promises even bigger rewards. It would be WERF's distinct honor to assist however we can to ensure the success of this vital initiative. On behalf of the Foundation, thank you for the opportunity to share our views on the important work of the Committee.



March 10, 2009

The Honorable Bart Gordon  
Chairman  
Committee on Science & Technology  
United States House of Representatives  
Washington DC 20515

Dear Chairman Gordon:

On behalf of the Water Innovations Alliance, public policy voice of the world's water researchers, technologists and innovators, I would like to thank you for your leadership in introducing HR 1145, The National Water Research and Development Initiative Act of 2009. The Alliance is pleased to offer this remarkable piece of legislation its full support.

The HR 1145 is a major turning point in of government leader's treatment of water technology and innovation, successfully recognizing water's importance and the past lack of attention to this crucial mater. The legislation you are introducing today will help America.

Your bill recognizes the tremendous importance of securing safe and affordable access to water resources as a cornerstone of our nation's physical health, economic prosperity, and general welfare. We share your view that Federal investment in water technology R&D is essential for our nation's future – and the world's.

We are all familiar with the statistics: in 2002, 1.1 billion people lacked access to a reliable water supply, and 2.6 billion people lacked access to adequate sanitation. By 2025, over half the world's population will live in water-stressed or water-scarce countries. 25 percent of global freshwater use exceeds local long-term accessible supplies. Agricultural uses are the biggest concern, with an estimated 15 to 35 percent of irrigation withdrawals in excess of sustainable limits. Industrial withdrawals of water are expected to rise by 55 percent out to the year 2025. In addition, within the US, population has been migrating from the water-rich North to the water- depleted sunbelt. Crumbling infrastructure means that cities such as Chicago lose upwards of 60 percent of their water in transit from treatment facilities to faucets. Over the past five years, municipal water rates have increased 27 percent throughout the United States.

Your bill reflects an ongoing commitment to progress that has long been absent in the water sector. We strongly agree with your calls for interagency collaboration and coordination, as well as increased evaluation and funding for water technology. As I mentioned at the Hearing, before founding the Water Innovations Alliance, I founded the NanoBusiness Alliance, where I worked extensively on the 21st Century Nanotechnology Research and Development Act. I believe that it can serve as great model for interagency coordination and public-private collaboration on key issues surrounding water technology.

The Water Innovations Alliance shares your commitment that clean water means a healthy America. And this goes beyond physical health, because an investment in unleashing America's entrepreneurial spirit by supporting the development of water technology and innovations will drive our nation's ability to compete in the global water sector—the third largest industry on earth.

On behalf of our members, America's water innovators, the Water Innovations Alliance strongly endorses the HR 1145, The National Water Research and Development Initiative Act of 2009.

Best Regards,



F. Mark Modzelewski, Executive Director  
Water Innovations Alliance  
Cambridge, MA