HEARING ON
WATER SUPPLY CHALLENGES FOR THE 21ST CENTURY

Statement of

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Good morning, Mr. Chairman, members of the Committee, and others. My name is Stephen D. Parker. I am Director of the Water Science and Technology Board (WSTB) of the National Research Council. As you may know, the National Research Council is the operating arm of the National Academy of Sciences, National Academy of Engineering, and the Institute of Medicine of the National Academies, and its goal is to provide elected leaders, policy makers, and the public with independent, expert advice based on evaluations of scientific evidence.

I am delighted to have the opportunity to participate in today's hearing, which examines the challenges of managing water supplies to meet social, economic, and environmental needs of the United States. Population growth, changes in water use patterns, competing demands for water supply, degradation of water quality, and climatic variations all are factors that influence the availability and use of water. I have held my position with the WSTB for 26 years and have overseen approximately 200 studies relevant to the topic of today's hearing. Thus, my remarks are drawn from a whole body of work, rather than just one recent report. (Note that my written statement has attached to it a listing of some our most relevant reports from the past several years.) Given the nature of the WSTB mission--to help ensure and improve the scientific basis for water management--my statement tends to emphasize science and research.

High quality, reliable drinking water is fundamental to human existence and quality of life. Not only is water a basic human need, but adequate, safe water supplies are crucial to the nation's health, economy, security, and ecosystems. A key strategic challenge is to ensure adequate quantity and quality of water to meet human and ecological needs, especially given the growing competition among domestic, industrial–commercial, agricultural, and environmental uses. To successfully address the nation's water resources problems likely to emerge in the next

10–15 years, decision makers at all levels of government will need to make informed choices among often conflicting and uncertain alternative actions.

There is abundant evidence that the conditions of water resources in many parts of the United States are deteriorating. Further, demands for water resources to support population and economic growth continue to increase, although water supplies generally are fixed in quantity and already are fully allocated in most areas. Examples of the mounting array of water-related problems exist in every region of the country. Today, these problems are especially pronounced in the West and in the Southeast. Both these areas are sites of rapidly-growing populations and have been affected by climate variability, drought, and a tightening water supply picture as multiple and new users vie for changes to more traditional allocation rules and patterns. Lasting solutions to these challenges of water supply and demand balances, as well as water quality, will require creative, science-based, and economically feasible strategies. The following questions highlight the central concerns; if answers to some of these questions are "no," it portends a future with complex water resource problems that will challenge the capacities of our scientific, engineering, and management organizations charged to address water resources issues. (Note that I do not attempt to separate water quantity from water quality considerations as the two are inextricably linked.)

- **Will there be sufficient water to both sustain ecosystems and support future economic and population growth?** The fast-growing states and cities of the Southwest face great challenges in meeting increasing water demands. Most of the sources and supplies of water for this arid region are fully allocated among environmental, urban, and agricultural uses. Mechanisms for reallocating water away from current uses, along with technological means for augmenting supplies, all have physical, economic, and social limits. Other rapidly growing areas of the nation, like the Southeastern U.S., also are exhibiting increasing vulnerability to drought. The traditional means for coping with ever-increasing water demands was to augment supplies by constructing more dams. For a number of reasons, that strategy today is far less viable. Unfortunately, the nation has limited precedent and seemingly a lack of long-term, strategic vision for alternative means for coping with increasing economic and population growth with existing, limited water supplies. Furthermore, we believe the nation has underinvested in the research needed to help municipalities augment water supplies, for example through wastewater reuse, desalination, or aquifer storage and recovery.

- **How effectively can our water management systems and institutions adapt to climate change?** Existing data reveal some significant climate changes in the U.S. in recent years, with implications for water quality and quantity. Warmer temperatures in some regions, and potential impacts on water supplies, are a special concern. Although there are uncertainties regarding future climate projections, there is broad scientific agreement that rising temperatures are having a number of effects, such as (1) earlier melting of snowpack, which affects agricultural production, increases flood risks, and is forcing changes in reservoir operations; (2) higher sea levels, which will increase salinity in coastal aquifers and alter marshes and wetlands; and (3) changing patterns of precipitation, such that extreme climatic events may increase in magnitude and frequency.

- **Will drinking water be safe?** Over the past 100 years, investment in water treatment and distribution infrastructure has made the quality of U.S. drinking water among the best in the world. Enormous gains in public health were realized from the virtual elimination of typhoid and cholera, such that today, the provision of safe supplies of drinking water is taken for granted. Nonetheless, new chemical and biological agents continue to emerge and intentional or unintentional contamination of drinking water supplies represents a real and continuing threat. Further, much of our drinking water infrastructure is reaching the end of its usable lifetime and will need to be replaced in the next 10-25 years

- **Will the quality of the nation's waters be enhanced and maintained?** Passage of the Clean Water Act helped the nation make great progress during the 1970s and 1980s in improving surface water quality, through financial support for municipal wastewater treatment plants and a permitting process for point sources of water pollution. Today, the more pressing surface water quality problem is nonpoint source pollution. Effective management of nonpoint source pollution problems requires good data on surface water quality. However, there are only limited water quality data for many of the nation's rivers and streams, including some large and very important ones. For example, a 2008 report of ours noted the limited data and limited monitoring efforts in many stretches of the Mississippi River, and recommended a more extensive and integrated approach to the river's water quality monitoring and assessment. Better information on water quality, and better management of nonpoint source pollution problems, also will require stronger, more aggressive federal leadership.

- **Can existing water policies effectively respond to present and future challenges?** Many of the nation's water policies and practices were created and designed for an earlier era of water resources challenges and problems. For example, the National Environmental Policy Act, the Clean Water Act, the Safe Drinking Water Act, and the Endangered Species Act all were passed in the early 1970s. Further, many dam operations and water allocation plans, designed for a set of users in an earlier era, are being challenged by increasing demands from users such as recreational, urban, and environmental interests. Moreover, many water professionals are concerned about declining engineering and scientific capacity in the nation's key water resources organizations—which is occurring at a time when the nation needs high-level, professional expertise in its primary water institutions more than ever.

Advances in the science and technology through research needed to address these problems are likely to be inadequate if no federal actions are taken, as the states and nongovernmental organizations have limited resources to invest in required research. The nation also will need stronger expertise in its leading water institutions in order to stay abreast of engineering and scientific developments, and to be able to interact productively with the scientific community at large. The increasing need to ensure clean and adequate water supplies, and to manage increasingly rapid human-induced modification of natural and social environments, make a compelling case for governmental support of water resources research and strong governmental scientific and technical capacity.

There are numerous examples of federal government-funded research on water resources that have led to significant payoffs for the nation. The flood forecasting systems that help save lives and protect property, and the drought forecasting systems that help keep farmers and municipalities abreast of water availability conditions, both rest on federally supported data gathering and research. Research in the past has led to the development of innovative water and wastewater treatment technologies, such as membranes. Other examples include improved management of salts in irrigated agriculture, and better understanding of implications regarding voluntary transfers of water among different users. Studies of eutrophication in inland waters, mercury deposition, and nitrogen loading in the Chesapeake Bay watershed seem to provide examples of federally funded research that has improved the effectiveness of regulatory processes. Research has allowed the nation to increase the productivity of its water resources, such that today the same amount of water yields, on average, more agricultural output than it did 50 or 100 years ago. Finally, the nation today uses many aspects of its water resources base far more efficiently than in the past, due to advances in water-efficient plumbing fixtures, landscaping practices, and wastewater reuse techniques. Future scientific and technical advances will be required to meet the water resources needs of an expanding U.S. population and to maintain the quality of the nation's surface, groundwater, and aquatic systems.

That concludes my statement. I commend the Committee for recognizing the importance of water resources—and the role of the federal government in water resources—to the nation. I'd be happy to answer your questions. Thank you!

Some Relevant Recent WSTB Reports of Interest to the Subcommittee

Desalination: A National Perspective 2008

Colorado River Basin Water Management: Evaluating and Adjusting to Hydroclimatic Variability 2007

Improving the Nation's Water Security: Opportunities for Research 2007

Integrating Multiscale Observations of U.S. Waters 2007

Mississippi River Water Quality and the Clean Water Act: Progress, Challenges, and Opportunities 2007

Prospects for Managed Underground Storage of Recoverable Water 2007

Water Implications of Biofuels Production in the United States 2007

Drinking Water Distribution Systems: Assessing and Reducing Risks 2006

Progress Toward Restoring the Everglades: The First Biennial Review, 2006 2006

River Science at the U.S. Geological Survey 2006

Toward a New Advanced Hydrologic Prediction Service (AHPS) 2006

Public Water Supply Distribution Systems:Assessing and Reducing Risks 2005

Regional Cooperation for Water Quality Improvement in Southwestern Pennsylvania 2005

Water Conservation, Reuse, and Recycling 2005

Assessing the National Streamflow Information Program 2004

Confronting the Nation's Water Problems: The Role of Research 2004

Estimating Water Use in the United States: A New Paradigm for the National Water-Use Information Program 2002

Missouri River Ecosystem: Exploring the Prospects of Recovery, The 2002

Privatization of Water Services in the United States: An Assessment of Issues and Experience 2002

Watershed Management for Potable Water Supply: Assessing the New York City Strategy 2000