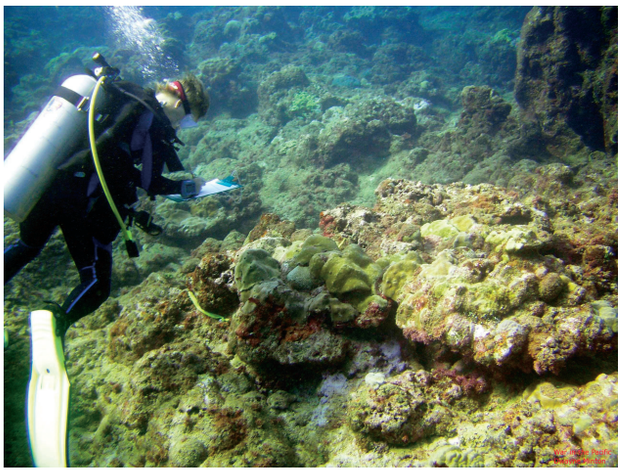
National Park Service
U.S. Department of the Interior

Natural Resource Program Center

WATER RESOURCES DIVISION

2007 ANNUAL REPORT



NATIONAL PARK SERVICE

Water Resources Division

2007 ANNUAL REPORT

Natural Resource Report NPS/NRWRD/NRR-08/01

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Fort Collins, CO 80525

National Park Service

U.S. Department of the Interior
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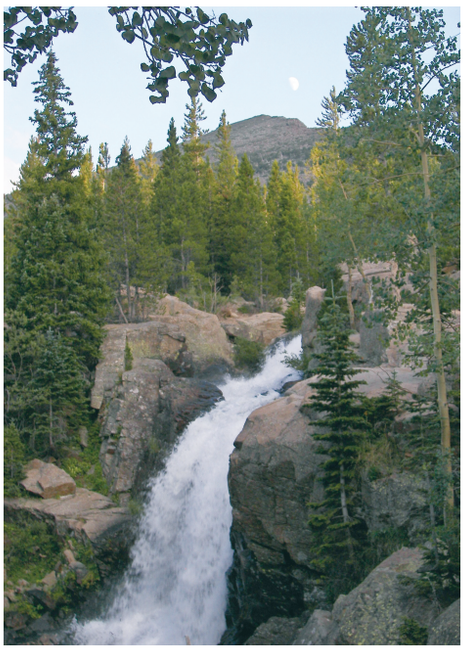
Front cover, photos:
Sea stars and sea anemones, Oregon (Jane Jackson, 2008)
Oregon coast (Eric Jackson, 2005)
Brook Trout, Great Smoky Mountains NP (Matt Kulp)

Opposite page, photos:
Diver on coral reef, War in the Pacific National Monument (Dwayne Minton)
Mouth of the Klamath River, Redwood National Park (Wullschleger)

Back cover, photos:
Kaloko Fishpond, Kaloko-Honokōhau National Historical Park (Keteles, 2007)
Lower Falls of the Yellowstone, Yellowstone National Park (Bill Jackson)
Coral Monitoring, Virgin Islands National Park (NPS, 2006)

Loch Vale, Rocky Mountain National Park (Jackson, 2007)

The Water Resources Division of the National Park Service Natural Resource Program Center is responsible for providing water resources management policy and guidelines, planning, technical assistance, training, and operation support to units of the National Park System. Program areas include water rights, water resources planning, regulatory guidance and review, hydrology, water quality, watershed management, ground water, fishery and marine resources management, and aquatic ecology.



Alberta Falls, Rocky Mountain National Park (Jackson, 2007)

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Background photo: Chinook Salmon, Necons River, Lake Clark National Park and Preserve (Dave Folleti, Alaska DF&G)

Sorting salmon at Lake Clark, (D. Young, 2007)

Blue shore, Grand Teton National Park (Keteles, 2007)

A Word from the Acting Associate Director Natural Resource Stewardship and Science

Herbert Frost, Ph.D.

This annual report provides a summary of the 2007 accomplishments of the National Park Service's Water Resources Division (Division or WRD). The Division, in partnership with parks and others, provides program and policy leadership, technical assistance, and funding support for understanding, protecting, and managing water and aquatic resources of the National Park System. In addition to directly helping parks succeed in enhancing the overall condition of their water and aquatic resources, the Division provides support to regional offices, networks, and the Washington office in addressing water resources issues facing the National Park Service. The WRD is part of the National Park Service Natural Resource Program Center and is located in Fort Collins, CO, with additional offices in Denver, CO, and Washington, D.C.

As you read this report, you will discover the incredible richness and diversity of water resources in the National Park system, and the variety and complexity of the water and aquatic resources issues confronted by our National Park managers. Oceans, desert springs, wetlands, lakes, streams, and reservoirs all contribute to the biological habitats, scenery, and recreation opportunities protected by the National Park System. It is with a sense of professionalism and commitment to parks that the Division provides leadership and expertise to activities as varied as the survival of the Devils Hole Pupfish, the protection of marine resources, the restoration of wetland resources, the protection of stream flows and park water quality, and the assessment of major events such as floods and hurricanes. In 2007, WRD formalized the establishment of a branch of ocean resources to bring much-needed leadership to and coordination of Natural Resource Program Center and NPS efforts to understand and protect park coastal and marine resources. The Division also will co-chair the newly created NPS Wild and Scenic Rivers Steering Committee established by the National Leadership Council to better coordinate NPS responsibilities under the Federal Wild and Scenic Rivers Act. Finally, I'd like to note the important efforts WRD has made through its planning and natural resource condition assessment programs to synthesize and insure that water and natural resource science is effectively delivered to park planning activities.

As we look forward, issues on the horizon such as global climate change, emerging aquatic contaminants, increasing demands for water supplies, and the rapid development of watersheds and aquifers external to parks will present challenges to the stewards of our National Parks. We are fortunate to have the expertise and leadership exemplified by the Division available to help our parks develop the knowledge and strategies needed to address these and many other important park water resources issues.

Comments from the Division Chief

Bill Jackson, Ph.D.

This the sixteenth consecutive annual report of the National Park Service Water Resources Division (Division), part of the National Park Service (NPS) Natural Resource Program Center. The report is a collaborative product of our entire staff and is prepared specifically for parks. It is intended to recount the many accomplishments achieved by the Division, parks, other NPS offices, and our partners, who are working together to address park water and aquatic resource issues. A sampling of some of these accomplishments is highlighted in the sidebar to this article.

We recently compiled some statistics on the water resources of the National Park system, and the results are pretty amazing. There are 84,271 miles of perennial rivers and streams in the National Park system, 2,261,274 acres of lakes and reservoirs, 32,576 miles of lake and reservoir shoreline, almost 2 million acres of ocean/marine resource, and 6,804 miles of ocean coastline. This enormous water resource base doesn't even include park wetlands (16 million acres, estimated), aquifers, springs, or intermittent water bodies, and it doesn't begin to convey the enormous variety of hydrologic and ecologic processes associated with these water resources. When you add to this the many challenges confronting our nation's water resources and the incredibly complex jurisdictional, legal, regulatory and policy framework within which water resources are protected and managed in this country, you begin to appreciate the challenges that parks face in trying to preserve or restore their waters. The goal of the Division is to assist parks in this mission.

The Division's base budget is currently $12.3 million. Over two-thirds of this total is passed through directly to parks, networks, regions, or cooperators to support park staffing or park-focused projects. Most of the remaining budget supports the Division staff, which is largely focused on providing park technical assistance and, to a lesser degree, on program management and accountability. The Division currently supports 15 park-based aquatic resource professionals, water quality monitoring activities in all 32 NPS monitoring networks, water resource and water rights protection projects in 18 parks, natural resource (including coastal resource) condition assessment projects in 42 parks, and water resource management projects in 25 parks. Significant accomplishments in all of these core program areas are highlighted in this annual report.

In addition to its base program, the Division is also administering four Servicewide 20% Fee Funding programs intended to enhance visitor experiences in parks (fish population restoration, instream structure removal and small stream restoration, estuarine wetland restoration, and marine recreational boater education). We cooperatively administer, with the U. S. Geological Survey (USGS) a $2.0 million annual program to support water quality assessment projects in parks; 35 park projects were supported through this partnership in 2007. We also work with the NPS Inventory and Monitoring Program to oversee acquisition of high-resolution national hydrography datasets for all parks, maintain a servicewide water quality database, and develop protocols and standards for submerged resource inventories. You will be reading about the accomplishments of these and other collaborative efforts in this report.

Looking to the future, the Division seeks to provide leadership to, or advocacy for, several

issues that historically have lacked adequate focus at the national level. We obtained approval from the Associate Director and Director to establish a Branch of Ocean and Coastal Resources. You will be reading about this new branch in this report. The Division also contributed to the establishment, by the NPS National Leadership Council, of an NPS Wild and Scenic Rivers Program and will co-chair the newly established NPS Wild and Scenic Rivers Steering Committee. Finally, as our agency becomes better engaged in understanding and responding to the many challenges that will stem from climate warming, the Division planning program is moving to coordinate with other divisions to increase the focus of our park planning assistance on climate change issues. We are also, through the USGS liaison to our division, looking for ways to enhance USGS climate science activities in parks–especially studies focused on the very significant effects to hydrologic regimes that are resulting, and will result, from climate warming.

These comments would not be complete without acknowledging two significant retirements from the Division and the National Park Service. Gary Davis retired October 1, 2007, after a 35 year career dedicated to knowing and preserving National Park ocean resources. Jim Tilmant retired December 31, 2007, after a 37 year career dedicated to conserving native park fish and aquatic resources. Both gentlemen made important and lasting contributions to the natural resources of the National Park system. Finally, I also want to acknowledge the retirement of Mike Soukup, the long-standing Associate Director for Natural Resource Stewardship and Science. Mike will be remembered as a visionary, a tireless advocate for the NPS natural resource preservation mission, and someone who oversaw a great increase in agency capacity to address its many natural and cultural resource issues. He, too, will be greatly missed.

Every year as our staff prepares this report, we gain perspective on the incredible variety and complexity of issues being confronted by parks, a renewed appreciation for how interesting and rewarding our work is, a reminder of how privileged we are to be applying our professions in support of the National Park system, and what a pleasure it is to work with the talented managers and resource specialists in parks.

As always, we appreciate your feedback and suggestions. We want to be as useful and relevant to parks as possible. And, while we take great pride in the talent and professionalism of our staff, we know there are things we can do better. We look forward to working with you in 2008.

Lower falls of the Yellowstone (Keteles, 2007)

Highlights of FY2007 Accomplishments Water Resources Division

- Completed the publication of *Water Resources Stewardship Reports* for Monocacy National Battlefield and Denali National Park and Preserve, a *Water Resources Foundation Report* for Ozark National Scenic Riverways, and a *Water Resources Information and Issues Overview Report* for Mississippi National River and Recreation Area.

- With the Biological Resources Management Division, provided leadership in organizing and technical support to the NPS Quagga Mussel Planning and Response Incident Command Team's development of a quagga mussel planning and response guide for parks.

- Provided leadership and technical support to the Devils Hole Pupfish recovery effort by representing NPS on the interagency Unified Command for the Devils Hole pupfish recovery.

- Organized and conducted the Eastern Rivers Summit Meeting, a workshop for all Eastern US river parks, to support improved protection and management of eastern park river resources. Participated on the task force that led to the establishment of a National Park Service Wild and Scenic Rivers Program.

- Completed four Settlement Agreements (two on behalf of Death Valley National Park, one on behalf of Chickasaw National Recreation Area, and one on behalf of Wind Cave National Park) that resolved issues related to water rights hearings in Nevada, Oklahoma, and South Dakota.

- Co-administered with USGS a water quality partnership program, resulting in the USGS funding 12 water quality assessment projects in parks in 2007 and approving funding for nine additional projects in 2008.

- Completed the acquisition of high-resolution National Hydrography Datasets for all National Parks; completed version 1.14 of NPSTORET, the NPS's primary software for managing water quality data; and updated and maintained a servicewide inventory of water body standards under the *Clean Water Act* (CWA) and an inventory of overall compliance of NPS waters with CWA standards.

- Established a Branch of Ocean and Coastal Resources and worked with the NPS Director on the announcement and coordination of a servicewide Ocean Park Stewardship Action Plan. As part of the development of these programs, re-established the NPS Ocean Park Task Force and supported development of regional ocean strategies.

- Coordinated interagency ocean programs and worked with the USGS Eastern Region to fund research on the effectiveness of the newly established Dry Tortugas Marine Research Natural Area.

OCEAN AND COASTAL RESOURCES BRANCH HIGHLIGHTS

Rebecca Beavers, Acting Chief, Ocean and Coastal Resources Branch

The Ocean and Coastal Resources Branch (OCRB) was formed within the Water Resources Division in February 2007. The Branch is responsible for leadership and coordination of NPS ocean responsibilities, policies, and interests in the Natural Resource Stewardship and Science Directorate.

On December 1, 2006, Director Mary Bomar released the Ocean Park Stewardship Action Plan, which was developed in consultation with park superintendents and the National Leadership Council. The Plan calls for heightening our organizational and scientific emphasis on managing over 6,804 miles of coast and more than three million acres of ocean and Great Lakes waters in the National Park system. The OCRB provides the initial organizational structure and focus for coordination within the NRPC and with parks, regional offices, the Submerged Resources Center, and other entities to meet servicewide goals for ocean and coastal resource stewardship.

Gary E. Davis, Visiting Chief Scientist for Ocean Programs, was appointed as the first Acting Branch Chief until October 2007 when Rebecca Beavers, Coastal Geology Coordinator in the Geologic Resources Division, assumed the next Acting Branch Chief detail. These Acting Branch Chiefs provided the necessary leadership in developing short and long-term strategies for enhancing the NPS scientific, technical, and organizational capacity for ocean and coastal resource stewardship. The goals of the Branch include: acquiring broad-based support in marine sciences and technologies, developing servicewide ocean policies and programs, and providing technical assistance and support to parks. The Branch works closely with the National Oceanic and Atmospheric Administration, the USGS, and other federal and state agencies, universities, and private partners. This function was identified as critical during our Spring 2007 Core Ops evaluation; we are able to meet this need with existing funds. Cliff McCreedy and Kristen Keteles were assigned to this branch from the Planning and Evaluation Branch. A search is underway for a permanent branch chief, and additional staff positions are planned as funding becomes available.

During 2007, OCRB staff provided a variety of servicewide and park specific technical assistance (Appendix A), coordinated multiple Coastal Watershed Assessment projects, coordinated two Recreation Fee Projects, and began development of Marine Inventory products, as described in separate articles. OCRB staff worked with the National Wildlife Refuge System and the National Oceanic and Atmospheric Administration (NOAA) to implement the Seamless Network of Ocean Parks, Wildlife Refuges, Estuarine Reserves and Marine Sanctuaries, another milestone achieved under the U.S. Ocean Action Plan. Significant accomplishments in 2007 under the Ocean Park Stewardship Action Plan included development of regional and park-specific action plans by the NPS Northeast and Southeast Regions. For example, the NPS cooperated with the State of Florida to establish the Research Natural Area (RNA) at Dry Tortugas National Park, a fully-protected, 46 square-mile marine reserve to restore and support research on species affected by fishing and loss of coral reef habitat. The RNA and the adjacent Tortugas Ecological Reserve in the NOAA Florida Keys National Marine Sanctuary now comprise the largest marine reserve in the continental United States (97 square miles). OCRB staff also worked with the USGS to establish a research program to evaluate marine reserves at Dry

Tortugas and the Virgin Islands National Parks, resulting in a $2.1 million commitment from USGS and the states. For more information, see http://www.nps.gov/pub_aff/oceans/conserve.htm and http://www.nature.nps.gov/water/marine.cfm.

We look forward to working with you to meet our ocean stewardship responsibilities in the parks.

Dolphins cavorting, Pu`uhonua o Hōnaunau National Historical Park (Haberfield, 2008)

Engaging Visitors in Conserving Ocean Parks

Cliff McCreedy, Marine Resource Management Specialist, Ocean and Coastal Resources Branch

The National Park System contains a rich legacy of ocean wildlife, maritime history, and beautiful landscapes where the land meets the water across 26 states and 5,100 miles of coast. Seventy-four parks attract 75 million visits annually to vibrant coral reefs, towering glaciers, remote beaches, and serene bays for fishing, diving, and wildlife viewing above and below the water. Given the right information and knowledge, recreational users are eager and equipped to protect the resources they enjoy. However, parks frequently lack detailed maps of park resources with locations of sensitive areas, while visitors lack boating skills and techniques for avoiding impacts to fragile resources. The result is unnecessary damage to park resources. Grounding a boat on a seagrass bed or coral reef, for example, results in a very bad day on the water and sometimes in a costly claim under the National Park System Resource Protection Act, or 19jj, to recover monetary damages for assessment and restoration of damaged habitats or aquatic life.

Visitor-focused programs are essential to avoiding boat groundings, wildlife disturbance, pollution, spread of invasive species, and other impacts. In 2006, WRD received approval for a five-year program designed to do just that, i.e., engage visitors and recreational groups to reduce and mitigate recreational impacts on marine resources. The Marine Recreational Stewardship Program is funded by visitor fees and modeled on efforts such as the Florida Bay Users Map and Guide at Everglades National Park and the Virgin Islands National Park mooring buoy program. Parks eligible

for 20 percent servicewide recreational fee monies are being targeted for educational partnerships, increased use of mooring buoys, signage, maps, and outreach to the recreational community.

Mooring buoys are an effective management tool for reducing anchor damage. In 2007, the WRD Ocean and Coastal Resources Branch (OCRB) provided funding to Biscayne National Park to develop a mooring buoy plan and environmental assessment and to purchase and install buoys. Dry Tortugas National Park recently adopted regulations for the Research Natural Area (RNA), a 46 square-mile management zone designed to restore fish communities and protect sensitive coral reefs by prohibiting fishing and anchoring. With funding from this program, the park published and disseminated a brochure and newsletter and will purchase and install mooring buoys in the RNA. Buck Island Reef National Monument will receive similar support for vessel management activities.

Fire Island National Seashore is utilizing these funds to publish a coloring book for kids on resource stewardship through safe and responsible boating. Education and outreach campaigns for other parks will target tour operators, boaters, kayakers, divers, and anglers. Media or interpretive tools will seek to minimize boating accidents, prevent exotic species introductions, reduce disturbance of marine mammals and shorebirds, promote catch and release and compliance with state fisheries management regulations, and encourage responsible diving and snorkeling techniques. OCRB and the Office of Outreach and Education invite your input into these plans.

Understanding the human dimension by characterizing local visitor use activities and attitudes will inform resource management planning, improve educational messages, and encourage compliance with park regulations. Working with NPS Visiting Chief Social Scientist James Gramann and Dr. David Loomis of the University of Massachusetts Human Dimensions of Marine and Coastal Ecosystems Program, OCRB is piloting studies of marine recreational use locations and patterns, and surveys of visitor attitudes, perceptions, and beliefs toward park resources and regulations at Dry Tortugas and Biscayne. Other parks will be selected for similar studies.

Deep scar dug by the propeller of a recreational boat on a seagrass bed, Biscayne National Park (McCreedy, 2001).

Finally, OCRB is working with the parks and the Reef Environmental Education Foundation to utilize volunteer scuba divers to conduct underwater fish surveys at Channel Islands, Biscayne and Dry Tortugas National Parks. These fish counts not only provide information on the status of fish populations, but they also connect recreational divers and snorkelers to their local parks and foster a stewardship ethic among the local recreational diving community.

OCRB is inviting input from 20-percent fee eligible parks to help identify additional projects. All of these efforts are designed to achieve a coordinated and integrated approach to reducing common recreational impacts and increasing visitor stewardship, an approach that can be transferred to other ocean and Great Lakes parks.

Coral head gouged by a recreational boat, Biscayne National Park (McCreedy, 2002). The blue paint was scraped off the hull.

For more information, contact Cliff McCreedy at 202-513-7164 or cliff_mccreedy@nps.gov.

Restoring Critical Estuarine Habitats at Coastal Parks

Kristen Keteles, Coastal Resources Analyst, Texas A&M University

The Oceans and Coastal Resources Branch received Recreational Fee Program funds beginning in 2007 to restore tidally influenced areas in coastal parks, including Channel Islands National Park (CHIS), Point Reyes National Seashore (PORE), Lewis and Clark National Historic Park (LEWI), Fire Island National Seashore (FIIS), and Cumberland Island National Seashore (CUIS). Estuarine communities exist where freshwater meets the ocean and are highly productive ecosystems that provide critical habitat to many species of shorebirds, waterfowl, fish, and invertebrates. However, historic land-use practices have greatly reduced the amount and quality of estuarine communities within the National Park system. Fragile estuarine habitats are easily damaged by the restriction of tidal and freshwater flow through the construction of dams, dikes, ditches, and other types of infrastructure. These structures alter the salinity regime and diminish the habitat suitability for estuarine organisms, resulting in a direct impact to the community composition. Furthermore, the restriction of tidal flow limits the exchange of nutrients and organisms with the marine environment, thereby affecting adjacent oceanic productivity and biodiversity. Extensive diking, filling, ditching, and channel dredging have eliminated or reduced this habitat type within and near many coastal parks.

This project is enabling parks to develop detailed estuarine wetland recovery plans, implement plans to restore estuarine habitat by facilitating tidal inundation, and provide scientific understanding for managing, restoring, and conserving

ecologically important marine systems. The conservation and restoration of these important ecosystems will provide habitat for fish and wildlife and increase recreational fishing and wildlife viewing opportunities for park visitors. In 2007, this program initiated restoration projects at PORE and CHIS. Restoration and rehabilitation of marsh and estuary habitats will restore the overall integrity and functioning of high value ecosystems within these parks and, ultimately, result in increased visitor enjoyment of park natural resources.

Parking lot at Kenneth Patrick Visitor Center, Point Reyes National Seashore (Keteles, 2007).

Point Reyes National Seashore has the unique opportunity to restore a coastal lagoon area near the Kenneth Patrick Visitor Center. Originally paved as part of a county park in the 1940s, the former coastal lagoon was completely filled when the parking lot was expanded in the 1960s. Recommendations from a scoping meeting included redesigning the parking lot and designating a portion of the currently paved area to be removed and restored to coastal marsh habitat.

Restoring a healthy, properly functioning tidal wetland and stream system at Prisoners Harbor in CHIS will enhance biodiversity for an increasingly rare and diminishing ecosystem in Southern California. Anthropogenic alterations have caused the near elimination of the largest tidal wetland ecosystem on Santa Cruz Island. This has negatively affected ecological processes that are crucial for regaining and sustaining aquatic (marine and freshwater) and terrestrial biodiversity for this vital ecosystem. In 2007, hydraulic modeling was completed, a draft conceptual design was developed, and meetings were conducted for interested individuals, organizations, and agencies. The Coastal Conservancy has designated this project as a high funding priority and is likely to contribute additional funds to this project.

Prisoners Harbor, Channel Islands National Park (Keteles, 2007).

Initial Steps for a Marine Inventory

Rebecca Beavers, Acting Chief, Ocean and Coastal Resources Branch

While the Inventory and Monitoring Advisory Committee clarified in December 2006 that the initial 12 inventories are "terrestrial" inventories, the inventory program recognized that one shortcoming of this designation is non-inclusion of more than three million acres of submerged habitat from the current inventory program. While the Soils and Vegetation Inventories have funded additional efforts for Submerged Soils and Subaquatic Vegetation Mapping, the Geologic Resource Evaluation has tried to seamlessly incorporate the complete marine component in the geologic inventory product for each park. Acknowledging the different methods and techniques required to map in submerged environments versus terrestrial environments, the Inventory Program previously committed to funding a pilot study in the Northeast Region in 2006.

In 2007, an interdisciplinary group of Water Resources Division and Geologic Resources Division staff led by Jim Tilmant created a "Servicewide Marine Benthic Habitat Mapping: Program Implementation Plan." Building upon this plan, $250,000 of FY2007 funds were allocated by the Inventory Program to facilitate greater focus and provide foundation materials for a future Marine Inventory. Using these funds, an Interagency Agreement with the USGS was signed in September 2007 with Jim Tilmant and Rebecca Beavers as Agreement Technical Representatives. This Interagency Agreement has three components:

1. USGS will convene a workshop entitled: "Enabling Technologies and Classification Protocols for a NPS Coastal and Marine Benthic Habitat Mapping Program." Representatives from NPS, USGS, NOAA, and other partners will be invited to this workshop, which will occur during 2008. Outcomes of this workshop will include an Open File Report containing the information presented and a list of recommendations for the establishment of an NPS benthic habitat mapping program.

2. The second deliverable will be a USGS Open File Report that details the recommended mapping technologies, national classification scheme, and verification standards to be used within the marine mapping program.

3. A pilot gap analysis of existing park map products, source imagery, and other data for three representative park units (that identifies the needed map products, satellite/aerial imagery, and vessel surveys) will be delivered as a report to the NPS in March 2009.

The work under this Interagency Agreement will provide a base layer for compiling many future marine data products and investigations. This funding from the Inventory Program represents the first step towards designing and conducting inventories of the marine environment in NPS ocean parks. In December 2007, the Inventory and Monitoring Advisory Committee made a further commitment of $500,000 for each of the next five years toward further developing a Marine Inventory Program and providing products that meet ocean park needs.

PLANNING AND EVALUATION BRANCH HIGHLIGHTS

Mark Flora, Chief, Planning and Evaluation Branch

Planning and Evaluation Branch (PEB) activities in FY2007 were focused upon expanding our efforts in implementing a new suite of water resources planning products that better respond to needs created by the new Park Program Planning Standards; providing servicewide policy and guidance for the protection of NPS wetlands and fisheries resources; providing programmatic oversight and funding accountability for WRD and NRPC-funded projects; and providing direct support to NPS units in the areas of water resources planning, wetlands restoration, and fisheries restoration and management.

In FY2007, the PEB's planning program completed the publication of several prototypes of new water-related planning products designed to better support planning needs brought forward by the new Park Program Planning Standards and the initiation of "pilot" efforts for the development of Resource Stewardship Strategies.

*Water Resources Stewardship Report*s were completed at Monocacy National Battlefield and Denali National Park and Preserve. This new report type provides the park with information needed for the development of the park's *Resource Stewardship Strategies* (RSS). The *Monocacy National Battlefield Water Resources Stewardship Report* (see accompanying "highlights" article) provides support to the planning process by synthesizing available information pertaining to the current condition of the park's water-related resources, identifying stressors influencing the current condition within the park's aquatic environment, providing "target values" for key ecosystem indicators reflective of the park's desired conditions, and outlining strategies that could be considered in order to move toward these desired conditions.

In addition, a *Water Resources Foundation Report* was completed for the Ozark National Scenic Riverways in support of the development of the park's General Management Plan and a Water Resources Information and Issues Overview was completed for Mississippi National River and Recreation Area to assist the park in better understanding the challenges of managing this important resource within the complexities of a highly urbanized environment.

During the year, the PEB's Wetlands Protection Program provided extensive support to the field pertaining to wetlands regulatory issues, wetland condition and functional assessment, and wetlands restoration. In the regulatory arena, PEB wetlands specialists worked closely with Wrangell-St. Elias National Park and Preserve and the Alaska Regional Office to assure that permits for hundreds of in-holder access routes are in compliance with NPS wetland protection policies and procedures. PEB wetlands specialists also worked closely with Big Thicket National Preserve, Padre Island National Seashore, and Lake Meredith National Recreation Area to assure appropriate wetlands compliance was undertaken as part of a significant increase in proposed oil and gas-related activities within these units.

The Wetlands Protection Program also provided technical assistance to National Capital Parks-East in developing a wetlands management plan for several large, emergent, wetland complexes along the Anacostia River, provided design support and construction oversight for the Upper Halstead Meadow restoration project in Sequoia National Park (see accompanying "highlights" article), and assisted in the development of conceptual design alternatives for the proposed Prisoners Harbor wetland restoration project in Channel Islands National Park.

In FY2007, PEB's Fisheries Management Program provided technical assistance to more than 15 parks and regional offices, including involvement in such high profile issues as the management of the Devil's Hole pupfish at Death Valley National Park, the potential impacts upon fisheries resources of a proposed liquefied natural gas (LNG) off-loading facility on the Tauton River, responding to the introduction of the invasive quagga mussel in Lake Mead, the restoration of sea-run fish access to the streams and rivers of Acadia National Park, and the restoration of native greenback cutthroat trout in Rocky Mountain National Park.

I am also pleased to report that in FY2007 the Fisheries Management Program received funding to initiate a new five-year program of native fish and fish habitat restoration within low-fee collection parks under the Servicewide 20% Fee Funding Program (see accompanying "highlights" article). With the availability of this new funding, restoration activities are being initiated at Pictured Rocks National Lakeshore, North Cascades National Park, Big South Fork National River and Recreation Area, Point Reyes National Seashore, Santa Monica Mountains National Recreation Area, and Capitol Reef National Park. Additional fisheries restoration projects will be solicited for funding in subsequent years.

In February 2007, WRD established a new branch to focus specifically upon coastal and marine resource issues. At that time, programmatic responsibility for several coastal and marine related functions, including the completion of coastal water resource assessments were transferred from PEB to the newly commissioned branch. However, the PEB has been pleased to continue to provide support to the new branch by providing technical review of draft coastal water resource assessments, technical assistance in the conceptualization and development of study plans for a new five-year program of estuarine ecosystem restoration, and guidance in the development of a servicewide marine resource mapping proposal.

During the course of FY2007, PEB staff has provided programmatic oversight, technical review, and guidance for 68 active WRD or NRPC funded projects totaling over seven million dollars of multi-year Natural Resource Challenge funding; provided technical advice, policy review, and regulatory review for 25 wetlands statement of findings / wetland compliance reviews; provided servicewide review and comment on six EIS/EA environmental compliance documents; and provided policy review of the water-related aspects of 10 NPS planning documents, including General Management Plans, Special Resource Studies, and other planning studies.

PEB staff members are also proud of the numerous opportunities we have had during this year to directly serve parks by providing technical support at the request of regional, network, and park staffs. In FY2007, the PEB provided project oversight and/or technical assistance to all seven NPS regional offices, three Inventory & Monitoring Program Network offices, and 97 individual units of the National Park system. The Planning and Evaluation Branch is proud to be part of the National Park Service and looks forward to being of continued service to the units of the National Park system throughout FY2008!

Life after the General Management Plan: Resource Stewardship Strategy

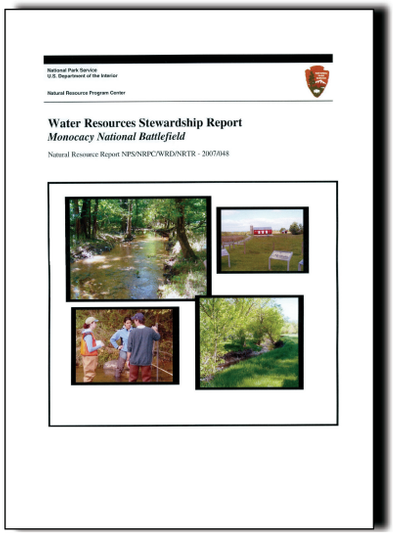
Don Weeks, Hydrologist, Planning and Evaluation Branch

Starting in 2006, a few parks were selected to tackle their first *Resource Stewardship Strategy* (RSS), the next resources planning element after the *General Management Plan*. The RSS recommends strategies for achieving the desired conditions for "fundamental" or "other important" park resources and values identified in the General Management Plan, with measurable or objective indicators that assess the degree to which the desired conditions are being achieved.

With the 2004 *Park Planning Program Standards*, draft *Director's Order 2.1 (Resource Stewardship Strategy)*, and draft *NPS Midwest Region Resource Stewardship Strategy Planner's Manual* as guidance, a variety of interpretations have evolved through the first completed RSS products. The RSS is where science and park management come together, providing appropriate management direction based on the scientific understanding of priority park resources. Parks have requested assistance from the various natural resource divisions within the Natural Resource Program Center (NRPC) as they work through the RSS process to quantify desired conditions for natural resources.

In response, the NPS Water Resources Division (WRD) has developed a planning product supporting the RSS–the *Water Resources Stewardship Report*. Two of these reports were completed in 2007 (Denali National Park and Preserve and Monocacy National Battlefield). The Monocacy National Battlefield (MONO) *Water Resources Stewardship Report* builds from lessons learned in the earlier Denali report, and represents WRD's latest thoughts on RSS support.

In the national battlefield's *General Management Plan*, the Monocacy River was identified as a "fundamental resource", with all other water resources (ponds, springs, wetlands, etc.) identified as "other important" resources. The MONO *Water Resources Stewardship Report* focused on these fundamental and important resources and included: 1) water resource indicators that serve as "barometers of health" for aquatic systems at Monocacy, with respective target values, 2) assessment of Monocacy's current water resource conditions, 3) identification of stressors influencing the national battlefield's aquatic environments, and 4) identification of strategies that move Monocacy's water resources toward the desired condition.


National Park Service
U.S. Department of the Interior

Natural Resource Program Center

Water Resources Stewardship Report
Monocacy National Battlefield

Natural Resource Report NPS/NRPC/WRD/NRTR - 2007/048

The MONO *Water Resources Stewardship Report* was recommended by the Northeast Region Chief Scientist as an "outline, guide and model" for preparing future RSS reports in the region. WRD staff have been invited to the Northeast Region Natural Resources Workshop in 2008 to participate on a RSS panel, presenting the MONO report as a case study example.

In 2007, the NPS Geologic Resources Division (GRD) teamed with the WRD to prepare

a multidiscipline *Physical Resources Stewardship Report* for Guadalupe Mountains National Park (GUMO), following the MONO example. Working with the NPS Denver Service Center, GUMO, and Intermountain Region staff, GRD and WRD (with some assistance from the NPS Air Resources Division) will address water, geologic, and air resources for the park's RSS.

GUMO Resource Stewardship Strategy Workshop (Weeks, 2007).

Ultimately, the objective in the near future is to develop a comprehensive natural resources product that pulls from all divisions in the NRPC to support the RSS process. This is currently under consideration through the Natural Resources Planning Technical Advisory Group of the NRPC.

Pilot Wet Meadow Restoration Underway at Halstead Meadow, Sequoia National Park

Joel Wagner, Wetland Program Leader, Planning and Evaluation Branch
Athena Demetry, Restoration Ecologist, Sequoia-Kings Canyon National Parks
David Cooper, Senior Research Scientist, Colorado State University
Evan Wolf, Research Associate, Colorado State University

Restoring damaged wetlands is never routine. Each site has a unique set of conditions, technical problems, and constraints to understand and address. Such challenges are abundant at Halstead Meadow, an artificially drained, 25 acre wet meadow in Sequoia National Park. This article describes a pilot meadow restoration approach that, if successful, can be a model for restoring similarly degraded wetlands in national parks.

Each year, thousands of visitors pass through Halstead Meadow as they drive the Generals Highway toward the park's famous giant sequoia groves. Montane wet meadows are rare in the park, occurring where hillslope runoff meets relatively level valley floors. Their productive vegetation, deep soils, and sheetflow characteristics help attenuate floodwaters, control erosion, maintain baseflows downstream, and sequester carbon. They also provide critical habitat for plants and animals and offer scenic beauty and recreational opportunities for visitors.

Unfortunately, this meadow has developed deep gullies that have degraded at least 12 wetland acres. Channel incision likely started early in the 20th century when livestock stripped away dense wetland vegetation. Damage intensified in 1934 when the highway was built across the meadow and water was directed through culverts under the fill.

A headcut began propagating upstream and channelization occurred downstream. By 2005, the main gully was 2000 feet long, up to 15 feet deep, and up to 85 feet wide. The incised channels lowered the water table, dried wetland soils, altered vegetation communities, allowed invasion by burrowing mammals, and curtailed wetland functions.

In 2005, Colorado State University cooperators analyzed hydrology, vegetation, topography, and soils in Halstead Meadow and five nearby, relatively undisturbed, reference meadows. This study identified key characteristics of intact meadows and helped us develop restoration concepts. We recognized the need to backfill and revegetate the gullies, raise the water table, and reestablish sheetflow, but also knew we would fail unless a critical problem, concentration of flow into culverts, was resolved. Fortunately, the highway is scheduled for renovation in 2010, and FHWA engineers agreed to replace the fill and culverts with a bridge to promote sheetflow restoration.

By 2006, we were ready to conduct a pilot restoration in the Upper Halstead Meadow north of the Generals Highway. We had completed construction specifications and had awarded contracts for earthmoving, revegetation, and assessment. The idea was to test our restoration methods in the upper meadow, learn from that experience, and restore the entire meadow once the bridge is built.

Earthmoving began in September 2007. Contractors diverted water from the gullies and then placed and compacted 8,100 CY of fill in one-foot lifts. Next, we had them carefully level the fill across the meadow to create flat cross-sections and discourage channelization. Biodegradable erosion control blankets were applied over bare fill to prevent rilling until vegetation can be reestablished. Trees were then cut and laid across meadow contours to help spread the newly restored surface flow and prevent channel formation. Water was released back into the upper meadow in late September and is spreading and sheetflowing as planned. A temporary structure just above the road is collecting sheetflow and directing it through the existing culverts until the bridge is built. In 2008, more than 53,000 wetland plants will be installed and monitoring will begin.

Channel incision has severely degraded wetland hydrology, soil, and vegetation functions at Halstead Meadow (Wagner, 2005).

Grades were checked constantly during construction to make sure that cross-sections were flat (Wagner, 2007).

Once construction was finished, water was released into the upper meadow and is spreading and sheetflowing as designed (Wagner, 2007).

Functional Assessment and Historical Analysis of Crockett Lake, Ebey's Landing National Historical Reserve

Kevin F. Noon, Ph.D., Wetland Scientist
Planning and Evaluation Branch

Crockett Lake – What conditions can be restored, or what conditions should be restored? Crockett Lake is a 600-acre natural resource in Ebey's Landing National Historical Reserve, located on Whidbey Island in Puget Sound. Since the park's establishment in 1978, speculations about the lake's restoration potential have been circulating without any source of rigorous justification. Several state and local resource protection agencies and non-profits have published numerous descriptions of what the lake should be, including an intertidal pocket estuary, a freshwater lake, and a brackish nearshore habitat. The park is essentially a consortium of several hundred land owner stakeholders, including Washington State Parks and the National Park Service, represented by a board of trustees, and as you might expect, a few surrounding lake land owners have their own restoration objectives, such as providing constant water levels for canoeing access and guaranteed protection of their septic fields.

WRD staff was asked to help park staff produce analysis-based and defensible information about pre-settlement conditions of the lake, anthropogenic induced changes that have occurred, and what type of habitat can be restored given current conditions and stakeholder concerns. WRD staff managed contractors in the preparation of a report that documented the results of a functional assessment and historical analysis of Crockett Lake. To characterize the ecological health of Crockett Lake, the contractors assessed the geomorphic and ecological state of the lake and how historic alterations have led to current conditions. Comparisons were made between physical and ecological functions provided at Crockett Lake and two nearby reference site coastal wetlands.

View of tidal gate channel and Crockett Lake, Ebey's Landing National Historical Reserve (Noon, 2007).

The study concluded that Crockett Lake is currently a saline lagoon with managed water levels and some minor, artificial, tide-gate estuarine exchange near its east end. Prior to development, Crockett Lake did not have a regular tidal connection to Admiralty Bay. The fault line adjacent to the lake slipped during an earthquake approximately 3,200 years ago, which elevated the lake area 1 to 2 meters. The shift produced an isolated brackish lagoon that is inundated by seawater only during extreme events. Since then, Crockett Lake's physical and biological functions have been limited by the lack of regular tidal exchange with marine waters; lack of woody debris and other organic inputs; surrounding land uses; and hydrologic alterations including ditches, culverts, and roads. In addition, invasive species encroachment is a significant and growing challenge within the lake.

What conditions should be restored? The physical and biological conditions of the lake and shoreline can be modified to cre-

ate intertidal exchange and allow fish access for spawning, feeding, and rearing, but at prohibitive financial expense. Therefore, the question becomes: What conditions can be restored? Since the currently maintained hydrologic conditions are similar to pre-European settlement conditions, the best options are: to acquire surrounding properties to protect remnant forest patches that contribute to the biological functioning of the lake system, to remove invasive species infestations, and to enhance biological functionality by adding woody debris that would have accumulated naturally over time.

Admiralty Inlet beachhead adjacent to Crockett Lake, Ebey's Landing National Historical Reserve (Noon, 2007).

Man-made drainage channel within the Crockett Lake wetland, Ebey's Landing National Historical Reserve (Noon, 2007).

Zebra Mussels Arrive in the West: A New Threat to NPS Aquatic Resources

John Wullschleger, Fisheries Biologist, Planning and Evaluation Branch

In January 2007, zebra mussels, originally believed to be *Dreissena polymorpha* but subsequently determined to be *D. rostriformis bugensis*, were discovered in a marina in Lake Mead National Recreation Area (LAME). Zebra mussels, which are native to Eurasia, have spread throughout the Great Lakes region and much of the eastern United States, resulting in damage to submerged infrastructure, increased maintenance requirements for water delivery systems, adverse impacts to boats and recreational boating, and disruption of aquatic ecosystems. The expansion of zebra mussels into the western U.S. has been slower, impeded by the arid climate and relatively large distance between waterbodies.

LAME responded to the detection of mussels by establishing an incident management team and developing a response plan that drew on expertise from within NPS, other federal and state agencies, and academia. Important components of the plan, which is now being implemented, include a boat inspection and cleaning program and monitoring to assess population trends and ecological impacts. Eradication was determined to be infeasible at this time due to the advanced state of the infestation; surveys found that mussels had established colonies throughout the Boulder Basin (area adjacent to Hoover Dam) with the sizes of some individual mussels indicating that they had been present for at least three years. In addition, mussels were found downstream in Lake Mojave and outside the National Recreation Area in Lake Havasu and the lower Colorado River.

The establishment of a reproducing zebra

mussel population in LAME is a sign that the potential for introduction to other western waters, including those managed by the National Park Service, is greater now than it has been in the past. Specifically, risk has increased for the following reasons:

1. Large numbers of boats are moved by trailer between LAME and other waters, especially western waters. The high volume of boat traffic and the large number of access points (many uncontrolled) within the National Recreation Area make it unlikely that every boat that is contaminated with mussels will be identified and cleaned.

2. It is now believed that mussels were present in Lake Mead for three years prior to detection. Thus, it is possible that mussels were transferred from Lake Mead to other waters even before their presence was discovered and an inspection program was in place. If this has occurred, mussels may eventually establish reproducing populations in these other waters, which may, in turn, serve as sources for further introductions.

3. During 2007, larval drift expanded the range of mussels downstream from LAME and Lake Havasu into the lower Colorado River and major aqueducts that conduct water into reservoirs in Arizona and California. The colonization of additional mainstem and off-channel impoundments increases the potential for additional boats to become contaminated and serve as vectors of introduction to waters outside the Colorado River system.

Recognizing the risk to western parks, the Water Resources and Biological Resources Management Divisions hosted a national incident command system (ICS) team charged with developing a servicewide zebra / quagga mussel prevention and response plan. The team and a group of subject matter experts produced a plan that builds on the experience of LAME and an ongoing prevention and monitoring effort at Lake Powell. It includes guidelines for risk assessment, early detection monitoring, public outreach and education, and emergency response. Staff from NPS units with aquatic resources are encouraged to download the plan via the Inside NPS intranet site, and complete the risk assessment. Units with at-risk aquatic resources should use the plan as a resource to develop prevention and detection monitoring programs.

Mussels (D. r. bugensis) netted from a raceway in the Lake Mead Fish Hatchery (Wullschleger, 2007). The Nevada Department of Wildlife is in the process of eradicating mussels and retrofitting intakes to prevent future invasions.

A National ICS Team and group of subject matter experts developed a zebra / quagga mussel prevention and response plan (Wullschleger, 2007).

Zebra / Quagga Mussel Resources and Contacts:

Quagga / Zebra Mussel Infestation Prevention and Response Planning Guide at the public web site http://www.nature.nps.gov/biology/Quagga/index.cfm or theNPS intranet site http://www1.nrintra.nps.gov/wrd/Quagga/index.cfm.

100th Meridian Initiative at http://www.100thmeridian.org/

Water Resources Division: John Wullschleger, 970-225-3572

Biological Resources Management Division: Linda Drees, 970-225-3595

Five-Year Native Fish and Mussel Habitat and Populations Improvement Program for Low-Fee Parks

Jeff Wagner, Fisheries Technician, Planning and Evaluation Branch
Jim Tilmant, Fisheries Program Leader, Planning and Evaluation Branch

While often unseen, native fish and mussels play an important role in preserving the natural ecosystems of National Parks, yet these resources are often imperiled. To help preserve native fish diversity servicewide, the Water Resources Division has instituted a new native fish and mussel habitat and population restoration program directed at twenty-percent fee eligible parks. The goals of this program are to improve populations of native species and the opportunity for park visitors to enjoy these resources by improving habitat, removing non-native fish, and/or reintroducing native species where they have been extirpated.

Six parks were selected for funding in 2007, and more projects will be accepted in 2008-2010 based on funding availability. Two projects initiated involve removal or reduction of non-native trout and salmon. At Pictured Rocks National Lakeshore (PIRO), coaster brook trout are a part of the park's natural heritage, and preserving populations of these fish is an essential part of maintaining the park's natural diversity. A project to restore coaster brook trout populations at PIRO involves removal of non-native steelhead and salmon to allow for coaster brook trout population expansion. At North Cascades National Park, a project was initiated to reduce non-native trout populations in several of the park's high mountain lakes. Many of these lakes were historically fishless but were stocked with trout over the last 100 years

to provide for recreational fishing. Some of these lakes have become over-populated with fish, and the park plans to remove or reduce populations over the next three years. The project will improve the quality of fishing as well as reduce impacts to native macroinvertebrates and the long-toed salamander.

Sevenmile Creek, Pictured Rocks National Lakeshore,(Tilmant, 2007).

Non-native plants are impacting riparian and native fish habitat at several parks and two projects were selected to address this issue. These projects will benefit coho salmon at Point Reyes National Seashore and steelhead at Santa Monica Mountains National Recreation Area by removal of non-native vegetation, allowing native riparian species to revegetate. This will restore stream shading, improve spawning and juvenile habitat, increase bank stabilization, and provide visitors with a more natural park experience.

A stream in Zuma Canyon, Santa Monica National Recreation Area, at low flow (Wagner, 2007).

Historic patterns of visitor use can harm native aquatic populations, and often, a unique solution may be required. For example, a river crossing often used by equestrian visitors at Big South Fork National River and Recreation Area has become impacted by years of use, making stream crossing difficult and reducing habitat available for native freshwater mussels. To maintain the diversity of mussels and to preserve the well known trail, the park began a project to restore slab rock into a riffle area at the crossing. This will allow trail access while leaving mussels and fish unharmed.

Stream crossing undergoing repair, Big South Fork National River and Recreation Area (Bakaletz, 2006).

At times, the populations in question are often overlooked but play an important role in the parks unique flora and fauna. This is the case at Capitol Reef National Park where the park has initiated a project to restore roundtail chub to the Fremont River. Roundtail chub are one of several species that are an important part of the native fish fauna of the Colorado and Rio Grande River Basins. They once were prolific in river mainstems as well as small tributaries like the Fremont River. This project involves removing young of year from the Escalante River and repopulating the Fremont River for a period of two years.

Fremont River roundtail chub reintroduction site, Capitol Reef National Park (Wagner 2007).

All of these projects contribute to the National Park Service goal of improving visitor experience with fee funded projects by restoring natural habitats and the aquatic diversity that visitors will have an opportunity to see and enjoy.

WATER OPERATIONS BRANCH HIGHLIGHTS

Gary W. Rosenlieb, Chief, Water Operations Branch

Successfully competing and obtaining funding for a new watershed restoration stream obstruction removal program; providing innovative work in defining and identifying unique restoration strategies; wrapping up a major phase of one of the 12 servicewide inventory themes; and receiving national recognition of NPS water monitoring programs with other agencies topped our the Water Operations Branch (WOB) accomplishments in 2007.

In the restoration arena, WOB established program guidelines and initiated restoration planning on eight park projects that received funding from the Servicewide 20% Fee Funding Program to conduct native fish restoration, habitat restoration, and stream obstruction removal projects within 20% fee eligible parks. These projects will result in 1) enhanced opportunities for recreational fishing, wildlife viewing, or visitor enjoyment of the aquatic resources restored, 2) reduced maintenance costs, 3) reduced risk to visitor safety, and 4) provide restoration interpretation and education opportunities. Five of the eight accompanying articles detail WOB's contributions to several park restoration surface- and ground-water restoration issues. Larry Martin provides a summary of a ground-water analysis that answers critical questions related to the challenging coastal restoration effort on the Herring River estuary at Cape Cod National Seashore. Pete Penoyer describes how monitoring is laying the ground work for tough restoration questions for a sediment-contaminated aquifer in Yellowstone National Park. Gary Smillie and Mike Martin summarize restoration challenges for erosion and sedimentation problems below a bridge on the South Fork Kings River at Sequoia and Kings Canyon National Parks and for a lotic system at Effigy Mounds National Monument. WOB also provided support to the Burned Area Emergency Response program this year, and Rick Inglis describes his use of watershed models for restoration efforts on the Dakota Hills Complex Fire at Zion National Park.

WOB's Information and Data Management Program achieved a key water resource inventory goal by completing the acquisition of high-resolution, 1:24,000-scale (1:63,360-scale in Alaska) National Hydrograph Dataset (NHD) for every national park unit. As described in the attached article by Dr. Dean Tucker, NHD will provide a valuable cartographic and hydrologic modeling tool for parks to address management issues. NPSTORET continues to be deployed and has brought national and international recognition to WRD and the NRPC. At the recommendation of the USGS, the Northwest Indian Fisheries Commission is looking at adapting NPSTORET to meet their needs. Dr. Tucker also provided support to the U.S. Agency for International Development's effort to assist Pakistan in developing water quality database management systems.

The WOB Water Quality Program continued to provide programmatic and technical support to the Water Quality Vital Signs Monitoring Programs by reviewing and approving water quality monitoring protocols for the Northern Colorado Plateau Network and the North Coast and Cascades Network. In addition, the efforts of the servicewide program are being coordinated with the National Monitoring Network through the National Water Quality Monitoring Council (NWQMC). Barry Long serves as the NPS representative on the councils and describes key areas of cooperation that are occurring between the EPA and the NPS in his two articles. Through the NWQMC, the NPS will be one of the sponsors of the 2008 National Water Quality Monitoring Conference

at Atlantic City, NJ, where several network abstracts on our monitoring efforts have been accepted for presentation.

The branch continued to provide technical assistance on a myriad of hydrology and water quality issues. A complete listing of the assistance is provided in Appendix A. A summary of our accomplishments in major program areas includes:

Provided assistance and review for 15 Floodplain Statement of Findings.

Provided hydrogeologic analyses and advice on well construction and ground-water management to 23 parks to help them meet their demand for potable water supplies for visitors and staff and to reduce the impacts of ground-water pumping on key park resources.

Successfully implemented the NPS-USGS Water Quality Partnership Program as part of the Clean Water Action Plan funded by Congress by selecting and funding nine proposals for implementation in FY2008.

Continued to provide assistance with contaminant cleanup efforts at Yellowstone National Park where the branch worked with the State of Montana to install ground-water monitoring wells at the proposed site of a State of Montana repository for the McLaren Mine tailings. The branch also provided assistance with a contaminants and water quality assessment for oil and gas contamination and CERCLA site investigations at Big Thicket National Preserve and Indiana Dunes National Lakeshore.

Through an Interagency Agreement, facilitated the three-month detail of an Environmental Scientist intern from the EPA to work with WRD on duties that increase her understanding of the National Park Service's role in carrying out the goals of the *Clean Water Act*.

I will conclude by saying that we enjoy our work in support of the professional resource managers and park management, and we are always here to support you through a phone call, email, or a visit to the park on the complex water resources management issues.

Assessment of Potential for Saltwater Intrusion in the Herring River Basin, Cape Cod National Seashore

Larry Martin, Hydrogeologist, Water Operations Branch
John Portnoy, Ecologist, Cape Cod National Seashore

The Herring River is the largest estuary on outer Cape Cod. It stretches four miles from its headwater kettle ponds in north Wellfleet, MA, to its mouth at Wellfleet Harbor. The River's floodplain encompasses more than 1,100 acres of degraded wetlands. Construction of a dike across the mouth of the Herring River in 1909 greatly reduced tidal flow of salt water into the estuary. In addition to impeding tidal flow, the change from natural hydrologic conditions upsets the normal biogeochemical cycling, causing surface-water acidification, eutrophication, and oxygen stress, all of which severely degrade estuarine biota.

Cape Cod National Seashore, the Town of Wellfleet, the Massachusetts Coastal Zone Management Wetland Restoration Program, the National Oceanic and Atmospheric Administration Restoration Center, the US Fish and Wildlife Service, and the Natural Resource Conservation Service are collaborating on a plan to restore tidal flow to the Herring River Basin. One of the issues of concern is the potential for saltwater from tidal flow to adversely impact the water quality of private, domestic wells on property adjacent to the floodplain of the Herring River system.

In 2006-07, we evaluated the potential for saltwater intrusion and identified those wells that might be affected by restoration of tidal flow to the Herring River basin. The best indicator of the potential for saltwater intrusion is by comparison with similar areas on Cape Cod. There are numerous developed areas adjacent to streams with natural tidal flow. Many of these areas have private, domestic wells producing good quality water from wells very near areas that are flooded at high tide. Reconnaissance of these areas led to the conclusion that unless the land surface at the wellhead is flooded at high tide, it will likely be unaffected by tidal flow. The well will continue to produce good quality water.

The location of private, domestic wells on property adjacent to potential tidelands throughout the Herring River basin was determined from examination of Assessors' Atlas maps, information on file at the Truro and Wellfleet Health Departments, and field inspections of individual properties. Wells that were located more than a few tens of feet horizontally and at an elevation more than a few feet higher than potentially flooded areas were deemed to be beyond the area of potential impact from tidal flooding.

Among more than 100 properties adjacent to the floodplain, we identified only seven private, domestic wells that would likely be affected by saltwater intrusion after restoration of tidal flow. Efforts are ongoing to identify mitigation alternatives for these wells.

Dike across the mouth of the Herring River (Herring River Technical Committee, 2007).

Accelerated Natural Processes and Threatened Habitats, Effigy Mounds National Monument

Michael Martin, Hydrologist, Water Operations Branch
Joel Wagner, Wetlands Specialist, Planning and Evaluation Branch

Founders Pond, a 40-acre wetland complex located in Effigy Mounds National Monument on a low terrace of the Yellow River, has experienced a dramatic increase in sedimentation in recent history. This pond receives fine grained sediment from occasional overbank flows of the Yellow River and periodic input of much coarser material from an ephemeral drainage emanating in the adjacent highlands. Based on recent sediment cores, the sedimentation rate has increased as much as an order of magnitude (from about 0.1 cm/year to over 1.0 cm/year) over the last hundred and fifty years. This increase in sedimentation, likely the result of widespread agriculture that came with European settlement, is of great concern to the health and existence of Founders Pond. Even a few inches of elevation change due to sediment accumulation could cause the conversion or loss of these valuable wetlands. Furthermore, the alluvial fan formed by the ephemeral drainage is encroaching on the pond margin, episodically reducing the area of the pond. Under present conditions, this valuable habitat could be severely compromised within a few decades.

Founders Pond looking east with the alluvial fan encroachment to the right side of the photo (NPS, 2007).

This wetland complex provides exceptionally high value habitat for fish and wildlife, including migratory and resident waterfowl, wading birds, songbirds, raptors, fish, mammals, and amphibians. The value of this protected wetland complex is magnified because of the tremendous loss of wetlands in Iowa since the mid-1800s (Bishop and Van der Valk, 1982; Dahl, 1990).

Park staff is compelled to evaluate management options that could extend the life of this rare habitat type. Reducing the amount of sediment delivered from the source is not a possibility, as most of the watershed is outside of the park. However, diversion of the intermittent stream appears to be a treatment that would be both fairly easy to accomplish, and very effective in reducing the sediment load to Founders Pond.

The likely point of diversion would be near the apex of the alluvial fan formed by the drainage and, therefore, would fit well within natural geomorphic processes. In fact, an intense thunderstorm in July 2007 resulted in a temporary diversion at that location. During the flow event, a large amount of cobble and boulder sediment was deposited in the channel at the upper end of the fan. For at least a time, a great deal of the flow was directed to a relatively low area on the floodplain, away from Founders Pond. Before the channel could completely avulse and form a new alignment, enough woody debris collected in the standing timber to re-direct flow back to

the original channel. Nevertheless, this event was a strong indication that favorable conditions exist for diverting the creek. A well designed and relatively small diversion constructed with local alluvium could be an effective option for re-directing sediment away from Founders Pond, substantially extending the life of this valuable resource.

References:
Bishop, R.A. and A. Van der Valk. 1982. Chapter 9: Wetlands in Iowa's Natural Heritage. Iowa Natural Heritage Foundation and the Iowa Academy of Science.

Dahl, Thomas E. 1990. Wetlands losses in the United States 1780's to 1980's. U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. 13 pp.

Parks Waters as Reference Sites for National Water Quality Assessments

Barry Long, Hydrologist
Water Operations Branch

The U.S. Congress enacted the Clean Water Act (CWA) in 1972 to protect the nation's vital water resources. The Act calls for periodic reporting to Congress and the public on the success or failure of efforts to protect and restore the nation's waters. A number of groups questioned whether the Environmental Protection Agency (EPA) and state environmental agencies have provided adequate information regarding the condition of the nation's waters and prompted the Government Accounting Office to issue a report in 2000, noting that EPA and the states could not make statistically valid references about water quality and lacked data to support management decisions. Subsequent reports from the National Resources Council, the National Academy of Public Administration, and the John Heinz Center issued similar conclusions. Therefore, beginning in 2002, the EPA started collaborating with other federal agencies, states, and tribes to provide Congress and the public with improved environmental information. This collaboration includes a new monitoring effort to assess the condition of the nation's waters, and a series of surveys and reports is being produced. The design of these assessments is statistically based, and the assessments are planned to be repeated every five years.

The first assessment initiated was the National Coastal Assessment, which surveyed the condition of the nation's coastal resources and efforts to protect, manage, and restore coastal ecosystems. The results of these surveys are compiled into three reports, the *National Coastal Condition Report*, the *National Coastal Condition Report II*, and the *National Estuary Program Coastal Condition Report*. The Wadeable Streams Assessment

came next and provides the first statistically defensible summary of the condition of the nation's streams and small rivers. The results of this assessment are compiled in the *2007 Wadeable Streams Assessment Report*. This report noted that 42% of the nation's stream length is in poor biological condition, 25% is in fair biological condition, and 28% is in good biological condition (5% was not assessed). In general, more streams in the West are in good biological condition and more streams in the Eastern Highlands are in poor biological condition. The most widespread stressors for streams are nutrients (nitrogen and phosphorus), riparian disturbance, and streambed sediments.

EPA and its partners are planning to conduct similar assessments of other types of waterbodies and have developed a schedule of future surveys. A field survey of lakes and reservoirs will occur in 2007, with a national assessment report of the results due in 2009. A survey of rivers will occur in 2008, with a similar report due in 2010. Wadeable streams will be surveyed again in 2009, with a report for all flowing waters (streams and rivers) expected in 2011. A coastal condition survey will occur again in 2010, and with a report expected in 2012. A wetlands survey will occur in 2011, with a report due in 2013. After that, surveys and national assessment reports will be repeated in sequence, and more focus will be on changes and trends.

The NPS has been contacted by EPA about including a special study of parks in the flowing waters or rivers assessment. To date, the NPS has been a passive participant in the EPA national water quality assessment process, with our focus being primarily on long-term monitoring and watershed condition assessment on a national and network scale. However, because of the magnitude of high value, aquatic resources on NPS lands throughout the country and our commitment to preserve and protect those resources, we should consider partnering with EPA and others by sponsoring national assessment sites in parks and adding our knowledge and data to the collective wisdom of these results.

High-Resolution National Hydrography Dataset Available for All Parks

Dean Tucker, Natural Resource Specialist, Water Operations Branch

Information about the network of surface water (hydrography) that drains an area is a critical need for resource stewardship. In fact, hydrography comprises one of the 12 core NPS Level I Inventories required for managing National Park units. During 2007, WRD and the Servicewide Inventory and Monitoring Program completed a multi-year cooperative effort with the USGS and others to create the 1:24,000 scale (1:63,360 in Alaska), high-resolution National Hydrography Dataset (NHD) for all National Park units. Integrating existing hydrographic data provided by the USGS, USFS, parks, and others, NHD is a geographic database that interconnects and uniquely identifies all the stream segments (or "reaches") that comprise the nation's surface water drainage system. Included in NHD are hydrographic features such as streams, rivers, canals, lakes, ponds, reservoirs, springs, wells, and other hydrologic phenomena that generally appear on USGS topographic maps. NHD is the national hydrographic standard, comprises the hydrographic layer in The National Map (http://nationalmap.gov/), and can provide source data to other hydrographic models (e.g., ArcHydro).

Potential applications of NHD for parks abound. NHD is ideally suited for both cartographic applications (Figure 1) and modeling (Figure 2). Because NHD uniquely identifies each reach with an unchanging reach code, users can attach attributes to a reach and share them with other NHD users. Additionally, point events (stream gages, water quality stations, etc.) and linear events (functional condition, impairment status, etc.) can be addressed/referenced to the NHD and also shared with other users. As an interconnected flow network, NHD can be used for time of travel studies to determine how long it will take for a spill upstream to reach a downstream point (e.g., a drinking water intake). Users can navigate the hydrographic network, both upstream or down, to determine reaches or events indexed to those reaches that may be impacted by incidents on the hydrographic network. Given the standardized national coverage, NHD can form the basis for an inventory of water resources–something the NPS WRD has done for the Designated Use and Impairment project (http://www1.nrintra.nps.gov/wrd/dui/)–as well as a framework for strategic planning and GPRA goals.

NHD should replace the typical DLG-derived hydrography layer in a park's GIS. As parks improve their hydrography layer by adding new features, changing stream alignments, or going to larger scales, these edits can be integrated into the parent NHD dataset through the NHD Stewardship Program so the national NHD coverage will always reflect the local NHD coverage. Many states have already upgraded their hydrography to larger scale (e.g., 1:4,800), and these data have been (or will soon be) integrated into the parent NHD dataset.

To download NHD data and/or tutorials, locate training or workshops in your area, examine other NHD applications, learn about the NHD Stewardship Program, or obtain additional information, visit the USGS NHD website (http://nhd.usgs.gov/).

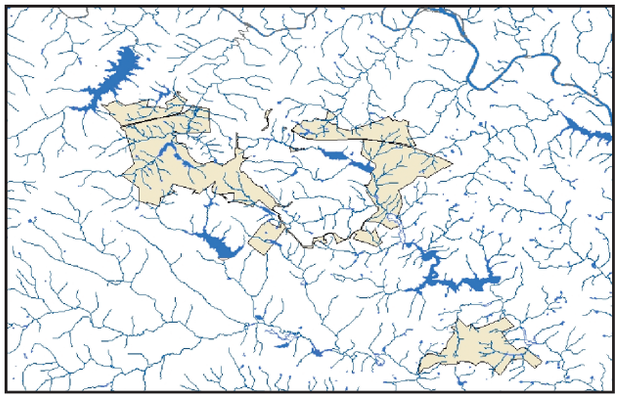


Figure 1. NHD at Fredericksburg and Spotsylvania County Battlefields Memorial National Military Park.

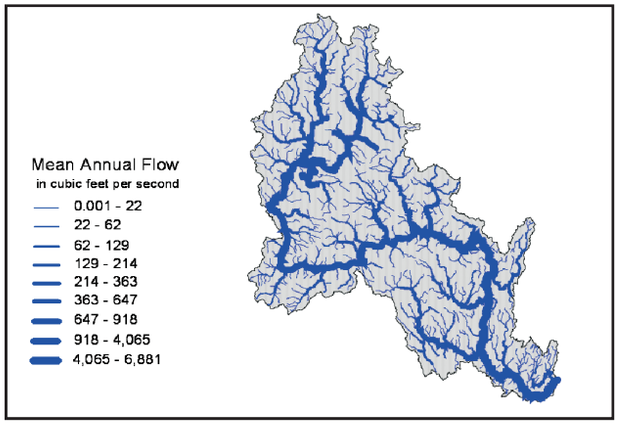


Figure 2. Mean annual flow displayed thematically within a subbasin.

Opportunities for Parks to Interface with Other National Water Quality Programs

Barry Long, Hydrologist, Water Operations Branch

In 2007, the Vital Signs Networks made progress implementing their long-term monitoring studies in parks. Most of the 32 networks have completed their ecological monitoring plans and are developing monitoring protocols. Water quality is a vital sign for many of these networks, and specific monitoring protocols and standard operating procedures are being developed for wadeable streams, large rivers, lakes and ponds, seeps and springs, wetlands and wetland habitats, groundwater, estuaries and marine areas, amphibians, macroinvertebrates, fish, stream flow quantity, nutrients, and toxic contaminants. During this process, networks and parks have been coordinating with individuals from a variety of agencies, institutions, and organizations. These collaborations have allowed NPS to not only strengthen our monitoring programs, but interface our monitoring with other national, regional, and local programs, and communicate our plans and results to a broader national audience.

One of the ways NPS has benefited is through our participation on the National Water Quality Monitoring Council and our interaction with many of the Council's member agencies and organizations. The Council is chaired by the USGS and the EPA. They have helped us by developing the Water Quality Data Elements for data sharing and comparability, developing the National Environmental Methods Index (a web-based compendium of available laboratory and field methods), promoting data quality objective planning, and recommending national laboratory accreditation. Last year, the Council developed a plan to implement a National Water Quality Network for U.S. Coastal Waters and three Pilot Studies were initiated (San Francisco

Bay, Lake Michigan, and Delaware Bay). One of our Vital Signs Networks (Southeast Coast Network) submitted a pilot proposal that was not selected for consideration. During the next phase of this program, Demonstration Studies will begin with the promise of new Federal funding. Another way that parks have been involved with the Council and the water community has been by participating in their national conferences, which are held every two years. The last one was held in San Jose, CA, in 2006, and several NPS aquatic professionals attended and participated in the conference. The NPS is co-sponsoring the Council's 2008 National Water Monitoring Conference, to be held in Atlantic City, NJ, in May. Ten NPS abstracts have been accepted for presentations or posters, and the Water Resource Division will be staffing an exhibit.

Restoration of Streambank Erosion in Association with a Bridge Replacement Project, South Fork Kings River, Kings Canyon National Park

Gary M. Smillie, Hydrologist, Water Operations Branch

Fluvial conditions in the South Fork Kings River, a river designated under the Wild and Scenic Rivers Act, have been adversely impacted by a bridge in the Cedar Grove area of Kings Canyon National Park. The bridge, called the Cedar Grove Village Bridge, has not performed well over its lifetime, with the development of a large mid-channel bar and erosion of a wide channel upstream of the bridge. This poor performance is due to the constriction in river width during high flows and the complicating hydraulics associated with a bend in the river. These factors have contributed to a tendency by the river to deposit coarse material just upstream of the bridge opening and to erode toward the outside of the bend. Much of the river's discharge now flows outside of the former channel prism, toward the left abutment fill, and then parallel to the abutment fill to reach the bridge opening. Plans are currently underway to design and construct a new bridge at this location that allows the river to function in the most natural manner possible. This is especially important given the South Fork of the Kings River's Wild and Scenic River designation.

The new bridge design will constrict the river much less than the existing structure, thus allowing more free-flow and natural fluvial processes. However, the morphology of the channel has been significantly altered by the past flow conditions, and it is not clear that a "natural" morphology will reestablish (over a reasonably short time frame) without intervention. Development of a natural fluvial morphology through the bridge reach

is important not only to be consistent with the Wild and Scenic designation of the river but also to create favorable hydraulic conditions for bridge performance, thus reducing (perhaps eliminating) need for future channel manipulations related to aggradation and bank erosion. Additionally, the wide channel upstream of the bridge may cause erosion of the low-terrace floodplain on river-left downstream of the bridge, an area of administrative and visitor use. For these reasons, restoration of natural conditions is considered an important component of bridge replacement on the South Fork. Specific actions that may promote a more natural fluvial condition include removing the mid-channel bar that has deposited upstream of the bridge, narrowing the channel width in this reach, and creating a low floodplain terrace under the bridge.

A contract with a fluvial restoration firm was developed in FY2007 to establish physical feasibility of the restoration of the left bank of the South Fork Kings River upstream of the Cedar Grove Bridge. The overall objective of the restoration is to recreate natural channel and floodplain conditions in the impacted reach to the extent practical and to do so in a sustainable manner using materials native to the area. Potential restoration methods will need to be analyzed with a hydraulics model to determine sediment transport capabilities and bank erosion potential. Modeling support of this nature has been offered by the Federal Highways Administration staff in Denver, CO. Several technologies for narrowing the channel and constructing a low floodplain through the former bridge opening will be evaluated by the contractor. These include biorevetment, use of naturally occurring large river rock as revetment, and construction of engineered woody debris jams to deflect flow. Long-term establishment of native vegetation is an important component for aesthetic reasons and to provide structural integrity.

Cedar Grove Village Bridge, Kings Canyon National Park (Smillie, 2007).

Continuous Turbidity Monitoring at Sylvan Pass Confirms Gravel Mining Impacts at Yellowstone National Park

Pete Penoyer, Hydrogeologist, Water Operations Branch
Gary Rosenlieb, Chief, Water Operations Branch
Henry Heasler, Supervisory Geologist, Yellowstone National Park

Sylvan Pass is both a topographic and hydrologic divide located at high elevation (8500 feet) near the eastern border of Yellowstone National Park (YELL). The pass is a narrow, U-shaped, glacially-carved valley in 50 million year old andesitic volcanic rocks. An East Entrance Road has existed in Sylvan Pass since 1903. The road has been upgraded through the years to become one of the five major access routes into Yellowstone. In 1992, YELL began using Sylvan Pass as the park's major gravel source for road construction activities. Since 1992, over 1.3 million tons of rock have been mined at Sylvan Pass. Along with the mining, gravel processing (including crushing, washing, and the separation of fines) has occurred on the pass. In August 2004 during gravel washing operations on the west side of the pass, a plume of white turbidity of unknown origin extended out of YELL for many miles into Middle Creek and the Shoshone River on the east side of the pass. In efforts to locate the plume's source, the turbidity plume was traced upstream on Middle Creek to a short, unnamed tributary stream and then to a groundwater discharge site at Mammoth Crystal Springs (MCS). A dye trace, coring and analysis of MCS sediments, water quality monitoring, and other studies were performed to better understand the hydrologic system, the interconnections between surface water and ground water, and the effects of permafrost on flow paths through the talus aquifer.

In late spring of 2006, water quality monitoring was begun consisting of five telemetered monitoring sites established under contract with the USGS at key waterbodies surrounding Sylvan Pass. The sites were selected to test the hypothesis that the elevated turbidity events in the ground water fed spring were not natural and might be related to past gravel washing operations. It was believed that remobilization of entrapped, anthropogenic fines from past discharges could recur under spring runoff or storm events (conditions conducive to generating slug flows) despite the cessation of all gravel washing on the pass. However, due to the snow pack, the initial monitoring site installations could not be established in time to capture the spring runoff peak in 2006, and no significant precipitation event occurred during the following summer to test the hypothesis.

Monitoring re-established in early spring 2007 at these same sites within the Sylvan Pass Hydrologic System captured the springtime peak runoff. The results of this monitoring, coupled with analysis of Mammoth Crystal Spring core data (2006) and dye tracing results from 2005, confirmed that the gravel processing operation was the primary source of fines that caused the recent high rate of sediment deposition and biological degradation observed at MCS pond.

It appears that residual fines lodged in the talus from past site operations are a reservoir of sediment from which remobilization of fines occurs during high flow (flushing) events associated with spring snowmelt and more intense summer precipitation. Lead 210 dating indicates these fines form distinctive, recent deposits of light gray sediment of up to 30 cm thickness in the spring pond in contrast to the older dark brown to grayish black sediment below. The associated turbidity events causing deposition of this pond sediment that is observed in ground water discharging to MCS during spring runoff and high precipitation events appear to be of very

short duration and subside quickly. Gravel mining and processing were stopped at Sylvan Pass in August 2004. In order to determine the best way to deal with the sediment-degraded, Sylvan Pass Hydrologic System, WRD, in conjunction with park staff, organized a workshop at the park in October of 2007 with experts in hydrogeology, hydrogeology and wetlands restoration to address key questions in restoring and mitigating the degradation done. A final summary report of the expert's recommendations was provided to the park in December of 2007.

Mammoth Crystal Springs about 24 hours after green (fluorescein) dye tracer test, Yellowstone National Park (David Susong, USGS, 2005).

Modeling Post Fire Hydrological Threats in Zion National Park

Rick Inglis, Hydrologist, Water Operations Branch

Wildfire in most landscapes will increase erosion and discharge of storm runoff. The Intermountain Region requested that WRD provide a hydrologic assessment as part of the Burned Area Emergency Response (BAER) to a series of wildfires in July 2007 in southwest Utah, called the Dakota Hill Complex. The Complex consisted of two, separate, lightning-caused fires (the East and West Fires), which burned at the same time and were located near the North Fork of the Virgin River, which is famous for a hiking trail called The Narrows. The objective of the assessment was to assess overall watershed changes caused by the fire, particularly those that posed substantial threats to human life, property, and critical natural and cultural resources. The BAER report evaluated changes to soil conditions, hydrologic function, and watershed response to precipitation events along with vegetation recovery issues.

A hydrological model, Technical Release 55 (TR-55) created by the Natural Resource Conservation Service, was used for estimating runoff and peak discharges in small sub-watersheds in the burned area. TR-55 begins with a rainfall amount uniformly imposed on the watershed over a specified time distribution. Area-wide rainfall is converted to runoff by using a runoff curve number (CN). CN is based on soils, plant cover, and amount of impervious areas, interception, and surface storage. Runoff is then transformed into a hydrograph by using unit hydrograph theory and routing procedures that depend on runoff travel time through segments of the watershed.

For this assessment, pre-fire GIS coverages of vegetation, soils, and elevations were overlain on baseline sub-watersheds to determine an

area-weighted CN. To simplify computations, similar vegetation mapping units were merged into fewer units with common hydrologic response, and soil mapping units were grouped into hydrologic soil groups. These curve numbers were used with a design (standardized) two-year rainfall, digitized watershed areas, stream lengths, and flow velocities to determine the baseline runoff hydrograph (stream discharge over time) of the affected watersheds before the fire.

A second run of the model was made using revised curve numbers based on changes of vegetation and soil characteristics observed after the fire. The same rainfall, watershed areas, and stream lengths were used to develop a new hydrograph, which reflected the conversion of rainfall to runoff during post-fire conditions. It should be noted that natural rainfall patterns rarely cooperate in producing storms of identical duration and intensity of design storms. Therefore, measured runoff following a wildfire will not match the hydrograph produced by the model. The purpose of this exercise was to compare pre- and post- fire conditions using identical hypothetical storms to determine the changes in stream flow caused by wildfire.

Plots of the pre- and post-fire hydrographs showed dramatic increases in potential runoff after the fires. Predicted runoff increase from the East Fire was more than 900%, producing a peak flow of 1,246 cubic square feet per second (cfs), up from 126 cfs in the baseline scenario. The West Fire area did not produce runoff from a two-year storm in baseline conditions. The post-burn model results for the West Fire indicated that runoff would peak at about 164 cfs. The model prediction of increased peak discharges was verified by a flash flood on July 27, 2007, from Telephone Canyon in the West Fire.

Runoff containing ash from Telephone Canyon, Zion National Park (NPS, 2007).

Looking at the larger watershed to compare model predictions to normal (historical) flows, data from the main drainage through the area was examined. The two-year return period discharge for the North Fork Virgin River USGS gauging station at Springdale (at park headquarters) was calculated from the gauged record to be 1,710 cfs. The theoretical modeled, post-fire, two-year discharge from the East Fire was at about 70% of this amount, which implies a significant potential increase in the river flow. Similarly, the modeled West Fire, post-fire, two-year discharge was approximate 7% of the discharge at Springdale, indicating a lesser increase was likely. When comparing the total, potential, post-fire, modeled runoff from both fire areas to flood flows (100-year discharge) at Springdale, a 14% increase in flow was possible.

The Dakota Hills Fire Complex produced detached, unanchored, and charred stems, trunks, and branches that were distributed throughout the watershed. The material near

swales, upland channels, and principle drainages will likely be mobilized during more frequent runoff events that normally would have infiltrated into soils covered by healthy, native vegetation. After a fire, the remaining woody debris on the ground can be moved by sheet flows that normally would be hung up and interlocked with living stems and anchored (rooted) plants and trees in the pre-fire landscape. Without the normal riparian vegetation (mostly shrubs and trees), woody debris from burned areas may frequently be delivered to downstream rivers, which in Zion National Park would be a major hazard to deep canyon hikers.

While no effective treatment is known to be practical to improve short-term hydrologic recovery after a wildfire, natural recruitment of native plant communities is the long-term preferred condition to absorb rainfall and reduce runoff and sediment discharge. Recommendations in the BAER report were provided to Zion NP on posting notices for visitors, advising increased risk of flash floods due to the fires with a serious chance of loss of life if floods are encountered in the narrow canyons.

Burned Area, Zion National Park (NPS, 2007)

WATER RIGHTS BRANCH HIGHLIGHTS

Chuck Pettee, Chief, Water Rights Branch

The Water Rights Branch (WRB) has continued to participate in hearings in state administrative proceedings, support NPS claims in court proceedings, settle issues via stipulated agreements, collect and analyze hydrologic and water-related resource data, and assist parks by being indirectly involved in non-NPS led, National Environmental Policy Act assessment proceedings.

WRB staff continues to collect data and analyses, investigating the potential for threats to park water related resources from proposed ground water pumping adjacent to Chickasaw National Recreation Area in Oklahoma; Wind Cave National Park in South Dakota; Niobrara National Scenic River in Nebraska; Great Basin National Park, Lake Mead National Recreation Area, and Death Valley National Park in Nevada; and Kaloko-Honokōhau National Historical Park in Hawaii. You can read about some of these studies in the articles that follow. WRB staff participated in one hearing before the Nevada State Engineer to express NPS concerns about proposed ground water pumping near Devils Hole, a detached unit of Death Valley National Park.

A new mediation effort to resolve the reserved water right for the Black Canyon of the Gunnison National Park was initiated in 2007. The parties to the Colorado Water Court litigation case joined together to hire a professional mediator to facilitate negotiation discussions. The mediation has made a lot of progress, and although we still don't know if the mediation will result in a settlement, there is some reason for remaining optimistic. The Colorado Water Court litigation case to establish a water right for in-situ ground water at Great Sand Dunes National Park and

Preserve has been delayed. The delay is related to another case being heard by the Court about the rules for how water rights will be administered in the valley within which the park is located. If the State of Colorado is successful in this "rules case," the claimed park water right would be entirely consistent with state administration.

The WRB has continued to collect scientific information to support claims for water rights under state and federal law. Examples are 1) information collected for a claim previously filed on Rincon Creek in Saguaro National Park, 2) information collected in preparation for the adjudication of water rights at Montezuma Castle National Monument, and 3) information collected where a claim has been filed, pursuant to the Great Sand Dunes Protection Act, for the in-place use of ground water at Great Sand Dunes National Park and Preserve.

As always, any successes accrued by the WRB would not be possible without the professional work of park management and staff. We encourage field managers to call on the WRB whenever water rights issues are, or could be, affected by management decisions or proposals by park neighbors.

Water Resource Division Holds Eastern Rivers Summit

William R. Hansen, Supervisory Hydrologist, Water Rights Branch

Over 110 National Park Service staff met at the National Conservation Training Center in Shepherdstown, WV, on February 26 – March 1, 2007, to discuss Eastern river management issues and capability. The multi-disciplinary group brought together experts in interpretation, partnerships, water resource specialties, natural and cultural resource management, and park management from 34 parks, four regions, and the Washington Office.

The conference focused on six major areas: water law and policy, watershed science, park planning, partnerships, education and communications, and technical assistance and park staff support. The Summit highlighted the need for action in several areas.

Eastern River Challenges

- Improve NPS awareness of state and local water management policies, legislation and regulations, and opportunities to influence decisions that may affect park resources. Eastern river management is becoming increasingly complex and challenging for the NPS. The Service needs a proactive approach to park river issues such as demands for water supply, emerging pollution, development and incompatible adjacent land uses, and growing recreational use–all of which have potential to affect our river resources. Because Eastern river parks have many jurisdictions to work with, it is imperative that park and regional staff have the capability to address issues and are adequately trained and informed to protect park river resources.

Watershed Approach

- Successful river management requires park managers to work within a watershed con-

text. Rivers provide an opportunity for park staff to develop partnerships with watershed stakeholders to better represent NPS interests in watershed planning decisions. Because many parks only cover a small portion of their watershed, we must engage with river communities, non-governmental organizations, user groups, friends organizations, and other stakeholders. NPS programs can assist with developing a comprehensive watershed approach. For example, Rivers, Trails & Conservation Assistance staff can help parks engage and develop partners, interpretive staff can broaden themes to include water resources issues, and the Natural Resource Program Center can provide technical expertise.

- Many parks would benefit from the development of improved river management plans that strategically connect park rivers with regional and local planning efforts, state and local laws and policies, and stakeholders to achieve desired river resource conditions.

Centennial Initiative

- Use the Centennial Initiative as a vehicle to connect people to the National Park system's rivers and teach visitors about the connection between river health and activities in their own backyard. Potential initiatives identified at the Summit include: creating park-based watershed communication civic engagement and interpretive positions; convening watershed summits for every park by 2016 to identify river management goals and create a park-watershed network; identifying Signature River projects; supporting USGS gauging stations to meet park information needs; and identifying rivers in parks that are eligible/suitable for Wild and Scenic River designation.

Organizing for Success

- Establish a Wild and Scenic Rivers program (so approved by the National Leadership Council on March 17, 2007). Recognize that these rivers are unique because the NPS has regulatory responsibilities under the national Wild and Scenic Rivers Act and these responsibilities extend to certain rivers that are not within NPS boundaries or managed by the NPS.

- Communicate river issues and opportunities throughout the NPS. Increase networking opportunities and tools for sharing experiences with river management issues, for example, expanded website; a new publication; information sharing; regional river summits; park-watershed summits; national river summits, regional river councils.

- Support training, workshops, and other learning opportunities for NPS river specialists and managers and other NPS staff, so they can remain current on emerging science and management tools for improved science-based decision making and interpretation. Ensure that staff are familiar with NPS laws and policies unique to rivers.

- Share expertise and use park projects to demonstrate best practices and latest science for river management.

- Ensure other federal agencies understand the NPS role in river management by establishing Memoranda of Understanding, outreach to other agencies, co-location of staff, and other partnerships.

Future Summits

- Convene river meetings on a regular basis, such as semiannual national meetings and more frequent regional meetings. Information exchanged in river-focused meetings is timely and valuable. Future meetings should engage the participation of NPS leadership and a broad range of NPS partners.

Conference presentations and materials were compiled on a DVD.

New NPS Wild and Scenic Rivers Program

Bill Hansen, Hydrologist, Water Rights Division
Joan Harn, Conservation and Outdoor Recreation Programs

Following a recommendation by the Wild and Scenic Rivers (WSR) Task Force, the National Leadership Council approved the creation of a NPS WSR Program on May 17, 2007. Implementation of the Program will include the establishment of a new National WSR Coordinator position and the creation of a Steering Committee. The new program will improve the NPS' consistency, coordination, and compliance with the 1968 Wild and Scenic Rivers Act (Act), enhance inter-divisional, inter-regional, and external communication, improve resource protection, and reduce litigation risk.

As of December 2006, the NPS has statutory management and regulatory responsibilities on 37 WSRs flowing more than 2,800 miles throughout the United States. Of this total, 28 of the rivers are units of the National Park system or contained within a park, and nine are partnership rivers managed in cooperation with state and local governments. Additionally, the NPS has a regulatory role on another 17 WSRs managed by states or tribes under Section 2(a)(ii) of the Act, totaling another 881 miles.

The Steering Committee has been formed and held their first meeting on December 11-13, 2007 in Fort Collins, CO. An action plan is being developed to implement the new Program, including the completion of a new director's order, development of funding strategies, and coordination of celebration activities for the 40th anniversary of the Act in October 2008.

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Alagnak River in Katmai National Park and Preserve, AK (NPS, 2001).

Sources and Flow Paths of Groundwater to Montezuma Well, Montezuma Castle National Monument

Paul K. Christensen, Hydrologist, Water Rights Branch
Raymond H. Johnson, Hydrogeologist, USGS
Ed H. De Witt, Geologist, USGS

Montezuma Castle National Monument is located in central Arizona. In 2002, the Water Rights Branch and monument staff began collecting basic hydrologic information that will be used to determine the monument's water rights through the Verde River adjudication.

The most prominent water feature of the monument is Montezuma Well, a travertine dissolution feature partially filled with groundwater that rises from depth and exits the well through a swallet (a dissolved channel in travertine). About 2.0 cubic feet per second of water are discharged from the well into a prehistoric (before settlement by Europeans) and historic (greater than 60 years old) ditch.

The well is located at the juncture of the Colorado Plateau and Basin and Range physiographic provinces. The nearby Mogollon Rim of the plateau is the likely source of most groundwater in the region. The flow paths of groundwater rising into the well, however, were uncertain. The NPS needs to understand the flow paths of this groundwater in order to protect it from excessive groundwater withdrawals in the surrounding area. To do so, the NPS acquired the services of the USGS to reduce the uncertainty regarding flow paths through geochemical, isotopic, and geologic analyses.

The first phase of the USGS investigation has been completed. Activities included collecting and analyzing water samples from selected wells and springs, interpreting data, geochemical modeling, constructing geologic cross-sections, and preparing a conceptual model of ground-water flow to Montezuma Well. Water samples were collected in Montezuma Well at depths greater than the 55-foot deep false bottom of the pool. These samples were the first collected within fractures through which ground-water flows up into the well.

The results of the first phase of the investigation indicate a "deep" source (greater than 500 feet) for the groundwater in Montezuma Well. This source is geochemically different than shallow groundwater occurring in the area surrounding the well. Geochemical data (including isotopes) from this deeper water suggest that the recharge area is on the nearby Mogollon Rim of the Colorado Plateau east of the well and that the water travels through fractured limestone and sandstone before discharging at the well.

The carbon dioxide concentration of the water in Montezuma Well is much greater than that found in shallow ground-water recharge of the area or that could possibly occur through rock/water interactions. Accompanying the large carbon dioxide concentration are high levels of arsenic, chloride, calcium, lithium, and boron not found in nearby shallow aquifers.

Given the complex nature of the geochemistry and ground-water flow to Montezuma Well, the USGS has initiated a second phase of the investigation. Objectives of the second phase include determining the source of excess carbon dioxide, confirming the geochemical reactions along the ground-water flow path, comparing the unique geochemistry of waters in and around the well with other existing data in the watershed, and using mixing models to limit possible sources and flow paths of groundwater to the well. The USGS will publish the data collected

during the investigation in an Open-File Report made available on the internet. A series of articles will follow that will discuss the findings of the investigation and be submitted to professional journals for publication.

View looking east across southern part of Montezuma Well (R. H. Johnson, 2007). The swallet is located at base of trees at right edge of photo.

View looking south across southern part Montezuma Well (G. A. Grant, 1945). The swallet is located at the base of trees.

View looking north across Montezuma Well toward the ruins (R.H. Johnson, 2007).

View looking north across Montezuma Well from behind trees at the swallet toward the ruins (G.A. Grant, 1945).

Nevada State Engineer Issues Decision on Southern Nevada Water Authority Proposed Ground-Water Development near Great Basin National Park

Chuck Pettee, Chief, Water Rights Branch

In 2006, the Southern Nevada Water Authority (SNWA) applied to the Nevada State Engineer (NSE) to develop about 91,000 acre feet per year (afy) of groundwater in Spring Valley immediately west of Great Basin National Park, and the NPS, FWS, BLM, BIA, and SNWA completed a Stipulated Agreement (Agreement) to protect park resources from effects due to the ground-water project. The Agreement anticipated potential approval of a portion of these applications, and in April 2007, the NSE issued Ruling 5726, approving in part and denying in part the applications.

The NSE approved 15 of 19 applications and set the maximum combined limit of 60,000 afy–the amount determined to be available for appropriation after taking into consideration existing rights and potential future in-basin uses. The NSE ordered that development occur in stages, in conjunction with significant monitoring to indicate pumping effects. SNWA must collect at least 5 years of hydrologic and biologic baseline data prior to any export of groundwater out of the basin. SNWA can then begin ramping up ground-water pumping to a maximum of 40,000 afy. Only after 10 consecutive years of withdraws averaging at least 35,000 afy can SNWA request permission from the NSE to pump the remaining 20,000 afy of permitted groundwater. SNWA must provide all monitoring data collected throughout the baseline and pumping periods and submit an updated ground-water flow model that provides predictive results for 10-, 25-, and 100- years, which the NSE will use to decide whether the remaining permitted amount may be pumped or additional study is necessary.

The staged-development approach taken by the NSE in Ruling 5726 fits the design of the Agreement. Only a portion of the total potential allowable water can initially be developed, while monitoring provides the NSE with information about the propagation of effects and their potential to impact resources. The Agreement's monitoring requirements are designed to provide that information, while its management requirements provide feedback to adjust the monitoring as pumping effects are detected. Also in this decision, the NSE reinforced his intent to impose curtailment or mitigation of pumping effects if unreasonable effects are seen or likely. In 2007, WRD staff worked closely with SNWA and the other DOI bureaus to implement the Agreement. The NSE also actively participated in the establishment of the hydrologic monitoring program for Spring Valley.

Preliminary Geomorphic and Habitat Assessment, Obed Wild and Scenic River

Jeff Hughes, Hydrologist, Water Rights Branch

As part of an ongoing effort by the NPS to analyze the impact to Obed Wild and Scenic River (OBRI) hydrology from thousands of small to medium-sized impoundments, the USGS was contracted to conduct a reconnaissance study of alluvial bars within the park, examine the processes that form and maintain the bars, and determine their stability. The vegetative ecology is also briefly to be described.

The alluvial bars in OBRI are seasonally flooded, vegetated boulder bars, where the boulders (greater than 256 mm diameter) make up the structural framework of the alluvial bars. Cobbles (64 – 256 mm) are also common, and sand and silt occupy the voids between the boulders and cobbles. These alluvial bars were formed by sediment transported and deposited by streams over a range of discharge events. Large, relatively rare, discharge events move the largest particles (boulders), while more frequent, smaller flows transport and deposit silt and sand size particles. Sediment is supplied by debris fall and erosion of the sandstone cliffs of OBRI. The higher flows also scour and remove large, woody vegetation, preventing older plants from inhabiting the bars. This process keeps the bars more open to sunlight.

The alluvial bars also provide important habitat for several Threatened and Endangered (T&E) plants, including the federally listed Virginia spiraea (*Spiraea virginiana*) and Cumberland rosemary (*Conradina verticilla*). These plants require habitat on alluvial bars to be open to sunlight, have a sandy substrate for rooting, and have competition from other species frequently removed.

For this study, 56 alluvial bars were examined, and three were selected for more extensive data collection efforts (plant and topographic surveys). The study concluded that the alluvial bars of OBRI are relatively stable, and the location and shape of major channel features have not significantly changed in the past 40 years. This period includes a flow event estimated at 105,000 cfs on the Obed River.

The alluvial bars in OBRI are unique in that their highest elevations exhibit xeric or drought conditions for part of the year, but are also flooded annually. It is thought that these conditions reduce competition and allow the Cumberland rosemary and Virginia spiraea to survive here.

In assessing the threats to the habitat formed by the alluvial bars, the study concluded that there was no indication that upstream impoundments are capturing sediment essential for the T&E vegetative species occupying the alluvial bars. An analysis of streamflow records indicates no reduction in the magnitude or frequency of high flow events (due to the construction of impoundments) that would alter the sediment transport regime of OBRI. However, there has been an increase in summer base flows at a nearby, long-term, stream gaging station, which is thought to be due to an increase in releases from upstream sewage treatment facilities. Increased base flows and a corresponding change in water quality could reduce stress on flood tolerant shrubs competing with the T&E vegetative species. One other threat to the ecology of the alluvial bars is that several, non-native, invasive plants were noted on eight of the 56 alluvial bars visited.

The full report can be found on the Internet at http://pubs.water.usgs.gov/sim2007-2972.

Vegetated alluvial bar on Daddys Creek just upstream of the confluence with the Obed River (Hughes, 2004)

Flood on Daddys Creek, an example of a high flow event over alluvial bars (Hughes, 2002).

Use of Environmental Tracers to Assess Ground-Water Flow Paths in the Vicinity of Wind Cave National Park, South Dakota

Jennifer Back, Hydrologist, Water Rights Branch

Ground-water development in the southern Black Hills area of South Dakota is of increasing concern to Wind Cave National Park due to potential impacts to underground lakes and streams within the park. Environmental tracers and major ion chemistry may provide insight into flow-paths and age of groundwater in the vicinity of the park, and assist park management in better understanding the hydrologic setting of important cave features.

Major ions, stable isotopes, tritium and chlorofluorocarbons were sampled as part of this study. Sampling sites included seven wells completed in the Madison aquifer, five local springs up-gradient of the park, and three large artesian springs down-gradient from the park. In addition, two surface water sites, two wells, and five cave water sites were sampled within the park boundary.

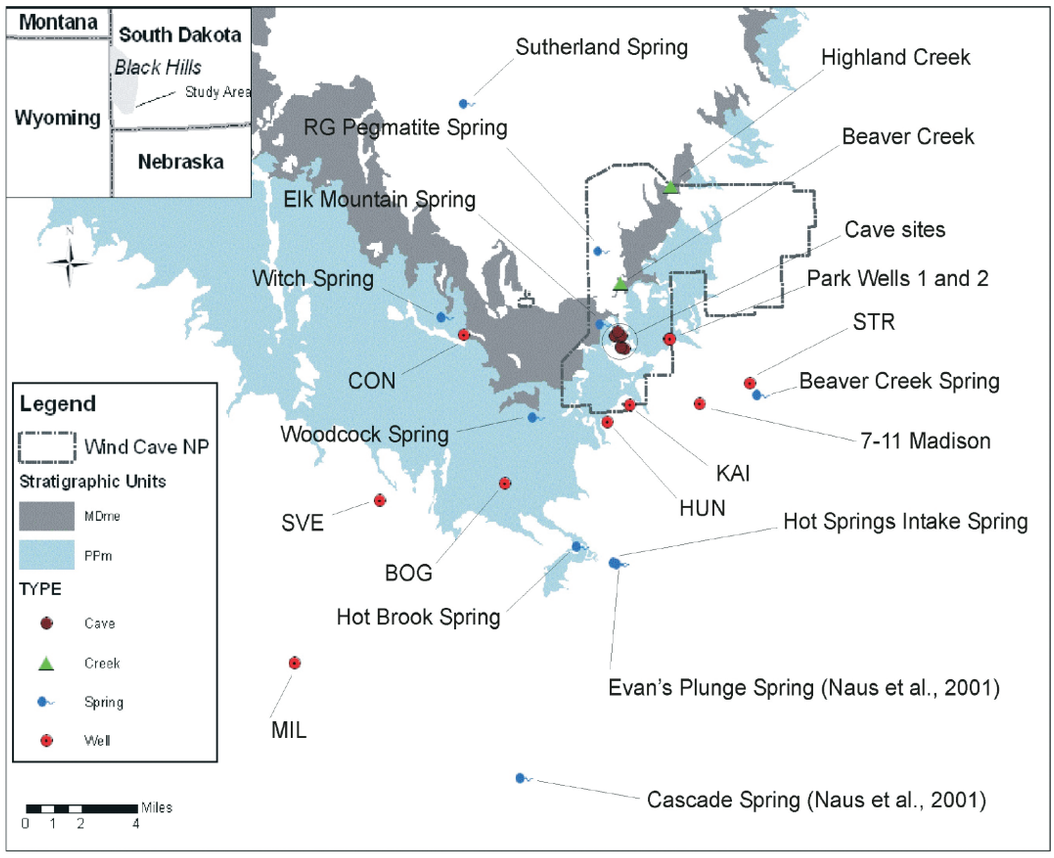
The isotopic values of up-gradient springs represent local recharge in the southern part of the Black Hills. Highland Creek and Beaver Creek, which flow through the park, the cave drip sites, and the underground lakes have similar isotopic values, although underground lakes were slightly more depleted than values reported for Highland and Beaver Creeks. In contrast, the isotopic values for artesian springs and wells south of the park are more depleted than streams and cave water in the park, indicating possible influence of regional flow from the west along the southern margin of the Black Hills. Isotopic values of Beaver Creek Spring fall between the up-gradient springs and down-gradient artesian springs.

The predominant water type in the study area is a calcium-magnesium-bicarbonate type with elevated concentrations of sodium, chloride, and sulfate in some springs and wells south of the park. Park Well No. 2, although completed in the Madison Limestone, is classified as a sodium-bicarbonate type.

Elevated sodium and chloride concentrations are evident in four springs and one well south and west of the park (Hot Brook Spring, Hot Springs Intake Spring, Cascade Spring, Evan's Plunge Spring, and MIL Well, respectively). These constituents are not evident at Beaver Creek Spring, suggesting mixing between regional flow from the west and water recharged locally in the southeast part of the Black Hills.

Chlorofluorocarbons (CFCs) are anthropogenic tracers that are useful for estimating ground-water age and fraction of young water in a mixture of old (> 50 years) and young water. Three species of CFCs used as tracers include CFC-11, CFC-12, and CFC-113. All of the samples collected as part of this study, with the exception of the 7-11 Madison Well, are interpreted to represent a mixture of young and old water. The presence of tritium confirms this interpretation.

In conclusion, isotopic data, major ions, and age dating methods indicate regional flow from the west with convergence of regional and local flow-paths at Beaver Creek Spring. CFCs and tritium concentrations indicate the presence of some fraction of young water in all of the samples, with the possible exception of the 7-11 Madison Well. CFC data suggests that underground lakes at Wind Cave National Park may be comprised of as much as 75% of water recharged in modern times.



Location of sampling sites at Wind Cave National Park (Back, 2007).

NATURAL RESOURCE CHALLENGE AQUATIC RESOURCE FIELD PROFESSIONALS HIGHLIGHTS

Funding from the Natural Resource Challenge helped support 15 field-based aquatic resource professional positions in FY2007. The aquatic resource professional positions were developed to provide the National Park Service with both an extension and an expansion of the functions and capabilities provided by the Water Resources Division and the handful of water and aquatic resource professional positions base-funded in parks and regions. The positions are designed to provide locally-based expertise to address water resource, fishery, and/or other aquatic issues that are substantial and ongoing in a particular watershed or area. The positions are unique in that they are designed to support the needs of multiple parks. Table 4 in Appendix B lists all currently supported positions, and a summary of accomplishments stemming from these positions is included in Appendix A.

APPENDIX A

TECHNICAL ASSISTANCE

TECHNICAL ASSISTANCE SERVICEWIDE

Strategic Planning

Participated in the NPS Planning Leadership Group's annual meeting in Washington, DC, presenting a proposal for a Park Planning Summit.

Supported the implementation and coordination of the NPS Natural Resources Strategic Planning Goals 1a4C Water Quantity.

Water Resources Planning

Continued coordination with DSC Planning and with staff associated with the development of *Director's Order 2.1 Resource Stewardship Planning.*

Continued dialog and liaison with NPS Park Planning, Denver Service Center, and Regional Planning Offices regarding adjustments to the WRD water resources planning products to more effectively support the NPS planning process.

Planned and held the Eastern Rivers Summit at the National Conservation Training Center. The Summit provided a forum to exchange ideas and develop a common understanding of eastern river management issues, review scientific approaches to evaluating river resources, and present available tools for elevating attention to park protection.

Served as NPS goal coordinator for the two DOI Land Health Strategic Goals related to streams and riparian zones.

Participated in a NRPC-wide effort to define data, analyses, and coordination needed to support park reporting to the GPRA "land health" performance goals, and to an Office

of Management and Budget natural resource condition scorecard.

Completed water-related policy and technical review of numerous draft General Management Plans, Foundation Reports, and other planning-related efforts.

Assisted with the servicewide survey of streamgaging needs in the NPS. Contacted USGS personnel to encourage funding for NPS streamgages.

Participated in the development of the *NPS Quagga Mussel Planning and Response Guide*.

Adult Dreissinid (zebra/quagga) mussels, Lake Mead National Recreation Area (Dave Britton, USFWS).

Decontaminating boat to prevent spread of Dreissinid (zebra/quagga) mussels, Glen Canyon National Recreation Area (NPS, 2007).

Worked with other NPS offices and programs–especially, Inventory and Monitoring program leadership and network coordinators, other NRPC divisions, Denver Service Center planning, Regional Science Programs–on strategies to improve linkages (integration) between park planning, science, and management.

Developed and lead a session on "The Extent of Aquatic Non-native Species Problems within the National Park Service" at the Biannual Session of the George Wright Society in St. Paul, MN.

Provided technical / policy review of EPA testimony regarding the impact of aquatic invasive species on the Great Lakes.

Served on the Executive Committee of the Western Regional Panel of the Aquatic Nuisance Species Task Force.

Provided technical / policy review of the Climate Change Science Program SAP 4.4 report (*Adaptation Options for Climate-Sensitive Ecosystems and Resources / National Parks*) to the NRPC Climate Change Program.

Watershed Condition Assessment

Continued developing the Watershed Condition Assessment Program (WCA) supported by the Natural Resource Challenge. For ongoing (FY2006 initiated) WCA project work at 17 parks, assisted parks and regions with interim product reviews and other technical project support.

Coordinated with WCA Program leads in regions to develop revised program guidance, including new project startup guidance for use in FY2007 projects.

Water Quality Management

Coordinated the NPS-USGS Water Quality Partnership Program as part of the Clean Water Action Plan funded by Congress. Reviewed proposals and final work plans for

12 project proposals selected for funding in FY2007 and 9 proposals selected for funding in FY2008.

Reviewed USGS pesticides project plan and participated in setting research priorities for future pesticides projects in parks.

Served as a member of the National Water Quality Monitoring Council representing the National Park Service. Participated in workgroup discussions related to the development of the National Monitoring Network for Coastal Waters and planning for the next council national conference.

Assumed the role of the water quality staff advisor for Designated Uses and Impairments Program and participated in meeting related to the status of park listed and protected waters and NHD coverage for those waterbodies.

Provided technical review and comment on the Air Quality Division's WACAP study results relating to fish feminization and dieldren concentrations found in fish from high altitude lakes in western parks.

Managed Vital Signs Water Quality Program budget activities and requests for information for 32 networks.

Wetlands Protection

Prepared a draft revision of *NPS Procedural Manual #77-1: Wetland Protection*. The manual provides detailed standards, requirements, and procedures for implementing NPS Director's Order #77-1: Wetland Protection.

Prepared NPS comments on the U.S. Army Corps of Engineers (COE) proposal to reissue and modify Nationwide Permits under Section 404 of the Clean Water Act.

Reviewed new EPA/COE guidance for implementing recent U.S. Supreme Court decisions on the Rapanos/Carabell cases, which changed Federal jurisdiction of wetlands under Section 404 of the Clean Water Act.

Served as the NPS representative for the Wetlands Subcommittee of the Federal Geographic Data Committee.

Prepared the draft *Areas of Cooperation to Accompany the Partnership Agreement between the National Park Service and the U.S. Army Corps of Engineers*.

Provided presentations on wetlands protection and regulatory issues for the NPS 9b Oil and Gas Workshop in Lakewood, CO.

Gave a presentation entitled "D.O. 77-1 and Sec. 404 of the Clean Water Act: Tools for Protecting Wetlands" at the Eastern Rivers Summit.

Compiled and submitted the NPS contribution for the 2007 President's Earth Day Report on Federal wetland restoration and protection programs.

Fisheries Management

Proposed, received funding, and initiated a new five-year program of native fish and fish habitat restoration within low-fee collection parks under the Servicewide 20% Fee Funding Program.

Assisted in the development of a fact sheet regarding the VHS fish virus that has recently appeared within the Great Lakes and seems to be spreading within streams and waters of the US.

Participated in a nationwide web-cast discussing wilderness lakes management policies and actions within National Parks and on other Federal lands.

Continued to interact with numerous NPS units and the Association of Fish and Wildlife Agencies on the National Fish Habitat Initiative.

Participated in a national coordination workshop for Federal voluntary fish passage delivery in Silver Springs, MD.

Co-chaired the Western Division of the American Fisheries Society's Western Native Fish Committee.

Served as the NPS representative on the National Coldwater Fisheries Partnership Board.

Drafted a citizen response letter for Associate Director's signature concerning an inquiry about protection and improvement of habitat conditions for American eels in eastern rivers.

Marine Resources Management

Coordinated international shared marine protected area monitoring program with Commission for Environmental Cooperation North American Marine Protected Area Network with NOAA and Mexican and Canadian counterparts.

Shared NPS ocean park experiences, strategies, and action plans with Canada's Department of Fisheries and Oceans, Wildlife Service, and Parks Canada in formal meetings (Wildlife and Ecosystem Trilateral Agreement-Quebec) and invited seminars (Marine Protected Area design and monitoring Mont Joli, Quebec & Parks Canada Marine Protected Areas conference-Victoria, British Columbia).

Shared NPS experiences with vital signs monitoring and ecological restoration with Brazilian Intervales State Park managers and University of Sao Paulo scientists.

Handled Announcement and Implementation of Ocean Park Stewardship Action Plan.

Drafted Implementation Memorandum from NPS Director to the field requesting action on the Ocean Park Plan and interagency Seamless Network Agreement with NOAA.

Re-established Ocean Park Stewardship Task Force and conducted monthly conference calls to coordinate and exchange information with regional staffs and superintendents.

Coordinated Marine Recreational Stewardship Fee Project. Successfully initiated program to mitigate and prevent recreational impacts on marine resources in several coastal parks.

Submitted revised FY2006-2009 servicewide oceans crosscut budget and narrative to DOI Budget Office and OMB under 2000 Oceans Act.

Coordinated interagency committee and developed plans to strengthen ocean partnerships between DOI bureaus (NPS, USGS, USFWS, and Minerals Management Service and external entities.

Assisted NPS, DOI Deputy Assistant Secretary, and NOAA with preparations and on-site logistics for October 2006 and March 2007 U.S. Coral Reef Task Force (CRTF) meetings.

Organized and chaired workshop with NOAA on Sustainable Coral Reef Tourism at USVI meeting.

Developed Task Agreement for financial assistance to 2008 International Coral Reef Symposium, coordinated NPS submission of abstracts.

Coordinated NPS Response to Marine Protected Areas (MPA) Executive Order 13158 and Seamless Network Agreement.

Worked with NOAA and BLM to review proposals for implementation of national system of MPAs under EO 13158.

Reviewed USGS State Partnership Proposals

for Research and Monitoring of NPS Marine Reserves at Dry Tortugas and Virgin Island parks.

Administered the fee demo project "Restoration of Estuarine Ecosystems to Enhance Visitor Recreational Opportunities."

Provided technical assistance in the conceptualization and development of study plans for a new five-year program of estuarine ecosystem restoration.

Developed a Servicewide Marine Resources Mapping I&M Program proposal.

Added a sea grass component to NPS Web Ranger program to help raise awareness and understanding of ocean park resources and special opportunities to learn in parks.

Celebrated NPS and Reef Environmental Education Foundation's 15th Great Annual Fish Count, a citizen scientist assessment of fish populations in ocean parks and marine sanctuaries.

Represented WRD at a Florida marine habitat mapping workshop hosted by the USGS Coastal Resources Lab to address marine habitat mapping techniques and priorities.

Information and Data Management

Coordinated the joint NPS-U.S. Geological Survey effort to acquire the high-resolution National Hydrography Dataset (NHD) for watersheds containing national park units, including acquiring and quality assuring NPS data incorporated into NHD.

Oversaw detailed Scope of Work for contracting the redevelopment of the software procedures employed to produce Baseline Water Quality Data Inventory and Analysis Reports for parks.

Continued development of NPSTORET, a series of Microsoft Access templates/forms for entering and documenting the results of water quality monitoring projects .

Maintained WRD's STORET infrastructure: a data entry workstation STORET containing NPS production data and servers hosting copies of Legacy STORET, National STORET, and the STORET Data Warehouse.

Represented WRD at the weekly NRPC Integrated Resource Management Applications (IRMA) meetings.

Met with EPA and representatives from Montana, Utah, Colorado, Alaska, and Minnesota to draft a scope of work for developing a replacement for EPA's local STORET water quality database management system.

Chaired a six-member NPSTORET User Board to help oversee the development and implementation of NPSTORET and conducted two meetings.

Updated a webpage (http://science.nature.nps.gov/im/inventory/water/index.htm) for the Servicewide I & M Program to explain the water resources-related inventories.

Provided the Florida Department of Environmental Protection with an entire copy of all the NPS water quality data in STORET.

Updated the website for Vital Signs Water Quality Data Management and Archiving at http://www.nature.nps.gov/water/infoanddata/index.htm.

Released NPSEDD v1.10, the NPS Electronic Data Deliverable specification to be used by parks and networks for contributing water quality data for inclusion in STORET.

Maintained version NPSCol2Row v2.11, a data formatting utility used to prepare data for the STORET Import Module, on the NPS' Vital Signs Water Quality Data Management and Archiving website and EPA's STORET

Tools website (http://www.epa.gov/storet/otherapps.html) for anyone to download.

Responded to the Office of Management and Budget's Geospatial Data Call Qualitative Survey Questions on behalf of WRD.

Provided advice to the Northwest Indian Fisheries Commission, a consortium of 20 tribes in western Washington State, on adapting NPSTORET to meet their needs.

Continued to upload long-term thermographic data logger results to STORET for the Florida Keys National Marine Sanctuary for 20 stations near National Park units in south Florida.

Provided review and comment on the development of the Water Quality Designated Use and Impairment Database and brought NHD data glitches to the attention of the U.S. Geological Survey.

Responded to a State of Illinois 305(b) data solicitation.

Provided support to the USGS on a U.S. Agency for International Development effort to assist Pakistan in developing water quality database management systems.

Wild and Scenic Rivers

Co-chaired the Wild and Scenic River Task Force established to review wild and scenic river policies and vulnerabilities and to provide recommendations to the National Leadership Council.

Co-chaired the newly established Wild and Scenic River Steering Committee.

Miscellaneous

Participated on the conference planning committee by selecting session coordinators for technical and breakouts sessions for the February 2008 WRD Aquatic Professionals Meeting.

Served as coordinator for NRPC reviews of submissions to the Development Advisory Board.

Served as a member of the WASO Rivers/Dams workgroup.

Communicated with external partners–especially the USFS, the National Parks and Conservation Association, and Parks Canada–to share ideas and products related to ecological resource condition assessment and reporting.

TECHNICAL ASSISTANCE VITAL SIGNS MONITORING NETWORKS

Assisted networks in their cost analysis and procurement of water quality sondes.

Appalachian Highlands Network

Provided background and information on the ArcHydro data model.

Provided advice on implementing NPSTORET.

Arctic Network

Continued to act as point-of-contact in developing the water quality monitoring program on an as needed basis.

Central Alaska Network

Provided status and background information on the NHD in Alaska.
Continued to act as point-of-contact in developing the water quality monitoring program on an as needed basis.

Cumberland/Piedmont Network

Assisted in review of water quality reports.

Quality assured and edited NPSTORET back-end database.

Uploaded all water quality data through 2006 from NPSTORET to STORET.

Incorporated recommended enhancements into NPSTORET.

Eastern Rivers and Mountains Network

Attended Network's Vital Signs water workshop at Pennsylvania State University, PA.

Reviewed Network's Phase III report.

Great Lakes Network

Quality assured and edited NPSTORET back-end database.

Uploaded all water quality data through 2006 for Mississippi National River and Recreation Area from NPSTORET to STORET.

Greater Yellowstone Network

Quality assured and edited three NPSTORET back-end databases.

Uploaded all 2005 and 2006 water quality for the park from NPSTORET to STORET.

Gulf Coast Network

Provided advice on how to implement in NPSTORET and use the import routines.

Provided staff with EPA comparison benchmarks for Gulf of Mexico water quality indicators.

Heartland Network

Provided review and comment on the Protocol for Monitoring Aquatic Invertebrates at Ozark National Scenic Riverways, Missouri, and Buffalo National River, Arkansas.

Mid-Atlantic Network

Provided background and support for implementing NPSTORET through the University of Virginia.

Mojave Desert Network

Project oversight of WRD funded project "Assessment of Groundwater Resources in the Mojave Network: Hydrogeological Framework."

Northeast Temperate Network

Served as point-of-contact in developing the water quality monitoring program .

Worked to include Appalachian National Scenic Trail in future monitoring activities.

Northern Colorado Plateau Network

Provided review and comments on the Network's Data Management Protocol Standard Operating Procedure.

Reviewed and provided comments on multiple water quality related protocols developed by the Network.

Northern Great Plains Network

Uploaded all 2004 and 2005 water quality data from NPSTORET to STORET.

Provided detailed guidance on how to retrieve Network data from EPA STORET.

Pacific Island Network

Provided review and comments on the Network's Water Quality Monitoring Protocol and Standard Operating Procedures.

Provided review and comments on the Network's water quality database and user's guide.

Met with Network staff and reviewed draft water quality monitoring plan, while serving as WRD point-of-contact.

Reorganized and integrated the Network's coral reef and Vital Signs monitoring programs to improve communication and operational effectiveness, following program reviews.

Rocky Mountain Network

Provided guidance and explanations on the methodology employed for calculating NHD hydrographic statistics.

Assisted Network staff in the selection of, procurement of, and protocol development for use of a water quality monitoring sonde in their pilot monitoring program (North Fork Flathead River Watershed).

Attended Network meeting to discuss status of protocol development and plans for conducting pilot program in summer of 2007.

Reviewed and submitted comments on draft Vital Signs Monitoring Plan.

San Francisco Bay Area Network

Provided advice and guidance on entering QC data in NPSTORET.

Sierra Nevada Network

Provided background information on detection limits and watershed boundaries in support of the Network's lake monitoring protocol.

Provided Network staff with advice on various long term aquatic monitoring issues.

Reviewed some additional water quality monitoring draft protocol changes.

Reviewed Network's Phase III report.

Southeast Coast Network

Reviewed Network's software system to process automatic data logger data.

Provided characteristic mappings for DDD, DDE, DDT synonyms.

Prepared a statement of interest to participate in the National Water Quality Monitoring Network pilot program.

Southern Plains Network

Assisted contractor in deciphering the meaning of replicate/duplicate samples in STORET prior to conducting trend analysis.

Upper Columbia Basin Network

Advised staff on various monitoring issues, including survey design issues, statistical and sensitivity issues, and sources of information for flow protocols.

Provided an updated analysis of past water quality, limnology, and contaminants data from Lake Roosevelt National Recreation Area.

Reviewed and submitted comments on preliminary water quality monitoring plan draft.

TECHNICAL ASSISTANCE REGIONS AND PARKS

ALASKA REGION

Provided policy and technical review of Interim *User's Guide to Accessing In-holdings in National Park System Units in the Alaska Region*.

Provided guidance on the creation of a wetland mitigation bank to be used for compensating impacts to wetlands.

Aniakchak National Monument and Preserve

Completed and published a technical report entitled *Assessment of Coastal Water Resources and Watershed Conditions at Aniakchak National Monument and Preserve* (Natural Resource Technical Report NPS/NRWRD/NRTR – 2007/371).

Obtained, entered, reformatted, QA/QCed and uploaded a variety of water quality data from fishery studies (Surprise Lake, Aniakchak River, and the Meshik River drainage) to STORET.

Bering Land Bridge National Preserve

Provided technical / policy review of the draft coastal resources / coastal watershed condition assessment report.

Denali National Park and Preserve

Provided technical / policy review and publication assistance in the completion of *Denali National Park and Preserve Water Resources Stewardship Report* (Natural Resource Technical Report NPS/NRPC/WRD/NRTR – 2007/051).

Provided water right guidance in responding to state concerns regarding the Eielson Visitor Center hydropower plant.

Provided technical and policy review on the draft Environmental Assessment and Wetland Statement of Findings for Cantwell Subsistence Off-Road Vehicle Management.

Provided technical and policy review and comments on the draft Wetland Statement of Findings for Executive Order 11990, Headquarters Area Master Plan.

Provided final technical and policy review on the Wetland Statement of Findings for a project entitled "Rehabilitate Mile 4.0 and 4.5 of Denali Park Road."

Facilitated the editing and preparation for the publishing by WRD of two reports of a WRD funded investigation of a state proposed access corridor through the park.

Obtained, entered, reformatted, and QA/QCed a variety of water quality data for upload to STORET.

Glacier Bay National Park and Preserve

Provided programmatic oversight for two NRPC funded projects at Glacier Bay National Park and Preserve initiated to address the possible reasons for the decline of Sockeye salmon in the East Alsek River drainage.

West Arm, Hugh Miller Inlet, Rendu Inlet, Queen Inlet, and Tarr Inlet, Glacier Bay National Park (Eichenlaub, 2004).

Katmai National Park and Preserve

Completed and published a technical report entitled "*Assessment of Coastal Water Resources and Watershed Conditions at Katmai National Park and Preserve*". (Natural Resource Technical Report NPS/NRWRD/NRTR – 2007/372).

Provided programmatic oversight, technical guidance and review support for the development of the draft Katmai National Park and Preserve / Alagnak Wild River Water Resources Information and Issues Overview Report.

Kenai Fjords National Park

Modified Task Agreement to provide additional funding to allow completion of the natural resource condition assessment report.

Lake Clark National Park and Preserve

Reviewed the implementation plan and approved release of funds in support of a BRMD project entitled "Conserving Sustainable Northern Pike Populations."

Modified Task Agreement to provide additional funding to allow completion of the natural resource condition assessment report

Sitka National Historical Park

Advised the park and region on Indian River water rights issues related to the pending closure of Sheldon Jackson College.

Wrangell-St. Elias National Park and Preserve

Provided policy and technical review of an environmental assessment entitled *Established and Sustainable Access to In-holdings Programmatic Environmental Assessment for Wrangell-Saint Elias National Park and Preserve*, addressing issues related to compliance with Director's Order 77-1.

Provided programmatic oversight for a project entitled "National Wetlands Inventory Mapping for Wrangell-Saint Elias National Park and Preserve."

Commented on technical adequacy of draft on project on estimating effects of salmon returns on chlorophyll and other environmental cofactors.

Obtained, entered, reformatted, and QA/QCed additional water quality data for upload to STORET in preparation for producing a Baseline Water Quality Data Inventory and Analysis Report.

Yukon-Charley Rivers National Preserve

Obtained, entered, reformatted, and QA/QCed a variety of water quality data for upload to STORET.

INTERMOUNTAIN REGION

Participated in the review and evaluation of adverse impacts proposed in the *Oil Shale and Tar Sands Resources Leasing Programmatic Environmental Impact Statement* on eight NPS units in Colorado.

Participated in a briefing for regional Planning and Natural Resources staff regarding the NRPC planning program and opportunities for interaction with the General Management Plan and Resource Stewardship Strategies planning processes within the region.

Monitored Department of Energy's (DOE's) initial and interim remedial action groundwater remediation progress at the Moab Site through review of progress reports and site Data Validation releases.

Monitored DOE progress toward laying the ground work for removal of the tailings pile, vicinity property remediation, and construction of the new repository at the Crescent Junction site through recent contract awards.

Assisted the Office of the Solicitor and Department of Justice in preparing a motion for

formatting hydrographic survey reports for NPS units in the Gila River General Adjudication.

Served as members of the Colorado River Technical Group and Steering Committee.

Provided comments on two drafts of Record of Decision for the Operation of Flaming Gorge Dam EIS.

Amistad National Recreation Area

Completed distribution of the *Binational Fisheries Management Plan for Amistad Reservoir.*

Prepared an overview report to summarize results of ground-water modeling and ground-water management issues.

Arches National Park

Assisted park staff with wetland/floodplain policy and technical issues for the repair of a trail segment and bridge over Salt Wash.

Visited the park to inspect conditions associated with erosion around a foot bridge on the Delicate Arch trail. Provided information regarding likely causes of the erosion and assisted in development of an environmental assessment.

Provided oversight and funding for spring flow measurements in Sevenmile Canyon and Courthouse Wash in support of water right negotiations.

Prepared project scope of work and agreement to contract with the University of Utah to age-date groundwater in the Moab Member of the Curtis Formation and Slickrock Member of the Entrada Sandstone aquifers.

Reviewed and provided comments on Utah Geological Survey report *Summary of Ground-Water Sampling in the Courthouse Wash Area, Grand County, Utah.*

Continued negotiations with the State of Utah to complete a water rights settlement.

Aztec Ruins National Monument

Provided assistance to investigate the source of moisture in soils adjacent to ruins that threatens the stability and preservation of the ruins for future generations.

Bandelier National Monument

Provided technical and policy review of the draft "*Bandelier National Monument Water Resources Foundation Report*".

Bent's Old Fort National Historic Site

Evaluated water rights applications in Water Division 2 to determine impact of diversions on water rights.

Big Bend National Park

Prepared an overview report to summarize results of ground-water modeling and ground-water management issues.

Big Hole National Battlefield

Submitted annual water use report as required by the NPS-Montana Water Rights Compact.

Reviewed statement of claims for upstream water right claimants in the Big Hole River Basin Adjudication and submitted a list of recommended objections to the park for review.

Big Thicket National Preserve

Provided technical and policy guidance for the proposed Seismic Assistants Limited Knight Phase IV 3D *Seismic Draft Plan of Operation*, recommending tasks that must be completed in order to bring the proposed project into compliance with Directors Order #77-1: Wetland Protection.

Provided technical review and evaluation of the *Wetland Delineation for the Seismic Assistants Limited Knight Phase IV 3D* proposed impact area of operation.

Bighorn Canyon National Recreation Area

Conducted hydrogeological analysis and provided recommendations for construction of a new water supply well at Horseshoe Bend.

Submitted annual water use report for park as required by the NPS-Montana Water Rights Compact.

Provided information to the Department of Justice concerning the relinquishments of two water rights found within the park boundary.

Black Canyon of the Gunnison National Park

Evaluated water rights applications in Water Division 4 to determine impact of diversions on park water rights.

Provided technical input to the park and region pertaining to flow recommendations for endangered fish and the *Aspinall Project EIS*.

Provided technical assistance to the park, region, and Department of the Interior in support of settlement discussions to secure water rights in Water Division 4.

Canyon de Chelly National Monument

Participated in a progress review for a project entitled "Develop Concepts for Riparian Habitat and Stream Restoration in Canyon de Chelly National Monument" and began framing an implementation plan for a follow-up project entitled "Implementation of Restoration Prescriptions: Native Seed Collection, Propagation, and Revegetation."

Coordinated a request to the USGS to reestablish a gaging station on Chinle Wash at the Highway 64 Bridge.

Canyonlands National Park

Assisted with an interagency Proper Functioning Condition Riparian Assessment of vehicle impacts on the open portion of the Salt Creek Canyon Road.

Salt Creek, Canyonlands National Park (NPS, 2007)

Proper Functioning Condition Riparian Assessment, Salt Creek, Canyonlands National Park (NPS, 2007)

Capitol Reef National Park

Initiated a Servicewide 20% Fee Funding Program Fish & Habitat Restoration Project involving the reintroduction of native round-tailed chub into the Freemont River.

Coordinated a project to remove two low head dams and a large block of concrete obstructing streamflow.

Investigated source of groundwater flooding at campground and provided recommendations for correcting the problem.

Continued project work related to quantification of state prior appropriation and Federal

reserved water rights.

Cable tool water well drilling rig in the backcountry of Capitol Reef National Park (Phil Ayers, IMR, 2007).

Carlsbad Caverns National Park

Assisted in the preparation of the Rattlesnake Springs Management Plan by reviewing historic information, park legislation, and available hydrologic and biological data.

Provided project oversight to WRD funded project "Delineate Watershed and Subsurface Channels Feeding Rattlesnake Springs Aquifer."

Began investigating available technologies to prevent movement of nonnative fish through an irrigation ditch and into the Rattlesnake Springs pool.

Evaluated pool levels of Lake of the White Roses in Lechuguilla Cave.

Continued oversight for stage gages in Lake of the White Roses.

Obtained, entered, reformatted, and QA/QCed additional water quality data for upload to STORET in preparation for producing a Baseline Water Quality Data Inventory and Analysis Report.

Chaco Culture National Historical Park

Completed a floodplain survey near the Gallo Wash Campground.

Chickasaw National Recreation Area

Provided oversight for the operation and data management of two monitoring wells located within the park boundaries and completed in the Arbuckle-Simpson Aquifer.

Drafted a letter of support to the Oklahoma Water Resources Board concerning a temporary provisional water right application filed by Meridian Aggregates. The letter requested that certain conditions be imposed if the temporary provisional permit is granted.

Protested a new temporary water right application (2006-601) filed by Meridian Aggregates, Inc.

Participated in negotiations with USFWS and Meridian Aggregates to resolve water right issues concerning proposed expansion of Meridian's mining operation .

Participated in technical review panel discussions on the existing monitoring and management plan being conducted by NPS, USFWS, Meridian Aggregates, and the Oklahoma Water Resources Board.

Reviewed Floodplain Statement of Findings for the park's General Management Plan.

Colorado National Monument

Evaluated water rights applications in Water Division 5 to determine impact of diversions on park water rights.

Curecanti National Recreation Area

Provided input to the park and region on flow recommendations for endangered fish and the Aspinall Project EIS.

Devils Tower National Monument

Updated NHD hydrographic statistics.

Dinosaur National Monument

Evaluated water rights applications in Water

Division 6 to determine impact of diversions on park water rights.

Revised a report of a telemetry study of brown trout (*Salmo trutta*) in Lodore Canyon.

El Malpais National Monument

Assistance park staff on an FY2007 Disturbed Lands funded project for removing several dams and dikes.

Assisted Office of the Solicitor and Department of Justice in responding to motions regarding the quiet title action and water right claim preparation for the Zuni River Adjudication.

El Morro National Monument

Assisted Office of the Solicitor and Department of Justice in responding to motions regarding the quiet title action and water right claim preparation for the Zuni River Adjudication.

Florissant Fossil Beds National Monument

Evaluated water rights applications in Water Division 1 to determine impact of diversions on park water rights.

Fort Bowie National Historic Site

Assisted in remediation of biofouling problem at the park's water-supply well.

Fort Union National Monument

Participated in a multidisciplinary team evaluating the impacts of wagon rut erosion on the Santa Fe Trail. Developed recommendations and priorities for mitigation of problem areas.

Gila Cliff Dwellings National Monument

Provided technical and policy review of a proposed project titled "Integrating Stream Restoration Principles and Transportation Maintenance to improve fisheries in the West Fork of the Gila River and reduce erosion that threatens an adjacent road in Gila Cliff Dwellings National Monument."

Provided NHS GIS files, hydrographic and impairment statistics, and data processing guidance.

Glacier National Park

Provided programmatic oversight of a WRD funded study of Bull Trout being undertaken by Montana State University.

Evaluated water right applications to determine impacts on park water rights pursuant to the NPS-Montana Water Rights Compact. Filed three objections.

Represented the park in Blackfeet Tribe Compact Negotiations / Coordinated reviews of settlement proposals with Office of the Solicitor, and briefed management on implications of settlement proposals.

Reviewed and submitted comments on the draft Terms of Reference for the Environmental Assessment Application for the Cline Lodgepole Mine Project in SE British Columbia, Canada.

Provided assistance to park related to the use of Logan Pit along McDonald Creek as a staging area for road work. Assisted in scoping and interpreting the hydraulic study conducted by the Federal Highways Administration.

Reviewed Floodplain Statement of Findings for St. Mary Visitor Center/Transit Plan.

Submitted annual water use report for park as required by the NPS-Montana Water Rights Compact.

Glen Canyon National Recreation Area

Worked with park staff to obtain Watershed Condition Assessment High Priority funds for quagga and zebra mussel prevention activities at Lake Powell.

Wahweap Marina, Glen Canyon National Recreation Area (NPS, 2007).

Looking for adult Dreissenid (zebra/quagga) mussels, Wahweap Marina, Glen Canyon National Recreation Area (NPS, 2007).

Provided technical review and comment on a proposal titled "Develop a Conservation Protocol to Prioritize Threats to Springs for Management Purposes."

Reviewed Floodplain Statement of Findings for boating center at Lees Ferry.

Provided technical assistance via conference call regarding a proposed uranium mill.

Represented the WRD at a Lake Powell Co-operators meeting.

Represented WRD at a Lake Powell Technical Advisory Committee meeting.

Coordinated the effort to acquire, QA, and incorporate park GIS hydrographic edits in the NHD.

Grand Canyon National Park

Participated in a workshop to identify strategies to prevent the introduction of quagga mussels to the Colorado River in Grand Canyon.

Advised the NPS Colorado River Coordinator and park staff regarding regulatory requirements for restoring native riparian vegetation on the river below Glen Canyon Dam.

Provided review comments on sections of draft Environmental Impact Statement for establishing criteria to trigger release of high flows from Glen Canyon Dam for the purpose of building beaches and improving habitat.

Participated in water right settlement discussions for the Little Colorado River Adjudication.

Provided water rights assistance in reviewing a water right application on Kanab Creek.

Provided oversight to complete the Geologic Map of the Cameron 30' X 60' Quadrangle.

Reformatted, QA/QCed, and uploaded to NPSTORET and STORET water quality data for 12 different projects conducted by the park and/or its contractors or cooperators.

Assisted in the scoping of a flood investigation in the headquarters area of the park.

Grand Teton National Park

Provided assistance to park in the development of strategies to secure and protect instream flows in the lower Gros Ventre River.

Installed and operated a streamgage on the lower Gros Ventre River.

Provided technical assistance on instream flow issues and studies for the Gros Ventre River.

Coordinated the development of fishery studies on the Gros Ventre and diversion ditches by the University of Montana.

Cooperatively submitted and received a One-Fly grant application to conduct hydrologic and fisheries studies on the Gros Ventre River.

Provided funding to Teton Science School to support hydrologic data collection.

Provided hydrogeologic analysis and recommendations for well construction at Teton Science School.

Provided water rights guidance to park to resolve ditch maintenance issues on the Savage Ditch.

Attended workshop at park on various science projects related to the Snake River and operations of Jackson Lake Dam.

Conducted hydrogeological analysis and feasibility of well construction at the Craighead Ranch.

Reviewed progress report for WRD funded project implementation plan titled "Baseline water quality of four western tributary streams in the Upper Snake River Basin."

Reviewed proposal to examine the hydrologic (hydraulic) relationship/connection of the alluvial valley aquifer with nearby surfacewaters.

Great Sand Dunes National Park and Preserve

Provided final technical and policy review on a Wetland Statement of Findings for the *Great Sand Dunes National Park General Management Plan and Wilderness Study*.

Collected field data and oversaw data collection/compilation for 13 shallow ground-water monitoring wells located in Big Spring, Little Spring, and Medano Creeks.

Assisted the Department of Justice in filing motions to resolve the NPS protest of the Beck water right application.

Coordinated evidence preparation to support the NPS in-place ground-water claim.

Reviewed and commented on expert witness disclosures to District Court, Water Division No. 3, Colorado, in support of the NPS in-place ground-water claim.

Reviewed and commented on NPS AMENDED in-place ground-water claim.

Attended Closed Basin ground-water model meetings.

Completed inventory and closure of the Baca Ranch flowing wells.

Completed interagency agreements and sole source contracts to retain expert witnesses.

Evaluated applications in Colorado Water Division 3 to determine impact of diversions on park water rights.

Guadalupe Mountains National Park

Initiated discussions with the park and region to provide technical support and assistance in the development of the Guadalupe Mountains National Park Resource Stewardship Strategy.

Provided advice regarding potential for impact to park resources from ground-water withdrawals in the Dell City area.

Hovenweep National Monument

Submitted annual water use report for reserved water rights at springs to the State of Colorado.

Evaluated water rights applications in Water Division 7 to determine impact of diversions on park water rights.

Hubbell Trading Post National Historic Site

Participated in water right settlement discussions for the Little Colorado River Adjudication.

Jewel Cave National Monument

Assisted with the evaluation of a hydromulch product being considered for use up gradient from park's water supply.

John D. Rockefeller, Jr., Memorial Parkway

Provided technical assistance to the park and to the EQD's Natural Resource Damage Assessment Program regarding introduction of a non-native plant species at the Snake River Gravel Pit reclamation site.

Provided technical review and comment on a draft restoration plan for Flagg Ranch.

Served as "key official" and provided technical assistance to the park, Federal Highways Administration, and contractors regarding data collection, design work, and regulatory issues for the Pond 5 wetland reclamation project.

Lake Meredith National Recreation Area

Provided technical and policy review for the ConocoPhillips Company Plan of Operations.

Little Bighorn Battlefield National Monument

Provided oversight for an agreement with the USGS to measure discharge at an NPS streamgage on the Little Bighorn River within the park. Maintained and operated the gage to monitor decreed flows.

Submitted annual water use report as required by the NPS-Montana Water Rights Compact.

Lyndon B. Johnson National Historical Park

Obtained, entered, reformatted, and QA/QCed a variety of water quality data for upload to STORET.

Mesa Verde National Park

Provided guidance to park staff on the certification of a wetland mitigation bank project on land adjacent to the park.

Evaluated water rights applications in Water Division 7 to determine impact of diversions on park water rights.

Provided technical oversight for park operation of a streamgage on the Mancos River.

Assisted park staff in determining potential environmental impacts and regulatory compliance requirements for proposed water treatment plant discharges into adjacent stream channels and wetlands.

Assisted park with preparation of annual water use reports for the District Water Commissioner.

Montezuma Castle National Monument

Provided NHD GIS files, hydrographic and impairment statistics, and data processing guidance.

Provided oversight for park operation of two streamgages at Montezuma Well and operation of a streamgage on Wet Beaver Creek.

Funded operation of a USGS streamgage on Beaver Creek at the Castle Unit.

Completed investigation of the Antiquities Act, ethnological values, and establishment of Montezuma Castle.

Initiated preparing summary report describing work completed for the *Verde River adjudication*.

Provided funding and oversight for USGS study of the source and flow paths of groundwater in Montezuma Well.

Natural Bridges National Monument

Continued negotiations with the State of Utah to complete a water rights settlement.

Organ Pipe Cactus National Monument

Provided technical review for a draft report entitled Plan for Rehabilitation of Northeast Spring at Quitobaquito Springs Complex.

Padre Island National Seashore

Provided technical review and policy guidance for the Statement of Findings for Wetlands and Floodplains for the proposed Kindee Oil and Gas DM Murdock Deep Well #1 Oil and Gas drilling operation.

Provided technical review and policy guidance for the Statement of Findings for Wetlands for the Kindee Oil & Gas Texas, LLC Wilson Prospect Wells ST 949 #1, ST 945 #1, St 949 #2.

Provided technical review and policy guidance for the *Plan of Operations for the BNP Petroleum Corporation MBP ST 991 #1, BNP ST 991 #2, Dunn McCampbell A-7, A-8, A-9 Padre Island National Seashore, Texas.*

Provided technical review and policy guidance for the Statement of Findings for Wetlands for the BNP Petroleum Corporation MBP ST 991 #1, BNP ST 991 #2, Dunn McCampbell A-7, A-8, A-9 Padre Island National Seashore, Texas.

Provided technical review and policy guidance regarding wetland impacts from a proposed Houston Petroleum Six Pigs Communication Tower Scope of Work at Padre Island National Seashore.

Provided a review of hydrocarbon breakdown analysis from the Sprint spill site.

Pecos National Historical Park

Assisted park staff and CESU cooperators in preparing a proposal for funding titled "Assess the Condition of the Pecos River Riparian Corridor Prior to Implementation of a Public Fishing Program."

Prepared a report evaluating the success of the lower Glorieta Creek riparian-wetland project in Pecos National Historical Park and made recommendations for removing the remaining upper reservoir levee and fully reconnecting Glorieta Creek to the newly restored floodplain.

Provided information regarding long term stream gaging activity on the Pecos River north of the park.

Inspected the site of a levee removal project funded by the Stream Obstruction Removal Project, an activity under the Twenty Percent Fee Demo Program.

Petrified Forest National Park

Assisted park staff in developing a proposal for a demonstration project that would control exotic trees on 830 acres of the Puerco River riparian zone.

Coordinated a request to USGS to establish a gaging station on the Rio Puerco within the park.

Participated in water right settlement discussions for the Little Colorado River Adjudication.

Submitted requests to transfer ownership of BLM water rights to NPS as a result of recent land transfer.

Pipe Spring National Monument

Provided advice on water agreement the park is negotiating with the Kaibab Paiute Tribe.

Initiated discussions with the superintendent and staff to provide water resource planning support as part of the park's management planning process.

Reviewed a report summarizing the status of knowledge and hydrologic investigations related to the declining spring flow.

Provided technical assistance for on-going studies of geology and hydrogeology and causes of springflow reduction and assisted in testing of new water-supply well.

Rio Grande Wild and Scenic River

Provided field assistance on a WRD funded project investigating vegetation encroachment on the channel of the Rio Grande due to flow reduction and invasive plants.

Prepared an overview report to summarize results of ground-water modeling and ground-water management issues and provided recommendations for protecting base flows in the river.

Assessed ground-water discharge points along the Lower Canyons of the Rio Grande and channel morphology.

Attended the Groundwater Management Area 7 joint planning meeting and met representatives from local groundwater districts and other stakeholders.

Rocky Mountain National Park

Evaluated water rights applications in Water Divisions 1 and 5 to determine impact of diversions on park water rights.

Participated in construction oversight and advised park staff on wetland planting zones and protocols for the Fan Lake restoration project.

Provided input to Air Quality Division and ROMO on studies documenting the occurrence of vitellogenin and intersex characteristics in male fish.

Attended a meeting in which geneticists presented data that indicate that restored trout populations that were believed to be greenback cutthroat (*Oncorhynchus clarki stomias*) are actually Colorado River cutthroat (*Oncorhynchus clarki pleuriticus*).

Evaluated the effectiveness and the costs associated with wetlands restoration projects proposed for Rocky Mountain National Park for the Development Advisory Board.

Continued assistance for a wetlands restorations project located near the Roaring Fork / Fall River confluence. Assessed the channel integrity of returning Fall River to its original alignment to reduce sedimentation to a wetland and provided recommendations for a channel realignment for the Roaring Fork.

Provided review comments on draft operation and maintenance plan for Grand River Ditch.

Support 19jj core case team regarding a claim for restoration costs from the breach of the Grand River Ditch.

Facilitated the incorporation of edits made to the park's GIS hydrographic coverage into the NHD.

Assisted in oversight of construction and testing for a new well at the Alpine Visitor Center.

Attended subcommittee meeting and provided feedback on Water Quality Framework

document containing plan for agreement to control emissions influencing nitrogen deposition in the park.

Saguaro National Park

Provided technical review and permit / regulatory guidance regarding park plans to clean low water crossing areas and other areas where roads cross stream channels.

Provided policy level review of the draft Saguaro National Park General Management Plan/EIS.

Completed oversight and funding for hydrologic, macroinvertebrate, riparian and emergent vegetation, and aquatic herpetofauna studies to support the instream flow water right application on Rincon Creek.

Initiated preparation of the assessment report for the instream flow water right application on Rincon Creek due the Arizona Department of Water Resources.

Operated two streamgages and monitored seven shallow wells on Rincon Creek to support the instream-flow water right application.

Provided technical assistance for rehabilitation of a water supply well for the Tucson Mountain District.

Sand Creek Massacre National Historic Site

Provided on-site technical assistance by locating and installing 12 shallow ground-water monitoring wells for long-term monitoring at Sand Creek Massacre National Historic Site.

Provided a technical support documenting methods and results of an on-site evaluation of fisheries resources at Sand Creek Massacre National Historic Site.

Sunset Crater Volcano National Monument

Participated in water right settlement discussions for the Little Colorado River Adjudication.

Tumacacori National Historical Park

Participated in water right settlement discussions for the Santa Cruz Active Management Area.

Provided technical assistance during an on-site workshop organized to identify issues and opportunities related to the management of visitors and the natural / cultural resources of the Santa Cruz River and floodplain property within the park.

Provided technical assistance related to impact of wastewater discharges to Nogales Wash on water quality in the Santa Cruz River.

Provided NHD GIS files, hydrographic and impairment statistics, and data processing guidance.

Obtained, entered, reformatted, and QA/QCed a variety of water quality data for upload to STORET.

Tuzigoot National Monument

Provided technical assistance during an on-site visit, identifying issues and opportunities related to managing the hydrology in order to create wetlands that are self sustaining and plant assemblages that are typical of pre-European settlement times.

Walnut Canyon National Monument

Participated in water right settlement discussions for the Little Colorado River Adjudication.

Washita Battlefield National Historic Site

Provided comments on a report of the geomorphic adjustments of the Washita River.

Uploaded to STORET water quality and aquatic invertebrate data from 2002 and 2003 collected by the Oklahoma Biological Survey and University of Oklahoma in preparation for producing a Baseline Water Quality Data Inventory and Analysis Report.

Wupatki National Monument

Provided technical assistance in assessing hydrologic and geomorphic conditions related to flooding on a primary access road.

Participated in water right settlement discussions for the Little Colorado River Adjudication.

Yellowstone National Park

Evaluated water right applications to determine impacts on park water rights and filed objections when needed.

Participated with Office of the Solicitor in negotiations, and drafted a Stipulated Settlement Agreement concerning the water right change application by Cooke City Park County Water District.

Submitted annual water use report to the State of Montana as required by the NPS-Montana Water Rights Compact.

Coordinated with Montana Bureau of Mines and Geology on their assessment of the condition of the Church Universal Triumphant/ Royal Teton Ranch geothermal well.

Yellowstone National Park (Keteles, 2007).

Provided oversight for an agreement with USGS to collect discharge measurements on Reese Creek to determine the accuracy of the upper flume.

Assisted USFS legal counsel on a variety of water rights issues related to the Reese Creek Water Rights Settlement Agreement.

Provided guidance on a proposal to use Cooke City wells for dust suppression activities in the Cooke City area.

Provided guidance on whether the park must file permits for drilling wells in the Wyoming portion of YELL.

Participated in the annual meeting of the Technical Oversight Committee of the Yellowstone Controlled Groundwater Area.

Met with park staff and State of Montana DEQ Abandoned Mine Lands Program representatives to discuss NPS objectives and concerns surrounding excavation and removal of the McLaren waste from the wetland to the adjoining proposed repository site.

Continued to review water level data collected from NPS financed monitoring wells installed at the state's proposed repository site for McLaren Tailings at Cooke City.

Provided a summary presentation on Sylvan Pass impacts and mitigation considerations to Federal Highways, park staff and invited experts attending the Sylvan Pass Mitigation/ Restoration Workshop.

Performed "key official" responsibilities in overseeing the contracting (USGS) and implementation of a real time turbidity monitoring program at Sylvan Pass.

Continued to assist park staff with the Area 4 solid waste repository underdrain monitoring and sampling. Coordinated collection sump monitoring with park staff to ensure

that any future releases by the repository to underlying talus would be documented and at least semi-quantitatively assessed over the course of the Sylvan Pass Hydrologic Monitoring Program.

Attended the annual New World Mine Technical Meeting and continued to participate on a team that served as DOI lead in the Hydrogeology Work Group steering committee.

Provided review and comment on the New World Mine restoration project documents generated by the USFS.

Continued serving as Water Resources Division POC and Project Coordinator for investigation performed under the Servicewide Comprehensive Call, evaluating the effects of the shallow groundwater system at the Norris Geyser Basin on visitor safety.

Zion National Park

Provided wild fire restoration recommendations as part of the Intermountain Region Burned Area Emergency Restoration (BAER) Team for the Dakota Hills Complex of about 9,000 acres.

Lightning storms caused multiple fires (the Dakota Hills Complex) July and August 2007 in Zion National Park (Sharrow, 2007).

Headwaters of flash flood, Telephone Canyon, Zion National Park (Sharrow, 2007).

Reviewed Floodplain Statement of Findings for Backcountry Camping Plan.

Evaluated water rights applications to determine consistency with the Zion Water Rights Agreement and to evaluate impacts of diversions on park water rights. Filed one protest.

MIDWEST REGION

Provided technical input on Section 7 reviews of several project proposals for non-NPS rivers protected by the Wild and Scenic Rivers Act.

Agate Fossil Beds National Monument

Briefed the Superintendent about instream flow protection strategies being developed for the Niobrara River Basin.

Assisted in development of a groundwater monitoring plan.

Apostle Islands National Lakeshore

Provided technical / policy review and publication assistance in the completion of the Apostle Islands National Lakeshore coastal resources / coastal watershed condition assessment report (Natural Resource Technical Report NPS/NRWRD/NRTR – 2007/367).

Collated comments on WCA reports and sent comments to investigators. Participated in conference call to discuss comments with investigators.

Organized and facilitated a close-out meeting with park staff.

Provided technical review of the draft "affected environment" section of the Apostle Islands National Lakeshore General Management Plan.

Buffalo National River

Reviewed draft Protocol for Monitoring Aquatic Invertebrates.

Continued serving as Water Resources Division POC and Project Coordinator for investigation performed under the Servicewide Comprehensive Call on geologic mapping related to karst groundwater studies.

Provided assistance to the park for their participation on the technical group for the Bear Creek Dam proposal.

Provided programmatic oversight and technical review in support of freshwater mussel study on the Buffalo River.

Received and approved the final report for the project entitled "Characterization of the Macroinvertebrate Community and Drift in a Tributary of Buffalo National River."

Cuyahoga Valley National Park

Provided technical and policy guidance for the Statement of Findings for Wetlands for the project entitled "Rockside Boarding Area Parking expansion and Class 1 Connector Trail and Bridge from Lock 39 Trailhead in Cuyahoga Valley National Park."

Assisted the Park and Bureau of Reclamation in sampling fish in Virginia Kendall Reservoir to obtain data for NEPA analysis of water level drawdown.

Advised park staff regarding NPS wetland compliance requirements for repair of a dam spillway and removal of accumulated sediment at Virginia Kendall Lake.

Continued work on the Cuyahoga Valley National Park Water Resources Information and Issues Overview Report.

Uploaded the 2006 water quality data collected by the park from NPSTORET to STORET.

Effigy Mounds National Monument

Provided technical and policy review and publication assistance in the completion of the *Effigy Mounds National Monument Water Resources Foundation Report* (Natural Resource Report NPS/NRWRD/NRR – 2006/350).

Initiated discussions with the park and region to provide technical support and assistance in the development of the Effigy Mounds National Monument Resource Stewardship Strategy.

Provided technical assistance regarding excessive sediment delivery and potential loss of a 40-acre wetland and open water complex at Founders Pond.

Fort Union Trading Post National Historic Site

Coordinated the publication of a Natural Resource Technical Report on the geomorphology of the Missouri River and bank erosion.

Reviewed and commented on a proposal to monitor canal seepage that may be related to bank erosion.

Consulted with the superintendent on specifications on groundwater monitoring in regards to bank erosion of the Missouri River.

Indiana Dunes National Lakeshore

Provided data analysis from the ongoing Bailly Generating Plant RCRA Facility Inves-

tigation where groundwater sampling by the responsible party led to the delineation of several possible dissolved metals groundwater plumes beneath park lands from past fly ash disposal in up gradient areas.

Provided technical assistance and guidance to management in their dealings with EPA and Responsible Parties for the ongoing Town of Pines CERCLA investigation where historic releases of metals to groundwater from a fly ash landfill could threaten park wetlands located down gradient.

Provided programmatic oversight for a project which completed the restoration of 500 acres of wetlands within the Derby Ditch-Great Marsh.

Evaluated potential effects of the Derby Ditch wetland restoration project on flooding in the town of Beverly Shores.

Discussed options for restoring the portion of the Great Marsh drained by the Brown - Kintzele Ditch system.

Reviewed progress on NRPP-funded wetlands restoration work in the Cowles Bog area.

Provided technical and policy review and comment on a draft Wetland Statement of Findings for INDU 211(1), Rehabilitation of East State Park Road, Realignment of Mt. Baldy Entrance, and Miscellaneous Improvements.

Provided technical / policy review of draft sections of the park's coastal resources / coastal watershed condition assessment.

Isle Royale National Park

Commented on emergency rule and worked with park on prohibition of untreated ballast water to prevent invasion by fish virus.

Continued revisions to the draft Isle Royale National Park Fisheries Management Plan.

Mississippi National River and Recreational Area

Provided technical and policy review and publication assistance in the completion of the *Mississippi National and Recreational River Water Resources Information and Issues Overview Report* (Natural Resource Technical Report NPS/NRWRD/NRTR – 2007/364).

Missouri National Recreational River

Extensive technical and policy assistance was provided for the analysis of hydrology related to releases from dams on the Missouri River and geomorphology pertaining to alternatives for bank stabilization proposals.

Provided ongoing review and technical comments on the preparation of an EIS on the cumulative impacts of bank stabilization projects (Section 33 Program).

Provided technical assistance in identifying potential impacts of emergent sandbar construction on aquatic organisms, including the endangered pallid sturgeon (Scaphirhynchus albus) in support of a NPS Wild and Scenic Rivers Act Section 7 determination on the Missouri River.

Mount Rushmore National Memorial

Conducted hydrogeological analysis and provided recommendations for construction of a new water supply well.

Niobrara National Scenic River

Assisted park in the evaluation of its current water quality monitoring program and traveled to park to meet with key staff to assess resource monitoring needs.

Egelhoffs Rapid, Niobrara National Scenic River (NPS, 2007).

Provided technical oversight and funding of a literature review, a hydrologic data analysis and recreational studies to support a state-based instream flow application to protect instream flows.

Provided water rights guidance to encourage the State of Nebraska to place a moratorium on surface- and ground-water development to protect instream flows in the Niobrara River.

Assisted the park and the Office of the Solicitor in filing protests of surface- and ground-water applications in the Niobrara River Basin.

Developed instream flow protection strategies and coordinated with the Niobrara Council, Nebraska Game and Parks Commission, the Nebraska Department of Natural Resources, three local Natural Resource Districts, and the USFWS.

Provided assistance to the park and region in reviewing Nebraska's *Annual Evaluation of Availability of Hydrologically Connected Water Supplies.*

Ozark National Scenic Riverways

Provided technical and policy review and publication assistance in the completion of the *Ozark National Scenic Riverways Water Resources Foundation Report* (Natural Resource Report NPS/NRWRD/NRR – 2007/363).

Reviewed draft Protocol for Monitoring Aquatic Invertebrates.

Pictured Rocks National Lakeshore

Provided technical / policy review and publication assistance in the completion of the Pictured Rocks National Lakeshore coastal resources / coastal watershed condition assessment report (Natural Resource Technical Report NPS/NRWRD/NRTR – 2006/361).

Received a final report and MS Thesis for the BRMD project entitled "Evaluation of Seasonal Stream Usage and Interstream Migration by Coaster Brook Trout."

Initiated a Servicewide 20% Fee Funding Program Native Fish & Habitat Restoration Project involving non-native salmonid control within Sevenmile Creek.

Saint Croix National Scenic Riverway

Provided water rights guidance to the park regarding a proposal the City of St. Croix Fall, Wisconsin to divert water from the Saint Croix River.

Provided park staff with a review of draft Minnesota Mercury report and another report entitled *The effect of cranberry operations on water quality, nutrient levels, macroinvertebrate communities and community tolerance, and pesticide levels of the St. Croix National Scenic Riverway.*

Provided consultation with the park on NPS regulations and policies for the use of live bait when recreational fishing.

Sleeping Bear Dunes National Lakeshore

Provided advice in the scope and development of a natural resources condition assessment.

Managed a WRD High Priority project "Investigate factors contributing to type E botulism outbreaks at Sleeping Bear Dunes National Lakeshore" by providing input into the study plan and project oversight. Facilitated a partnership between NPS and the U.S. Navy for botulism E analyses.

Assisted with ongoing Glen Lake/Crystal River watershed planning activities, a stakeholder-based process to define water levels needed for balanced protection of lake and river resources.

Theodore Roosevelt National Park

Provided technical review for the *Wetland Delineation Report for Cedar Canyon and Squaw Creek Repair and Rehabilitation of Scenic Drive, North Unit, Theodore Roosevelt National Park*.

Surveyed established cross sections on the Little Missouri River to detect floodplain evolution and channel movement.

Provided oversight and funding for a USGS agreement to operate and maintain the Little Missouri River (near Watford City) streamgage.

Reviewed and provided comments on a draft manuscript by USGS and private scientists summarizing and expanding on a previous GIS analysis of riparian vegetation in the Little Missouri River floodplain.

Reviewed a proposal to complete a detailed aquatic inventory in the Little Missouri River within the park.

Determined whether the State of North Dakota considers the Little Missouri River non-navigable waterbody.

Voyageurs National Park

Continued as WRD project officer on for project "Impacts of forest fires on levels of mercury in lake and forest environments."

Provided technical and policy guidance review for wetlands delineation and the Wetland Statement of Findings for the Rainy Lake Visitor Center Bike Trail Project.

Assisted the park in developing a WRD Contingency funding proposal to address the recent spiny water flea invasion of park lakes.

Provided extensive technical input on Section 7 reviews for the National Rivers Coordinator of several project proposals for non-NPS rivers (Little Miami River and Big Darby Creek in Ohio) protected by the Wild and Scenic Rivers Act.

Wilson's Creek National Battlefield

Uploaded additional water quality data for upload to STORET in preparation for producing a Baseline Water Quality Data Inventory and Analysis Report.

Wind Cave National Park

Conducted hydrogeological analysis to investigate sources and solutions of high arsenic concentrations in a water-supply well.

Reviewed proposal to use environmental tracers to assess karst groundwater flow to and from the cave in the park.

Prepared evidentiary materials and presented testimony in an administrative hearing concerning Applications 2580-2 and 2585-2 by the Southern Black Hills Water System. Coordinated testimony with park staff and Office of the Solicitor.

Provided comments to South Dakota DENR on the draft findings, conclusions and rulings resulting from a hearing on the Southern Black Hills Water System groundwater applications.

Initiated a geochemical study with USGS to determine groundwater flow paths in and near WICA, contributed WRD staff for sample collection, and provided study oversight.

Continued water level monitoring at Well #2.

Evaluated a water right application and submitted a letter of Intervention for an application by the Fall River Water Users District. Completed a negotiated agreement with the District that allows them to proceed with the process of withdrawing groundwater while providing the NPS with valuable hydrogeologic and geochemical information.

Evaluated a water right application and sent a letter of Intervention for an application by United Land Management. This letter informed the State that the NPS was chiefly concerned with cumulative impacts to WICA water rights and water-dependent resources and not the lone impacts of this proposed withdrawal.

Conducted a meeting with the South Dakota Chief Engineer and staff, and park and WRB staff to discuss NPS concerns for ground-water development plans near the park, information needed to protect park resources and the direction of future NPS studies.

Assessed possibilities for conversion of storage right to instream flow purposes.

NATIONAL CAPITAL REGION

Provided review and comment on the investigator's final report for the USGS short nose sturgeon study on the Potomac River.

Continued to provided consultation and review of a multi-year NRPP project looking at dwarf wedgemussel habitat in multiple eastern parks.

Provided guidance regarding NPS regulatory authorities under the Wild and Scenic Rivers Act to assess potential migratory fish impacts caused by the development of a proposed liquefied natural gas off-loading facility on the Taunton River, downstream of a proposed Wild and Scenic River Study Area.

Appalachian National Scenic Trail

Assisted park by reviewing the Palmerton Zinc Quality Assurance Project Plan.

Reviewed volunteer water quality monitoring plan and participated in discussions to initiate a Level I water quality inventory.

Catoctin Mountain Park

Conducted hydrogeologic analysis and prepared a summary report of well construction at the park.

Chesapeake and Ohio Canal National Historical Park

Provided final technical and policy review and comment on a Statement of Findings for Floodplain Management and Wetlands Protection: Catoctin Power Water Supply and Wastewater Discharge Right-of-Way.

Provided technical assistance during an on-site visit reviewing the adverse effects of rock levee built by the Corps in the 1920's within the Potomac River floodplain.

George Washington Memorial Parkway

Provided final technical and policy review for a Wetland/Floodplain Statement of Findings for the Woodrow Wilson Bridge Replacement Project at Jones Point Park.

Monocacy National Battlefield

Provided technical / policy review and publication assistance in the completion of the *Monocacy National Battlefield Water Resources Stewardship Report* (Natural Resource Technical Report NPS/NRPC/WRD/NRTR – 2007/048).

National Capital Parks – East

Provided technical assistance for developing a Wetland Management Plan and Environmental Impact Statement concerning several large, emergent, wetland complexes on the Anacostia River.

Prince William Forest Park

Provided technical assistance during an on-site visit training park staff to recognize and delineate wetlands.

NORTHEAST REGION

Continued to work with Region's Wild & Scenic River Program to help assess potential impacts to migratory fish by the development and operation of a proposed Liquefied Natural Gas off-loading facility on the Taunton River downstream of a proposed Wild and Scenic River Study Area.

Provided technical assistance to the region in reviewing a proposal by the Somerset Power to do maintenance dredging at their power plant on the Taunton River.

Assisted with plans for New York-New Jersey Bight Area Seamless Network workshop

Attended interagency oceans meeting between NPS, USFWS, and USGS to plan regional activities.

Acadia National Park

Participated in conference calls and progress review meetings to monitor progress and ensure substantial involvement in the development of a natural resources condition assessment.

Reviewed and evaluated a proposal for a Wetland Hydrologic Restoration at Great Meadow.

Provided review and comment on proposed catadromous brook trout studies.

Provided input and review of a new park program to restore fish passage for sea-run brook trout and lampreys.

Consulted with park and regional staff on sample size issues and forwarded mercury issue updates to park staff.

Traveled to the park and inspected conditions associated with many road culverts.

Allegheny Portage Railroad National Historic Site

Conducted an assessment of the stability of two ponds in the Staple Bend Tunnel Unit that are proposed to be used to neutralize acid mine drainage and prepared a rainfall runoff model to determine the ponds capacity to contain stormwater runoff.

Assateague Island National Seashore

Provided review comments on "Contaminant Hazard Quotient" reports.

Boston Harbor Islands National Recreation Area

Developed request for statements of interest, reviewed statements of interest, facilitated the selection of investigators, and finalized Task Agreement for a Coastal Watershed Condition Assessment project.

Cape Cod National Seashore

Developed request for statements of interest, reviewed statements of interest, facilitated the selection of investigators, and finalized Task Agreement for a Coastal Watershed Condition Assessment project.

Uploaded water quality data from the park's long-term kettle pond monitoring program and ground-water monitoring program to STORET.

Assisted in preparation of a study plan to investigate potential impacts of septic effluent on water quality of East Harbor.

Conducted analyses of potential impacts of restoring tidal flow in the Herring River system on adjacent private, domestic wells.

Colonial National Historical Park

Reviewed draft mercury risk assessment document.

Delaware Water Gap National Recreation Area

Provided technical consultation and assistance on assessing potential ecological impacts of various flow management alternatives resulting from an instream flow study being conducted by the Delaware River Basin Commission.

Fire Island National Seashore

Developed plans with park staff for boater educational materials under Marine Recreational Stewardship fee project.

Provided review and comment on the Project Agreement for the park's General Management Plan.

Participated in quarterly conference calls to track progress of a Coastal Watershed Condition Assessment project and ensure substantial involvement. Attended scoping workshop to provide guidance to investigators.

Provided review comments on Contaminant Hazard Quotient reports.

Project oversight NRPP funded project "Simulation of the Shallow Ground-Water Flow System."

Flight 93 National Memorial

Reviewed and evaluated the effects on wetlands of the proposed architectural developments in the Flight 93 National Memorial.

Fort Necessity National Battlefield

Uploaded water quality data from the 1999 Level I Water Quality Inventory conducted by the California University of Pennsylvania to STORET.

Fort Stanwix National Monument

Provided policy review and technical comment on the draft General Management Plan/EIS.

Fredericksburg and Spotsylvania County Battlefields Memorial National Military Park

Facilitated the incorporation of edits made to the park's GIS hydrographic coverage into the NHD.

Uploaded water quality data collected by park staff from 1993-1996 and 2003-2005 to STORET.

Gateway National Recreation Area

Participated in quarterly conference calls to track progress of Watershed Condition Assessment report and ensure substantial involvement. Attended scoping workshop to provide guidance to investigators.

George Washington Birthplace National Monument

Provided technical review of the George Washington Birthplace National Monument Natural Resources Synthesis Report.

Minute Man National Historical Park

Provided recommendations regarding stream drainage and fish passage restoration issues at Minute Man National Historic Park.

Made a site visit to the location of a project funded by the Stream Obstruction Removal Project, an activity under the Servicewide 20% Fee Funding Program.

Morristown National Historical Park

Initiated name correction of "Indian Grove Brook" to "Indian Grave Brook" in the U.S. Board on Geographic Names' Geographic Names Information System.

Richmond National Battlefield Park

Summarized past technical assistance responses on contaminants issues for current staff.

Roosevelt-Vanderbilt National Historic Sites

Facilitated the incorporation of edits made to the park's GIS hydrographic coverage into

the NHD.

Sagamore Hill National Historic Site

Evaluated regulatory documents regarding the impacts to wetland from adjacent property owner's farming activities adjacent to Sagamore Hill National Historic Site.

Participated in quarterly conference calls to track progress of a Coastal Watershed Condition Assessment project and ensure substantial involvement. Attended scoping workshop at Sandy Hook NRA to provide guidance to investigators.

Provided review comments on "Contaminant Hazard Quotient" reports.

Saratoga National Historical Park

Continued to work with park on PCB technical assistance request.

Saugus Iron Works National Historic Site

Provided technical and policy review the Statement of Findings for Wetlands for the Turning Basin Wetland Restoration Project at Saugus Iron Works National Historic Site.

Developed request for statements of interest, reviewed statements of interest, facilitated the selection of investigators, and finalized Task Agreement for a Coastal Watershed Condition Assessment project.

Shenandoah National Park

Completed review and acceptance of the final report on NRPP supported study of acid deposition impacts on park aquatic resources.

Project oversight NRPP funded project "Hydrology of Big Meadows, Shenandoah National Park, Virginia: Assessment of a Sensitive Wetland System in the Blue Ridge Mountains."

Upper Delaware Scenic and Recreational River

Assisted the park in developing a WRD Contingency funding proposal to address flood restoration work on upper Delaware River tributaries.

Served as WRD coordinator for a High Priority Project that enabled the park to contract for assistance with planning appropriate actions to take following several large floods that impacted park and neighboring infrastructure.

Conducted hydrogeological analysis and provided recommendations for construction of a new water supply well.

Valley Forge National Historical Park

Facilitated the incorporation of edits made to the park's GIS hydrographic coverage into the NHD.

PACIFIC WEST REGION

Reviewed water rights applications near California NPS units for potential to impact to park water rights and resources.

Prepared briefing statement for Director's Office on development of Nevada's in-state ground-water resources for southern Nevada.

Participated as a cooperating agency for the Clark, Lincoln, and White Pine Counties Ground-Water Development Environmental Impact Statement (CLWP EIS).

Compiled water right information from DOI bureaus regarding selected ground-water applications in the Death Valley, Colorado, and Upper Great Salt Lake Desert Ground-water Flow Systems of Nevada.

Participated in discussions between SNWA and DOI bureaus concerning ground-water applications in Delamar, Dry Lake, and Cave Valleys.

Participated in USGS/Nevada Bureau of

Mines and Geology Geoscience Workshop in Las Vegas, NV.

Attended Nevada Water Resources Association (NvWRA) Annual Conference.

Participated on the planning committee for the NvWRA's "Regional Tour of the Carbonate System" in eastern Nevada, a tour comprised of water resource professionals and local, county, state, and Federal representatives with an interest or stake in the development of the carbonate aquifer systems

Cabrillo National Monument

Helped park analyze U.S. Navy data summaries for San Diego.

Uploaded automatic data logger water quality data from the City of San Diego Ocean Monitoring Program to STORET.

Obtained, entered, reformatted, and QA/QCed additional water quality data for upload to STORET in preparation for producing a Baseline Water Quality Data Inventory and Analysis Report.

Channel Islands National Park

Assisted park staff in preparing a proposal to acquire funding from the Southern California Wetlands Recovery Project for the Prisoners Harbor wetland restoration project.

Developed conceptual design alternatives for the Prisoners Harbor wetland restoration project on Santa Cruz Island. Initiated the NEPA process and the development of the final grading and planting plans for the selected alternative.

City of Rocks National Reserve

Assisted park and region staff in conducting a field assessment and preparing a proposal to remove an earthen dam.

Researched the standing of a water right at the Tracy Reservoir.

Crater Lake National Park

Prepared a presentation for the Crater Lake augmentation water supply working group.

Advised park staff on water transparency and monitoring frequency issues.

Obtained, entered, reformatted, and QA/QCed additional water quality data for upload to STORET in preparation for producing a Baseline Water Quality Data Inventory and Analysis Report.

Death Valley National Park

Cooperated with USFWS, the Nevada Department of Wildlife, and others to identify, implement, and evaluate measures intended to reverse the species decline of the Devils Hole pupfish in its native habitat and to establish a refuge population.

Participated in workshops and meetings on Devils Hole pupfish genetics, propagation, monitoring, and population modeling.

Provided final technical and policy review on a Wetland/Floodplain Statement of Findings for the Reconstruction of the Furnace Creek Water Collection System project.

Provided technical assistance regarding a proposal to restore wetland/spring habitats at Travertine Springs.

Reviewed and evaluated a proposal to restore Texas Spring to pre-settlement wetland conditions.

Advised park staff regarding wetland compliance requirements for replacing a water line that crosses an arroyo.

Evaluated Nevada water right applications for potential impacts to park resources and water rights and prepared protests of applications where needed.

Coordinated the development and implemen-

tation of a technical and legal strategy with the Office of the Solicitor, park, and other Federal agencies; obtained expert hydrogeologists' services, and submitted expert witness reports to the Nevada State Engineer; presented testimony at a state administrative hearing in support of NPS protests of water rights applications in the Amargosa Desert, including protests of eight individual water right applications filed by Rockview Dairies, Inc.

Provided oversight for the operation and data management of five spring flow and water level monitoring gages at Devils Hole and Texas, Travertine, and Nevares Springs.

Revised water level and temperature data from the Department of Energy monitoring network in the Amargosa Desert.

Provided technical assistance in the review and revision of a draft manuscript on the effects of regional tectonic stress on water levels at Devils Hole.

Participated in Amargosa Basin DOI Coordination Meeting and 2007 Devils Hole Workshop.

Coordinated with USAF on a well replacement proposal at Creech AFB pursuant to MOA for Federal agency water rights coordination in southern Nevada.

Reviewed draft manuscript to be submitted to the journal Geophysical Research Letters on the effects of regional tectonic stress on water levels at Devils Hole. Provided revisions and comments to improve manuscript to the authors.

Devils Postpile National Monument

Provided hydrogeologic analysis and recommendations for well construction.

Ebey's Landing National Historical Reserve

Provided technical / policy review and publication assistance in the completion of the Ebey's Landing National Historical Reserve coastal resources / coastal watershed condition assessment report (Natural Resource Technical Report NPS/NRWRD/NRTR – 2007/369).

Organized and attended a closeout/implementation meeting with investigators, NPS staff, and Reserve Board to discuss the key findings and recommendations.

Initiated a resource condition assessment / feasibility study with Herrera Environmental for restoring a 600-acre "pocket estuary."

Golden Gate National Recreation Area

Participated in a conference call with park staff, and professional editor to discuss a strategy for revisions to a Coastal Watershed Condition Assessment. Maintained contact with professional editor to guide the revision process.

Helped cooperators and park staff kick off the WRD funded project entitled "Data Collection and Detailed Restoration Design for the Rodeo Beach Wetland Complex."

Provided technical review and comments on the *Environmental Assessment for the Tennessee Hollow Upper Watershed Restoration Project at the Presidio of San Francisco.*

Evaluated hydrologic data and advised park staff regarding possible causes of surface saturation in the south picnic area at Stinson Beach.

Provided technical assistance to park and the DSC GMP planning team, working on desired conditions for the park's water resources.

Reviewed draft design report and approved

release of 2007 funds for the NRPP Disturbed Lands Project entitled "Complete Restoration of Salmonid Habitat at Banducci."

Advised WRD staff updating endocrine issues in the NPS on latest findings from GOGA. Updated GOGA staff on pesticide issues and what it takes to prove cause and effect in outdoor environments.

Provided NHD GIS files, hydrographic and impairment statistics, and data processing guidance.

Researched chain of title to park lands regarding the severance of water rights in support of wetland restoration project and continued assessment of alternatives for water rights exchange in support of wetlands rehabilitation.

Provided water right guidance for the resolution and acquisition of land and water rights from the Zen Center on Green Gulch.

Great Basin National Park

Evaluated Nevada water right applications for potential impacts to park resources and water rights and prepared protests of applications where needed.

Evaluated Utah water right applications in basins adjacent to the park for potential impacts to park resources and water rights; coordinated preparation of protests with BLM, USFWS, and Office of the Solicitor.

Assisted DOI-SNWA water resources liaison with letter from DOI bureaus to White Pine County concerning implementation of the Spring Valley Stipulated Agreement.

Provided technical and editorial review to USGS Open-File Report #2006-1342 by David Prudic, which comprised a technical response to a memorandum by Peter Rowley and Gary Dixon, Consulting Geologists, to the Southern Nevada Water Authority (SNWA).

Provided oversight of an agreement with USGS to operate and maintain the Lehman Creek streamgage.

Developed proposal to evaluate basin-fill aquifers in southern Spring and Snake Valleys and assess their connection with surface-water resources and with the regional carbonate-rock aquifer in and adjacent to the park for funding under the Southern Nevada Public Lands Management Act, Round 8.

Initiated a USGS study of the source of Cave Springs, and provided technical oversight to the investigation.

Implemented provisions of the SNWA-DOI Spring Valley stipulated agreement, including participation in meetings and conference calls as part of an overall effort to implement the hydrologic 3M Plan of the agreement.

Coordinated with Department of the Interior liaison on SNWA Spring Valley ground-water development project.

Uploaded water quality data from five park-based projects from NPSTORET to STORET.

Revised a report on Bonneville cutthroat trout (*Oncorhynchus clarki utah*) restoration for publication in the Natural Resource Technical Report series.

Hagerman Fossil Beds National Monument

Provided advice on construction of a new water-supply well.

Filed change in ownership application for a NPS acquired well.

Haleakalā National Park

Served as Contracting Officers Technical Representative for a contract for the installation of a hydrologic monitoring system in the Kipahulu area of the park.

John Day Fossil Beds National Monument

Prepared a water rights assessment, reviewed park water uses to determine if they align with water rights.

Conducted hydrogeological analysis and recommendations for construction of water supply wells at Foree, Painted Hills, and Blue Basin.

John Muir National Historic Site

Provided comments about information needs and funding sources to implement a watershed management plan for Mt. Wanda open space.

Follow up work was provided to locate private consultants available to provide the remote sensing data for a highly detailed topographic map of the watershed.

Attended a meeting with stakeholders and city managers concerned about impacts to private residences on the Alhambra Creek floodplain from overflow from a new storm water drain. Maintenance recommendations were made while inspecting the storm water drainage system inside the park.

Joshua Tree National Park

Worked with DSC staff and private consultant on strategies for providing flood protection to the Black Rock Campground area and assisted in scoping future studies.

Kalaupapa National Historical Park

Reviewed environmental and contaminant transport aspects of proposed re-construction of the docks.

Developed Scope of Work and Evaluation Criteria for Watershed Condition Assessment contract

Provided review comments regarding proposal submitted to USGS, *The development of a microarray for the identification of planktonic larvae and spores of Hawaiian reef biota*.

Kaloko-Honokōhau National Historical Park

Made site visit and provided advice related to storm water runoff from a new resort development located adjacent to park.

Obtained funding from the High Priority Project program to help fund the efforts of a USGS ground-water scientist in developing a ground-water monitoring program.

Provided fiscal and technical oversight for WRD funded project on Determining Subterranean Groundwater Nutrient Input to Kaloko-Honokōhau National Historic Park's Coastal Ocean Ecosystem.

Evaluated Hawaii water-right applications for potential impacts to park resources.

Reviewed the Natural Resources Management Plan and the Water Development Impacts Study for a development adjacent to the park and provided comments and recommendations to Hawaii County regarding the potential for the proposed irrigation wells to cause saltwater intrusion.

Participated in a meeting with the Hawaii County Planning Director to discuss a proposed water-development system adjacent to the park.

Submitted to the Hawaii Commission on Water Resources a protest of an application to pump 2.2 Mgd of brackish water adjacent to the park.

Initiated agreements and provided oversight on projects concerning saltwater intrusion monitoring and the sensitivity to salinity of candidate endangered species within the park.

Provided technical assistance in the field during the installation of continuous salinity monitoring equipment in the park.

Participated in a meeting with the Hawaii Commission on Water Resource Management to discuss management options for ground-water development in North Kona.

Prepared a letter to the Hawaii Department of Health regarding an Underground Injection Control permit application adjacent to the park.

Lake Mead National Recreation Area

Provided technical support pertaining to the quagga mussel invasion via interacting with the park, BRMD, and the region on possible response strategies.

Advised park staff on the meaning of mercury data in fish from various parts of the lake versus comparison values from around the nation.

Evaluated Nevada water right applications and filed protests to protect park water rights and resources.

Completed draft of water right summaries for all hydrographic basins in the Colorado Ground-water Flow System of Nevada.

Provided technical oversight of work by GeoTrans, Inc., to develop a numerical ground-water flow model of 13 selected basins within the Colorado Flow System, which comprises part of the watershed for regional warm springs that discharge in the park and the Virgin and Muddy Rivers that discharge to Lake Mead within the park.

Planned, organized, and participated in a progress meeting for the numerical ground-water flow modeling effort in southeastern Nevada.

Completed technical oversight of USGS surface geophysics study that delineated deep sedimentary basins within the area of the ground-water model, generally to the north of the park.

Provided technical oversight of a USGS study to quantify ground-water discharge by evapotranspiration within the area of the ground-water flow model, generally north of the park.

Implemented agreement with USGS Geologic Discipline to provide advice and support services to modeling contractors regarding the geologic-framework model, which is a part of the numerical ground-water flow model.

Prepared scope of work for external expert hydrogeologic review of the numerical ground-water flow model, including scrutiny of boundary conditions and model conceptualization.

Provided technical oversight on USGS agreements to operate and maintain streamgages at Rogers and Blue Point springs and the Virgin River near Overton, NV.

Continued implementation of monitoring and ground-water management provisions of negotiated settlements with SNWA and with Vidler Water Company, Inc.

Provided technical review comments and recommended revisions to a USGS project proposal for a study of the hydrogeology of hot springs in the Black Canyon area of the Colorado River below Hoover Dam within the park, to be funded via the Southern Nevada Public Lands Management Act of 1998, Round 6. Prepared project scope of work and budget for agreement with USGS.

Responded to questions concerning Arizona's regulations for groundwater development in the Mohave County area.

Lassen Volcanic National Park

Facilitated the incorporation of edits made to the park's GIS hydrographic coverage into the NHD.

Revised Kings Creek water rights assess-

ment, coordinated with Office of the Solicitor regarding NPS response to unauthorized access to divert water.

Lewis and Clark National Historical Park

Provided technical / policy review and publication assistance in the completion of the Lewis and Clark National Historical Park coastal resources / coastal watershed condition assessment report (Natural Resource Technical Report NPS/NRPC/WRD/NRTR – 2007/055).

Mojave National Preserve

Reviewed the accomplishment report for the NRPP T&E project "Lake Ecology and Population Dynamics of Mohave Tui Chub (*Gila bicolor mohavensis*)."

Participated in conference calls and advised park staff in dealings with Lahontan Regional Water Quality Control Board representatives and their contractor, addressing appropriate delineation of a ground-water plume from the Mountain Pass Mine that may be impacting park resources.

Completed inventory of park water rights, prepared Statements of Water Diversion and Use, and Reports of Licensee for filing with California State Water Resources Control Board.

Mount Rainier National Park

Reviewed the accomplishment report and approved release of funding for the NRPP project "Assess Status of Native Bull Trout and Cutthroat Trout Populations."

Reviewed the final accomplishment report for the WRD funded project "Develop Reference Site Data for Monitoring Biological Integrity and Water Quality of Streams."

Reviewed the final accomplishment report for the WRD funded project "Assess Impairment of Water Quality and biological Integrity through Use of Invertebrates in Lakes."

Consulted with park staff on ostracods as an example of a species we would not try to stop from moving around as a result of climate change (this species is still slowly reoccupying territory after recovering from the last ice age).

Served as WRD point-of-contact for Fluvial Geomorphologist in the park, a position supported by the Natural Resources Challenge.

North Cascades National Park

Initiated a Servicewide 20% Fee Funding Program Fish & Habitat Restoration Project involving gill net reductions of non-native fish in two of the park's high mountain lakes.

Reviewed the final accomplishment report for the WRD funded project "Develop Reference Site Data for Monitoring Biological Integrity and Water Quality of Streams."

Reviewed the final accomplishment report for the WRD funded project "Assess Impairment of Water Quality and biological Integrity through Use of Invertebrates in Lakes."

Advised park staff on the survey design and QA/QC aspects of proposed lake monitoring protocol.

Facilitated the incorporation of edits made to the park's GIS hydrographic coverage into the NHD.

Olympic National Park

Provided continuing assistance related to the proposed removal of two dams on the Elwha River including assisting in the development of a plan for a pre-drawdown of Lake Mills to assist with the management of sediment in the lakebed.

Discussed importance of QA/QC and monitoring design detectability issues with park staff developing fish monitoring protocols to, issues of importance when trying to detect small changes away from pristine conditions.

Reviewed Floodplain Statement of Findings for Twin Creek Bridge replacement.

Reviewed Floodplain Statement of Findings for the park General Management Plan.

Reviewed the final accomplishment report for the NRPP Disturbed Lands project entitled: *Restore Hydrologic Function, Fish, Wildlife and Native Vegetation on the Upper Hoh River.*

Received an additional peer reviewed publication for the NRPP project entitled "Determine Migratory Pathways, Spawning Areas, and Potential Sources of Threats to Bull Trout."

Provided technical and policy review of the draft coastal resources / watershed condition assessment for the coastal strip of Olympic National Park.

Reviewed the final accomplishment report for the WRD funded project "Develop Reference Site Data for Monitoring Biological Integrity and Water Quality of Streams."

Reviewed the final accomplishment report for the WRD funded project "Assess Impairment of Water Quality and biological Integrity through Use of Invertebrates in Lakes."

Modified Task Agreement to provide additional funding to allow completion of a Coastal Watershed Condition Assessment report.

Pinnacles National Monument

Obtained, entered, reformatted, and QA/QCed Level I Water Quality Inventory data collected by the U.S. Geological Survey for upload to STORET in preparation for producing a Baseline Water Quality Data Inventory and Analysis Report.

Point Reyes National Seashore

Collected site information in support of applications to convert consumptive use rights to instream flows.

Continued research of Section 1707 conversions focusing on need for state and local permits or possible consultant input.

Provided water rights guidance to resolve the protest of the North Marin Municipal District's change application for the acquired Giacomini water right on Lagunitas Creek.

Participated in a conference call with park staff and a professional editor to discuss a strategy for revisions to a Coastal Watershed Condition Assessment report. Maintained contact with professional editor to guide the revision process.

Met with park staff to discuss the initiation and implementation of the Fee Demo Project to restore a tidal lagoon at the Kenneth Patrick Visitor Center.

Initiated a Servicewide 20% Fee Funding Program Fish & Habitat Restoration Project involving aquatic habitat improvements through the removal of non-native riparian vegetation and restoration of stream bank habitat.

Provided technical and policy review and comments on the draft Environmental Assessment and Wetland Statement of Findings for Cantwell Subsistence Off-Road Vehicle Management.

Provided technical and policy review and comments on the draft Wetland Statement of Findings for Executive Order 11990, Headquarters Area Master Plan.

Provided technical and policy review for the Statements of Findings for Wetlands and Floodplains for the Giacomini Wetland Restoration Project.

Participated in teleconferences to discuss

past research efforts, current information status, and NPS response to Drakes Estero oyster farming issue.

Pu'ukoholā Heiau National Historic Site

Provided technical / policy review and publication assistance in the completion of the park coastal resources / coastal watershed condition assessment report

Redwood National and State Parks

Provided technical / policy review and publication assistance in the completion of the parks' coastal resources / coastal watershed condition assessment report (Natural Resource Technical Report NPS/NRWRD/NRTR – 2007/368).

Conducted site visit to assess restoration and contaminants issues and review progress in restoration of Redwood Creek.

Obtained, entered, reformatted, and QA/QCed additional water quality data for upload to STORET in preparation for producing a Baseline Water Quality Data Inventory and Analysis Report.

Salt River Bay National Historical Park and Ecological Preserve

Provided technical and policy review for the Statement of Findings for Wetlands for the Proposed Marine Research and Education Center and Abandoned Motel.

San Juan Island National Historical Park

Provided technical / policy review and publication assistance in the completion of the San Juan Island National Historical Park coastal resources / coastal watershed condition assessment report (Natural Resource Technical Report NPS/NRWRD/NRTR – 2006/360).

Santa Monica Mountains National Recreation Area

Initiated a Servicewide 20% Fee Funding Program Fish & Habitat Restoration Project involving aquatic habitat improvements through restoration of native aquatic habitat in Zuma Creek.

Sequoia and Kings Canyon National Parks

Provided design technical assistance and construction oversight for the Halstead Meadow Pilot Restoration Project, which involved backfilling a 10-12 foot deep erosion gully and re-establishing historic meadow sheet-flow hydrology.

Made a follow-up trip to site of a poorly designed highway bridge near the Cedar Grove development. Successfully acquired funding from High Priority Project program to fund an environmentally sensitive bank reconstruction design.

Provided technical information on how and when to consider using remote sensing to determine lake levels, how to understand and interpret the difference between various types of detection limits, and sources of information on using lichens to monitor for contaminant deposition.

Provided background information on the National Watershed Boundary Dataset and the reach catchments in NHDPlus.

Provided consultation assistance to park fishery biologist concerning use of the fish piscicide Antimycin within the NPS and associated studies of non-target organism impacts.

Provided technical comments related to a proposal to find chemical and biological tracers below marijuana growing fields.

USS Arizona Memorial

Reviewed Floodplain Statements of Findings for new visitor center.

Whiskeytown-Shasta-Trinity National Recreation Area

Provided park staff with information on diel variation in metals concentrations in big reservoirs.

Coordinated and compiled technical comments related to a proposal to find chemical and biological tracers below marijuana growing fields.

Developed, in conjunction with other NRPC staff, a proposal for Caltrans and Colorado State University researchers to consider in mitigating the changes to the site hydrology from a highway realignment that altered the habitat and threatened an indigenous rare plant species.

Prepared technical report on hydrogeology of springs associated with *Puccinellia howelii* habitat.

Yosemite National Park

Participated in a workshop held at the park to refine the VERP monitoring protocols for stream bank erosion. Stream bank erosion is a key indicator of use along the Merced River.

Provided Rebuttal Declaration follow-ups for submission to court case regarding the adequacy of the Merced River Plan.

Provided continued assistance regarding a lawsuit filed in U.S. District Court (Eastern District of California) against the Secretary of the Interior. WRD staff provided a declaration for the court on behalf of the NPS and developed talking points for U.S. attorneys for use in a court hearing.

Provided final technical and policy review on a Floodplain / Wetland Statement of Findings for Reconstructing Critically Eroded Sections of El Portal Road.

SOUTHEAST REGION

Abraham Lincoln Birthplace National Historic Site

Reviewed draft Mercury Implementation Plan and provided comments to ARD.

Big Cypress National Preserve

Provided technical review and comment on the draft Wetland Statement of Findings: Tamiami Trail Welcome Center.

Provided wetland restoration technical assistance in evaluating procedures utilized in restoring the wetland damage from off-road vehicles, and the oil and gas drill pad restoration efforts.

Big South Fork National River and Recreation Area

Participated in a meeting with the USGS, TNC, Tennessee Tech, and park staff to discuss two projects: the USGS instream flows needs for ecological health project and The Nature Conservancy's Habitat Conservation Plan on the Cumberland Plateau to determine if the park could benefit from these research activities.

Reviewed and evaluated language in the *Big South Fork National River and Recreation Area and Obed Wild and Scenic River Oil and Gas Management Plan* regarding the circumstances that would require a Wetland Statement of Findings for the restoration of oil and gas drilling operation impacts.

Initiated a Servicewide 20% Fee Funding Program Native Fish & Habitat Restoration Project, involving aquatic habitat improvements through the instream reconstruction of slab-rock and riffle habitat.

Reviewed draft Mercury Implementation Plan and provided comments to ARD.

Biscayne National Park

Participated on the interdisciplinary team

addressing coral reef and seagrass restoration actions and the development of programmatic EISes for restoration.

Continued to provide technical assistance on the development of a cooperative fisheries management plan.

Co-authored a draft report on fishery management alternatives to achieve desired fishery conditions in conjunction with cooperators from the University of Miami.

Provided review and comment on a draft "dead" fish identification book being developed for use by park enforcement rangers and ramp creel survey clerks.

Advised DSC staff on tidal wetland boundaries and on compliance with NPS wetland protection procedures for a proposed concrete path on Elliot Key.

Provided review and comment on the materials for a Fishery Education Course.

Developed a Task Agreement / Coordinated kick-off meeting for Coastal Watershed Condition Assessment with Florida International University, park staff, and South Florida – Caribbean Inventory and Monitoring Network.

Met with park staff to develop plans for mooring buoy installation under Marine Recreational Stewardship fee project.

Blue Ridge Parkway

Proposed and assessed, in conjunction with park staff and Virginia DEQ regulators, site investigation approaches and methodologies that would minimize surface impacts during ground-water site characterization studies on park lands yet achieve the desired level of site characterization.

Canaveral National Seashore

Reviewed draft final report by USGS for Mosquito Lagoon water quality project funded by NPS-USGS partnership program.

Cape Hatteras National Seashore

Provided advice regarding ongoing (and related) issues of campground flooding, draining wetlands, water quality, and ORV access to beaches.

Initiated Task Agreement with University of North Carolina/Wilmington for Phase II watershed condition assessment project "Investigation of Pollutant Drainage on South Bodie Island."

Chattahoochee River National Recreation Area

Provided consultation and response to the NPS Office of Policy on the new NPS stocking policies in response to an inquiry concerning state stocking of trout in the park.

Assisted with the review and publication of a technical report entitled *Genetic Integrity of an Isolated Population of Shoal Bass (Micropterus cataractae) in the upper Chattahoochee River Basin* (Natural Resource Technical Report NPS/NRWRD/NRTR-2007/366).

Initiated discussions with the park and region to provide technical support and assistance in the development of the Chattahoochee River National Recreation Area Resource Stewardship Strategy.

Provided guidance and explanations on the methodology employed for calculating NHD hydrographic statistics.

Chickamauga and Chattanooga National Military Park

Provided technical and policy assistance for a proposal to stabilize eroding river banks within the Moccasin Bend National Archeological District.

Cumberland Gap National Historical Park

Reviewed draft Mercury Implementation Plan and provided comments to ARD.

Dry Tortugas National Park

Tracked progress and provided input to NOAA Center for Coastal Monitoring and Assessment for joint assessment of the park under the "NOAA Biogeographic Assessment of the Tortugas Ecological Reserve."

Participated in joint NPS workshop with Florida Fish and Wildlife Conservation Commission to develop science strategy for Research Natural Area (RNA) and drafted social science portion of plan.

Met with park staff to develop plans for mooring buoy installation and outreach publications related to the RNA under Marine Recreational Stewardship fee project.

Everglades National Park

Reviewed a COE technical memorandum entitled "Modeling the Effect of Spreader Canals on the Performance of Culverts under Tamiami Trail" and assisted park staff with related wetland compliance issues.

Fort Pulaski National Monument

Advised the impact assessment and the General Management Plan teams on the adverse impacts from proposed highway improvements through wetlands.

Great Smoky Mountains National Park

Provided review comments on the North Shore Road Draft Final Environmental Impact Statement.

Provided review and comment on park's draft Standardized Sampling Protocol Manual for the Use of Antimycin in Streams, Impoundments, and Small Lakes.

Assisted the park in troubleshooting the installation of NPSTORET on a desktop operating at very high screen resolution.

Gulf Islands National Seashore

Assessed potential hydrologic impacts of road construction and provided technical and policy review comments on draft Wetland/Floodplain Statements of Findings for the proposed Fort Pickens Road and J. Earle Bowden Road reconstructions.

Jean Lafitte National Historical Park and Preserve

Reviewed and commented on a proposed project entitled "Remove Trees and Replace Palmetto Trail Boardwalk Destroyed by Hurricane Katrina" for the NPS Development Advisory Board.

Advised region staff on NPS wetland compliance requirements for actions proposed in the *Environmental Assessment for Debris Removal and Dredging of Canoe Trails within the Barataria Preserve*.

Provided technical and policy guidance for the proposed draft Plan of Operation for the Helis Oil & Gas Company Plan of Operations for Drilling the LL&E No. 1 Exploration Well in the Barataria Unit.

Little River Canyon National Preserve

Provided programmatic oversight for a WRD funded project entitled "Wetland Inventory for Little River Canyon National Preserve."

Mammoth Cave National Park

Reviewed draft Mercury Implementation Plan and provided comments to ARD.

Natchez Trace Parkway

Provided final technical and policy review on a Wetland/Floodplain Statement of Findings for the Pigeon Roost Creek Bridge Replacement Project.

Provided technical and policy review and evaluation of the Natchez Trace Parkway: Lindsey Creek, Threet Creek, County Road 85, and Highway 13 Bridge Replacements Environmental Assessment.

Provided technical review for a Wetland Delineation Report for Segments of the Parkway.

Obed Wild and Scenic River

Reviewed and evaluated language in the *Big South Fork National River and Recreation Area and Obed Wild and Scenic River Oil and Gas Management Plan* regarding the circumstances that would require a Wetland Statement of Findings for the restoration of oil and gas drilling operation impacts.

Completed study of streamflow associated with geomorphologic processes and vegetation of alluvial surfaces.

Provided comments to park concerning the COE Regional Water Supply Scoping Report.

Participated in a meeting with the USGS, TNC, Tennessee Tech, and park staff to discuss two projects, the USGS instream flows needs for ecological health project and The Nature Conservancy's Habitat Conservation Plan on the Cumberland Plateau, to determine if the park could benefit from these research activities.

Reviewed draft reports and provided comments to the USGS regarding their multi-year, paired-basin study to investigate the effects of small and medium sized impoundments on streamflow.

Organized and led a meeting with the USGS and other organizations to inform park staff of the progress of several USGS studies that are continuing.

Initiated an underwater video habitat assessment as part of the Cumberlands Habitat Conservation Plan through the CESU-University of Tennessee.

Reviewed and provided comments on the park's proposed response to a gravel mining operation permit.

Salt River Bay National Historical Park and Ecological Preserve

Reviewed Floodplain Statement of Findings for Marine Research and Education Center.

Shiloh National Military Park

Obtained, entered, reformatted, and QA/QCed additional water quality data for upload to STORET in preparation for producing a Baseline Water Quality Data Inventory and Analysis Report.

Virgin Islands National Park

Provided advice on statistical outliers and marine/coral monitoring developments issues.

Distributed for broad review and commented on the draft Watershed Condition Assessment Report.

Celebrated 50 years of science in the park with a symposium keynote speech "Persistence and Special Places" that affirmed the values of park as places to learn about people and nature and exemplifies the NPS Research Learning Center concept.

Establish a Project TEKTITE museum with University of Virgin Islands that documents the park's role in promoting research and continuing education.

TECHNICAL ASSISTANCE PROVIDED BY NATURAL RESOURCE CHALLENGE AQUATIC RESOURCE FIELD PROFESSIONALS

TECHNICAL ASSISTANCE INTERNATIONAL

Presented the Appalachian Trail MEGA-transect concept to the international Northeast Regional Air Quality Committee. Following this presentation, representatives of the Canadian government expressed interest in expanding this idea into the newly established International Appalachian Trail, which extends from Maine to the end of the Gaspé Peninsula.

Provided comments on the NPS Report for Gulf of Mexico Alliance in regard to fulfilling NPS commitments to accomplish the coastal wetland restoration efforts outlined in the Gulf of Mexico Governor's Action Plan.

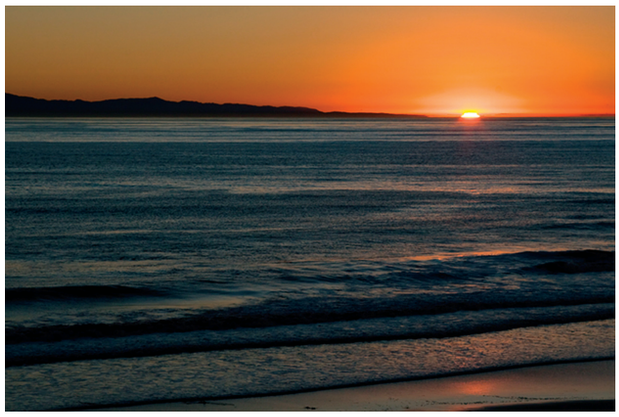
Prepared and presented summary of NPS hydrologic assistance to Cambodia in FY2006 to the USGS-NY office.

TECHNICAL ASSISTANCE SERVICEWIDE

Helped coordinate the first ever NPS Eastern Rivers Summit. Provided input and direction on completion of Summit findings and applications.

Provided assistance with revision of GPRA water quality goals and reporting, which resulted in creation of a new goal for parks and direct WASO reporting.

Worked with Vital Signs Networks, as requested, to support water quality monitoring initiatives.



Channel Islands National Park (Wullschleger, 1999)

TECHNICAL ASSISTANCE REGIONS, NETWORKS, PARKS

ALASKA REGION

Modified Shallow Lake Monitoring Strategy to work for Yukon Flats National Wildlife Refuge.

Collaborated with USFWS Wildlife Biologist to develop a wetland monitoring strategy and classification system for interior Alaska.

Maintained partnerships with University of Alaska Fairbanks faculty to investigate shallow lake dynamics in interior Alaska.

Collaborated with the Alaska Department of Fish and Game (ADF&G) to collect baseline genetic data from sockeye salmon, Chinook salmon, and chum salmon in the headwaters of the Kuskokwim River drainage.

Assisted ADF&G with sockeye salmon research in the Kuskokwim River drainage, including logistical support, supervision of data collection, and review of project proposals and reports.

Interviewed Florence Collins, a former USGS scientist, identified her monitoring stations, and cataloged her photos and data.

Arctic Network

Collaborated with Aquatic Ecologist to developing a strategy for monitoring aquatic ecosystems.

Continued a cooperative agreement with the University of Alaska Fairbanks (Gordon Haas and Scott Ayers) to compile all accessible fisheries and aquatic related data Network parks.

Central Alaska Network

Developed methane monitoring strategy for Network parks with Dr. Katie Walters University of Alaska Fairbanks International Polar Year Post-Doctorate.

Collected methane, DOC, and DIC samples for USGS scientist Robert Stiegel for inclusion in a monitoring project in conjunction with the USGS Yukon Basin Initiative.

Maintained water quality monitoring sondes in one lake.

Deployed temperature loggers for USFWS project monitoring Yukon River water temperature.

Modified Shallow Lake Monitoring Strategy to work for Yukon Flats National Wildlife Refuge. Collaborated with Nikki Guldager to develop a wetland monitoring strategy and classification system for interior Alaska.

Denali National Park and Preserve

Implemented the Shallow Lake Monitoring Plan, sampled 30 lakes, and presented preliminary results to park staff.

Collaborated with USGS scientists Ben Jones and Chris Arp to develop a lake classification scheme.

Gates of the Arctic National Park and Preserve

Served as Graduate Committee member at University of Alaska Fairbanks for Investigations on Old Man Char.

Katmai National Park and Preserve

Reviewed and edited the Water Resource Management Plan.

Participated on the Pebble Mine Resource Management Team.

Kenai Fjords National Park

Provided with project studying aquatic habitat in the upper Nuka River.

Lake Clark National Park and Preserve

Designed and implemented a northern pike radio telemetry study in the Lake Clark watershed.

Estimated the 2007 escapement and population structure of Lake Clark sockeye salmon. Provided project oversight, completed data analysis, and wrote progress and annual reports.

Submitted proposals and acquired funding to continue monitoring the escapement of sockeye salmon to Lake Clark from 2008 – 2011.

Continued to provide project oversight and technical assistance for a research project studying the distribution and population structure of humpback whitefish within the Lake Clark drainage.

Provided project oversight for a study estimating the sportfish harvest of coho salmon at Silver Salmon Creek.

Collaborated with the Alaska Department of Fish and Game (ADF&G) to collect baseline genetic data from sockeye salmon, Chinook salmon, and chum salmon in the headwaters of the Kuskokwim River drainage.

Little Underhill Creek in the upper Kuskokwim River drainage, southwest Alaska (Young, 2007).

Assisted ADF&G with sockeye salmon research in the Kuskokwim River drainage, including logistical support, supervision of data collection, and review of project proposals and reports.

Provided technical assistance for an ADF&G fish distribution survey in the Stony River and upper Kuskokwim River drainage.

Sampling sockeye salmon, Lake Clark National Park and Preserve (Young, 2007).

Southwest Alaska Network

Reviewed and verified fish voucher specimens collected during freshwater fish inventories.

Yukon-Charley Rivers National Preserve

Implemented the shallow lake monitoring plan and sampled seven lakes.

INTERMOUNTAIN REGION

Continued to represent the NPS to the Upper Colorado River Endangered Fish Recovery Program by participating in Biology Committee meetings and workshops, critically reviewing all program documents, and providing information and input to Management and Implementation Committee representatives.

Aztec Ruins NM

Acted as NPS lead for hydrology study fund-

ed by Colorado Plateau CESU through Fort Lewis College. This project is aimed at the identification of water sources impacting ruins at the park and the development of effective methods to mitigate the water impacts.

Canyon de Chelly National Monument

In cooperation with the I&M Program, surveyed several streams for native fishes, arranged for expedited genetic analysis of bluehead sucker (*Catostomus discobolus*) samples to determine if they contained Zuni bluehead haplotypes, which are endangered. No Zuni haplotypes were detected.

Bluehead suckers spawning in Whiskey Creek, in CACH (Trammell, 2007). Several brightly colored males surround one larger female.

Nonnative goldfish captured in Tsaile Creek, Canyon de Chelly National Monument (Trammell, 2007).

Provided hydrologic support to fish survey.

Capitol Reef National Park

Successfully prepared proposals and was granted Bureau of Reclamation and WRD funding for project to restore roundtail chub to the park, although the project itself has been delayed due to Utah Division of Wildlife Resources approval processes.

Chaco Culture National Historical Park

Continued ongoing hydrological support to resource staff. Moved stream gage instrument panel at Chaco Wash to higher ground and reinstalled bubbler line and staff plates.

Dinosaur National Monument

Presented an assessment of the Upper Colorado River Endangered Fish Recovery Program's progress towards implementing recommendations for improving nonnative fish (NNF) control efforts to the annual workshop.

Made progress at 2006 NNF workshop in increasing effort to remove smallmouth bass (*Micropterus dolomieu*) in the Green River in the park.

Helped Colorado State University (CSU) staff remove nonnative smallmouth bass from the Yampa River above the park.

Large examples of nonnative smallmouth bass removed from the Yampa River above Dinosaur National Monument (Trammell, 2007).

Worked with park, USFWS, and Colorado Division of Wildlife (CDOW) staff to take some critically imperiled humpback chub (Gila cypha) into captivity. Assisted with the capture and transport effort and photo documented the event for the Upper Colorado River Endangered Fish Recovery Program.

An unusually large roundtail chub, now rare in the Yampa River (Trammell, 2007).

Seining in the Yampa River, Dinosaur National Monument (Trammell, 2007).

Young chubs are transferred to a stocking tank for transport, while Mantle Ranch caretaker looks on (Trammell, 2007).

Young of the year Gila spp *captured in the Yampa River in Dinosaur National Monument might be a roundtail chub or a humpback chub; it's too soon to tell (Trammell, 2007).*

Fort Bowie National Historic Site

Continued direction, oversight, and data analysis of the hydrological monitoring program. The program supports the park by providing documentation needed for water rights claims, understanding the relationship between ground-water pumping and spring flow, and establishing a long-term baseline of water availability for inventory and monitoring purposes.

Provided continuing technical assistance in addressing biofouling in park water supply well.

Gila Cliff Dwelling National Monument

Conducted site scoping, planning and equipment purchase for stream gaging station. This station will provide baseline data on stream flows in support of long-term aquatic monitoring and understanding the effects of fire and climate change in the West Fork of the Gila River watershed.

Organ Pipe Cactus National Monument

Continued technical support for ongoing monitoring at Quitobaquito springs and pond. The springs and pond system support an endemic endangered desert pupfish as well as a biologically rich oasis in the Sonoran Desert. The site has been experiencing a declining trend in water availability for a decade.

Carried out technical planning, material purchasing and coordination of rebuilding of the northeast spring at Quitobaquito management area.

Sonoran Desert Network

Continued to provide technical support in development of site specific water quality and water quantity protocols for aquatic resource monitoring.

Tumacácori National Historical Park

Provided continuing support of groundwater monitoring. Coordinated removal of a pump from one of the two wells near Santa Gertrudis Lane and moved monitoring instrumentation to that well.

Participated in several meetings aimed at identifying alternative management concepts and assessing public health issues for the land addition along the Santa Cruz River.

MIDWEST REGION

Participated in the USGS Midwest Environmental Science Center Review for aquatic ecology.

Participated in the Federal Aquatic Invasive Species Rapid Response working group of the Great Lakes Regional Collaboration.

Participated in an interagency invasive species effort, culminating in a risk assessment proposal for riverine backwaters in federal lands.

With the Regional I&M Coordinator, led effort to compile flow-gaging needs for region parks.

Apostle Islands National Lakeshore

Reviewed and provided comments on the

Coastal Watershed Condition Assessment.

Effigy Mounds National Monument

Participated in planning meetings for Natural Resource Condition Assessment.

Indiana Dunes National Lakeshore

Provided substantial comments and helped revise the Coastal Watershed Condition Assessment.

Isle Royale National Park

Researched and provided information on Viral Hemorrhagic Septicemia threats to park fisheries. Provided supporting documentation for emergency order to prohibit any ballast water discharge in waters of the park by Great Lakes freighters and other ships or boats.

With USGS and USFWS cooperators, co-authored a project proposal for lake trout genetic investigations in Lake Superior waters of the park.

Worked with the Great Lakes Fish Commission and the USFWS on lake trout morphometrics investigations in the park. This was not a park derived study but was conducted in park waters and required logistics and operational coordination between the Commission and the park.

Preparing lake trout for morphometrics photograph, Isle Royale National Park (Glase, 2007).

With a university cooperator, co-authored a proposal addressing effects of nitrogen deposition and climate change on boreal lakes in the park.

With regional aquatic ecologist and a USGS cooperator, co-authored three proposals related to rock pools and amphibian conservation in the park.

Worked with USFWS on annual coaster brook trout surveys at Tobin Harbor and Siskiwit Bay. Captured over 70 brook trout in Tobin Harbor.

Mississippi National River and Recreation Area

Completed revisions of the Water Resources Information and Issues Overview Report and presented a summary to park staff.

Analyzed spatial, seasonal, and long-term trends in 30 years of Metropolitan Council water quality data, including six Mississippi River sites, one Minnesota River site, and the Metropolitan Wastewater Treatment Plant.

Assisted with planning and implementing the USGS backwater nutrient study.

Missouri National Recreational River

Developed a scope of work related to water level fluctuations and mussel fauna for consideration by research partners.

Ozark National Scenic Riverways

Participated in planning meetings for Natural Resource Condition Assessment.

Pictured Rocks National Lakeshore

Reviewed and provided comments on the Coastal Watershed Condition Assessment.

With park aquatic ecologist and USGS cooperator, co-authored proposal to investigate freshwater mussel and fish interactions in Grand Sable Lake.

Coordinated with WRD staff to secure funding for project to remove non-native salmonids in one stream. Provided comments for project study plan developed by Northern Michigan University professor.

Saint Croix National Scenic Riverway

Continued participating in the St. Croix Basin Water Resources Planning Team, including a TMDL listing for Lake St. Croix and the fulfillment of several monitoring gaps outlined in the previous year's monitoring plan.

Participated in annual fisheries meeting with personnel from the park, Minnesota and Wisconsin DNR and USACE.

Provided information and comments for fisheries habitat rehabilitation plan for Namekagon River.

Assisted with planning and implementing the USGS backwater nutrient study and pharmaceutical study.

Assisted with qualitative and quantitative zebra mussel monitoring in Lake St. Croix.

With USGS, co-authored proposals addressing flow gaging needs (successful) and nutrient-related food quality declines affecting native mussels (pending).

Sleeping Bear Dunes National Lakeshore

Provided comments on fisheries survey report conducted by the Grand Traverse Band of Ojibwe and Chippewa Indians.

Received funding through the WRD Contingency Program to address factors contributing to type E botulism outbreaks. Prepared implementation plan and collected data during summer 2007, with support from park staff, the St. Croix Dive Team, and the regional fishery biologist.

Assisted cooperators from the Great Lakes WATER Institute (UW-Milwaukee) with data collection and experiments addressing nuisance growth of the alga *Cladophora* in the park's Lake Michigan waters.

Highlights from the Sleeping Bear Dunes National Lakeshore botulism-type E study, summer 2007, showing a range of invasive species issues (all: LaFrancois, 2007). From left to right: continuous water quality monitoring equipment in rocky area covered in Dreissenid mussels and Cladophora, *collection of sediment and sloughed* Cladophora *samples for toxin analysis, native crayfish colonized by quagga mussels, and round gobies.*

Voyageurs National Park

In cooperation with the park aquatic ecologist, secured funding through WRD Contingency Program to characterize native zooplankton communities in interior park lakes prior to any invasion by the spiny water flea. Prepared implementation plan and assisted with field sampling during summer 2007.

With a university cooperator, co-authored a proposal addressing effects of nitrogen deposition and climate change on boreal lakes in the park.

Worked with Park Biologist and a Volunteer on a lake sturgeon tagging project, involving coordination with the Minnesota DNR, the Ontario MNR, and the USFS.

Lake Sturgeon ready to be released back to waters of Voyageurs National Park (Glase, 2007).

NPS biologist collecting zooplankton, Voyageurs National Park (Maki, 2007).

NATIONAL CAPITIAL REGION

Regional goal contact for GPRA goals for Streams and Shorelines in Desired Condition and Streams and Shoreline Restoration.

Catoctin Mountain Park

Produced a draft Water Resources Scoping Report in partnership with park natural resource managers.

Chesapeake and Ohio National Historical Park

Provided technical assistance and advice during multiple site visits on potential river restoration sites in partnership with the USACOE and The Nature Conservancy.

Provided GIS support and opinions on water resources for an ongoing NPS / George Mason University cooperative agreement that will provide insights on how the local public views threats to the water resource assets of the park.

Chesapeake Watershed Cooperative Ecosystem Studies Unit

Team member on technical advisory committee charged with developing an on-line catalog of research needs for NPS units in the Chesapeake Bay watershed.

George Washington Memorial Parkway

Continued semi-annual monitoring of nine Surface Elevation Tables in Dyke Marsh in a cooperative effort with the USGS Patuxent Wildlife Research Center. This project will gather information on the quantity of sedimentation and degree of subsidence of the surface of this marsh.

Harpers Ferry National Historical Park

Provided site assessments and hydrologic opinions for park projects evaluating proposed development on park boundaries.

National Capital Region Network

Acted as key official on a NPS / USGS / University of Maryland - Baltimore County project, developing tools for natural resource managers to graphically explore the condition of water resources surrounding park lands.

Provided technical assistance to the water monitoring program, including interpretation of results, statistical analysis of data, and installation and operation of stream gages and Hydrolab continuous water quality monitoring equipment.

National Mall and Memorial Parks

Provided technical assistance and advice re-

garding the control of algal blooms in Constitution Gardens Lake, the Reflecting Pool, and the WWII Memorial fountain.

Rock Creek Park

Provided technical assistance and advice for water related issues for the Watershed Condition Assessment.

Served as team leader for the GIS workgroup charged with developing maps and spatial analyses for the Rock Creek Park Watershed Condition Assessment in partnership with the National Capital Region Network and the University of Maryland Center for Environmental Science.

Urban Ecology Research Learning Alliance (NPS Research and Learning Center)

Provided teacher training and on-line educational materials in support of the Prince George's County high school continuing education requirements for Environmental Science instructors.

NORTHEAST REGION

Represented the Northeast Region on the Inventory and Monitoring Advisory Committee.

Regional contact for GPRA goals for Streams and Shorelines in Desired Condition and Streams and Shoreline Restoration.

Presented a water resource overview and issue assessment at the Virginia natural resource manager's network meeting.

Provided assistance with preparation of FY2008 Natural Resource Manager's workshop.

Organized information and prepared list of necessary and unfunded stream gages within region parks.

Represented the region as a presenter at the USGS Annual NER Project Review.

Acadia National Park

Provided verbal and written direction on trail construction alternatives to maintain and improve hydrology in Sieur de Monts wetlands and other locations.

Investigated and provided written comment regarding proposed stormwater and septic management for development adjacent to the park.

With a university cooperator, co-authored a proposal addressing effects of nitrogen deposition and climate change on boreal lakes in the park.

Reviewed and provided comment on USGS report entitled *Assessment of Potential for Nutrient Enrichment in Estuaries at Mt. Desert Island, Maine from Shallow Ground Water using Aerial Thermal Imagery.*

Assisted natural resource staff with determining appropriate hydrography data for GPRA reporting.

Reviewed Seawall road design for associative beaver impacts. Determined road failures are due to design on mobile dune and suggested design alternatives.

Reviewed stream fish passage issue with WRD personnel and provided suggestions for improvements to encourage stream stability and native trout migration.

Produced draft report for the statistical review of the park's Freshwater Monitoring Program in support of an assessment of the effectiveness of the program in meeting objectives.

Allegheny Portage Railroad National Historic Site

Assisted WRD hydrologist with interpretation and assessment of ponds for acid mine

drainage treatment.

Appalachian National Scenic Trail

Provided written and verbal input to the water quality group formed to establish monitoring directives for the trail. Helped group create a fact sheet to explain this effort.

Designed and presented a poster on soil, water, and vegetation monitoring proposal at an air and water quality monitoring workshop.

Booker T. Washington National Monument

Reviewed site to assess stream restoration effort and allocation of Northeast Region funds.

Delaware Water Gap National Recreation Area

Organized and led a workshop to establish common issues, interests, and approaches for water resource management.

Organized and wrote Department of Interior response to the Delaware River Basin Commission Flexible Flow Management Plan and the Decision Support System for assessing ecological flow impacts for the Delaware River.

Provided comment on NPS letter of support for establishing the Delaware River Basin in the National Water Quality Monitoring Network for U.S. Coastal Waters and their Tributaries. The Delaware River Basin was ultimately chosen as one of two national prototypes.

Provided review and written comment on draft protocol change for Special Protection water quality monitoring by Delaware River Basin Commission.

Provided review and submission assistance with funding proposal to assess surrogates for predicting bacterial contamination of the Delaware River.

Eisenhower National Historic Site

Assisted with writing and submission of stream protection funding proposal.

Fire Island National Seashore

Co-authored the FY2008 Water Quality Partnership Program funded project "Characterizing submarine groundwater discharge from a barrier island as a vital component of managing estuarine eutrophication, Fire Island National Seashore, New York."

Coordinated written comments for region and park review of the USGS draft report "Analysis of the Shallow Ground-Water Flow System at Fire Island National Seashore, Suffolk County, New York."

Provided written comments for the development of the USGS Leetown Science Center proposal "Exploratory Research to Assess Horseshoe Crab (*Limulus polyphemus*) Spawning Activity, Habitat Use, and Status on the National Park Service, Fire Island National Seashore" for USGS Park Oriented Biological Support funding.

Represented NPS on the Habitat Evaluation Procedures Team for USACE Fire Island to Montauk Point Reformulation Planning.

Represented NPS on The Nature Conservancy's Blue Point Bottomlands Council to develop restoration and protection of the Great South Bay ecosystem.

Represented NPS on The Nature Conservancy's Efroymson Fellowship Program to develop a conservation plan for Great South Bay.

Represented NPS on the Suffolk County Wetlands Management Group.

Developed GPS activity to demonstrate concepts of barrier island ecology and geomorphology for the Division of Interpretation to use with school groups.

Participated in shoreline erosion workshop.

Fort Necessity National Battlefield

Worked with the park natural resource manager to complete and submit funding proposal to Restore Natural Hydrology to Great Meadow Run & Wetlands.

Fredericksburg and Spotsylvania National Military Park

Provided project review and guidance to park natural resource manager regarding removal of two dams.

Gateway National Recreation Area

Participated in multi-agency Planning and Development Team for the development of restoration design plans for Elders Point West and Yellow Bar Marsh Islands, Jamaica Bay Unit. During FY2007, 90% design plans were completed for the estimated $5 million Elders Point West Restoration Project.

Coordinated with park staff and partner agencies during completion of construction of 39-acre Elders Point East marsh restoration.

Coordinated with partners for implementation of sediment elevation and accretion, biogeochemistry, and landscape monitoring. Supervised and managed data collection, management, and analysis for vegetation, nekton, benthic, avian monitoring.

Prepared *Jamaica Bay Marsh Islands Ecosystem Restoration: Program Year 2006 Monitoring Report*.

Provided written comments for the development of park sediment criteria.

Northeast Region Coastal Marine Ecologist measures sediment elevation at Elders Point East marsh (Rafferty, 2006).

George Washington Birthplace National Monument

Participated in General Management Plan meeting and workshops. Provided written comments on the Affected Environment section of the draft plan.

Worked with principal investigators from the Virginia Institute of Marine Science to write and submit funded proposal to assess storm vulnerability.

Coordinated erosion assessment workshop with NPS GRD, local agencies, cooperators, and park staff.

Provided technical assistance regarding potential adverse effects of operations of a neighboring power plant on groundwater resources.

Gettysburg National Military Park

Provided direction on methods and riparian impact avoidance for restroom installation.

Hopewell Furnace National Historic Site

Provided written comment and instruction for submission of toxin fate and transport funding proposal.

Johnstown Flood National Memorial

Initiated study to assess potential temperature change along the NPS managed length of the Little Connemaugh River.

Minute Man National Historical Park

Wrote proposal and received funding commitment from WRD to complete final phase of stream restoration project. Worked with local township and state cooperators to implement plan.

New River Gorge National River

Provided written comment regarding New River impacts associated with the reconstruction of the historic Thomas Buford Pugh Bridge.

Richmond National Battlefield Park

Reviewed Grove Pointe Development Proposal near Chickahominy Bluff Unit with natural resource manager and developer.

Coordinated Drewery's Bluff erosion assessment workshop with NPS GRD and staff. Established high potential for slope failure and impact to park resources and outlined next steps for resource protection.

Roosevelt-Vanderbilt National Historic Site

Provided written comment on water resource assessment report and pond dredging.

Saint Gaudens National Historic Site

Provided written comment regarding Blow-Me-Down Mill Treatment Recommendations.

Saratoga National Historical Park

Provided site assessment near Schuylerville, NY; made regulatory agency contacts; provided supporting language regarding potential impacts to park wetlands associated with adjacent landowner's wetland drainage efforts.

Provided Victory Woods Unit site assessment and written analysis of NPS owned wetland impacts initiated by adjacent landowner.

Shenandoah National Park

Provided written review and organized external agency review of *Biological significance of headwater streams and springs in Shenandoah National Park – Study Plan*.

Looking for eels in Rapidan River, Shenandoah National Park (NPS, 2007).

Eel from Rapidan River, Shenandoah National Park (NPS, 2007).

Upper Delaware Scenic and Recreational River

Organized and led a workshop to establish common issues, interests, and approaches for water resource management.

Organized and wrote Department of Interior response to the Delaware River Basin Commission Flexible Flow Management Plan and

the Decision Support System for assessing ecological flow impacts for the Delaware River.

Provided comment on NPS letter of support for establishing the Delaware River Basin in the National Water Quality Monitoring Network for U.S. Coastal Waters and their Tributaries. The Delaware River Basin was ultimately chosen as one of two national prototypes.

Reviewed and organized external professional review of NPS funded report titled *Predicting flow and temperature regimes at three Alasmidonta heterodon locations in the Delaware River.* Presented findings to the DRBC Subcommittee for Ecological Flows for future inclusion in the Flexible Flow Management Plan.

Assisted park staff with purchase of new water quality monitoring probe.

Worked with the US Corps of Engineers, DRBC, The Nature Conservancy, New York Department of Environmental Conservation, the USGS, and others to promote funding for a river flow gage and ecological flow model enhancements.

Worked with Stormwater Task Force to establish stormwater management recommendation for the Delaware River Basin.

Valley Forge National Historic Park

Worked with USGS-PA to maintain sediment monitoring probe in Valley Creek.

Provided oversight of completion of NPS contracted report titled *Characterization of sediment storage and remobilization in Valley Creek, Valley Forge National Historical Park.*

Participated in interviews and written assessment of the natural resource management program at the request of the Superintendent for a Natural Resource Transitional Management Assistance Plan.

PACIFIC WEST REGION

Finalized a two-year WRD funded project to inventory and characterize wetlands in small parks in the region.

Participated in an interagency workgroup with USGS and BLM to create a framework for long-term, landscape-scale ecological monitoring in the Great Basin and Mohave ecoregions.

Channel Islands National Park

Assisted park staff with designing and conducting compliance for a coastal restoration project at Prisoners Harbor on Santa Cruz Island.

City of Rocks National Reserve

Assisted in evaluation of condition of Circle Creek dam and impoundment at Smoky Mountain water gap; assessed potential hazards and risks, and provided management recommendations.

Golden Gate National Recreation Area

Assisted planning for several wetland restoration projects, including Big Lagoon Wetland Restoration Project and Crissy Marsh Expansion Project.

Great Basin National Park

Reviewed initial EIS documents and prepared NPS response to initial planning documents related to the proposed groundwater development delivery pipeline by Southern Nevada Water Authority, proposed to run some 300 miles from near the park into the Las Vegas Valley, NV.

John Day Fossil Beds National Monument

Assisted with creating an agreement between NOAA fisheries and the monument to initiate streambank restoration along Bridge Creek within the John Day River watershed.

Joshua Tree National Park

Provided technical assistance in the development of a ground-water monitoring plan for the protection of resources within the Pinto Basin.

Lake Mead National Recreation Area

Assisted WRD and other DOI bureau hydrology and water rights professionals in negotiations with the Nevada State Engineer regarding the NPS and DOI protest regarding water rights application by Southern Nevada Water Authority for 90,000 acre feet groundwater in Spring Valley, NV.

Developed joint project with USGS (funded by the Southern Nevada Public Lands Management Act) to accomplishment spring flow monitoring and water origination studies within the park.

Mojave Desert Network

Provided team lead and technical assistance to the Inventory and Monitoring program in the development of a water resources monitoring plan.

Mount Rainier National Park

Identified and mitigated flood hazards. Performed storm damage assessments for November 2006 flood event and provided site-specific prescriptions to minimize future flood damages. Contracted and supervised post-November 2006 flood aggradation surveys in the park.

Provided technical outreach and interpretive services to post-flood park visitors and media.

Measured river aggradation and completed a field program to measure historic river aggradation rates as a basis to understand what the park must design for to protect infrastructure.

Continued project to identify and prioritize road segments prone to flood and debris flow damage in the park and to develop a suite of options to protect these areas in a fish-friendly way.

Served as co-principal investigator for GIS modeling project to clarify Holocene environmental patterns and identify prehistoric human habitats in the park.

Served as thesis advisor for a Masters of Science project "The Environmental Implications of Aggradation in Major Braided Rivers at Mount Rainier National Park, Washington."

Catastrophic stream shift, Kautz Creek, Mount Rainier National Park (Ganthier, 2006).

Stream gone bad, Winthrop Glacier, Mount Rainier National Park (Kennard, 2007).

Olympic National Park

Developed site-specific recommendations to reduce erosion hazards to park infrastructure, while maintaining wilderness aquatic

and riverine values.

Pinnacles National Monument

With Pacific West Region cultural resources staff, initiated a Watershed History Study to address management concerns regarding water availability.

Point Reyes National Seashore

Assisted Point Reyes National Seashore with planning and data collection for the Giacomini Wetland Restoration Project.

Assisted park staff with conservation and monitoring of an endangered wetland plant.

Drafted park Foundation for Planning Statement.

Worked with park staff towards completion of a Resource Stewardship Strategy for park natural and cultural resources.

San Francisco Bay Area Network

Assisted with efforts to create and initiate long-term ecological monitoring programs for amphibians and reptiles, rare plants, and wetlands.

Whiskeytown-Shasta-Trinity National Recreation Area

Helped assess potential ground-water and water quality impacts related to abandoned mine discharges.

Yosemite National Park

Assisted park staff with designing and implementing a riverbank monitoring program to evaluate effects of high visitor use on the banks of the Merced River in Yosemite Valley.

In response to pending litigation, participated on expert panel and developed practical river bank erosion protocols to reduce human disturbance to rivers.

Provided technical assistance in assessing ground-water resources within Mariposa Grove.

SOUTHEAST REGION

Received funding from NPS Challenge Cost Share to conduct analysis of aquatic resources and threats in regional parks to refine the draft strategic plan for fisheries and aquatic resources in the region.

Represented NPS on advisory council to develop state plan for Georgia invasive species.

Attended the 2007 Georgia Water Resources Conference.

Helped obtain and administer funding from USFWS Fish Passage and National Fish Habitat Initiative for projects throughout the region.

Performed collateral duties related to hunting issues in the region due to lapse in wildlife biologist position. Coordinated dissemination of information related to Executive Order on hunting on federal lands.

Performed collateral duty as Regional Coordinator for the NPS Research Permitting and Reporting System.

Acted as Regional Goal Contact for FY07-11 and FY 08-12 NPS Strategic Plan Goals 1a1D—Land Health-Riparian, 1a2b—Species of Management Concern, 1a1H—Land Health-General, and 1a1J—Riparian Areas Restored.

Reviewed and certified data for region parks under GPRA Goal Ia1C.

Attended Gulf States Regional Panel for aquatic invasive species semi-annual meetings as NPS representative.

Worked with Southeast Aquatic Resources Partnership to develop the Southeast Region Aquatic Habitat Plan under the National Fish Habitat Initiative.

Reviewed and provided comments/recommendations on region park proposals for SCC funding categories (BLRI, CANA, GUIS, GRSM, CAHA) in PMIS; discussed proposed changes and improvements to project proposals.

In collaboration with staff from the Southeast Region Division of Planning and Compliance, developed a process for the review of draft wetland and floodplain Statements of Findings developed by region Parks during the NEPA process.

Reviewed four amendments to federal rules regarding fishing the South Atlantic, Gulf of Mexico, and Caribbean.

Reviewed a PEIS for drilling in marine areas.

Represented NPS at Southeastern Association of Fish and Wildlife Agencies on federal panel as an invited speaker, discussing role of federal agencies in conserving aquatic resources in the Southeast.

Reviewed and provided comments on the Federal Geographic Data Committee's Wetland Mapping Standards.

Big South Fork National River and Recreation Area

Assisted the park in receiving in funds from the Fish and Wildlife Service through the National Fish Habitat Initiative and NPS 20% Fee Demo Aquatic Restoration Program to restore fish habitat at two locations in the river.

Reviewed and provided comments on draft Floodplain and Wetlands Statement of Findings, Wetland Mitigation Plans, and Environmental Assessments for Vista Management Plan and Visitor Use Facilities Project.

Review and provided comments on ER document *Plan of Operations for St. Joseph Petroleum in regard to wetland/floodplain and T&E species impacts*.

Biscayne National Park

Worked toward completion of a Fisheries Management Plan.

Participated in teleconference regarding study of management alternatives toward recovering fish stocks.

Canaveral National Seashore

Participated in teleconferences related to marine resource planning.

Cape Hatteras National Seashore

Provided comments and information regarding the Buxton Woods wetland area and water quality issue at Cape Point Campground.

Completed an eight day detail in April to monitor and survey for piping plovers and migratory shorebirds nesting along the seashore.

Provided comments and review on responses to the USFWS revised critical habitat designation for the federally listed piping plover.

Provided comments and review of the USFWS Biological Opinion for the Interim Species Management Plan and participated in conference calls to discuss the requirements proposed monitoring protocols.

Reviewed and provided comments on Environmental Assessment for replacement of Bonner Bridge.

Side Lake Creek, Carl Sandburg Home National Historic Site (Long, 2007).

Cape Lookout National Seashore

Reviewed and provided comments on the FONSI for the Interim Species Management Plan.

Castillo de San Marcos National Monument

Reviewed and provided comments on draft Floodplain and Wetlands Statement of Findings, Wetland Mitigation Plans, and Environmental Assessments involving historic seawall stabilization.

Chattahoochee River National Recreation Area

Assisted with FERC re-licensing of Morgan Falls Hydropower project upstream of the park by attending meetings and negotiating settlement agreement.

Completed the final year of the five-year shoal bass stocking in partnership with Georgia DNR by stocking approximately 34,237 young-of-year at three sites.

Thousands of shoal bass fry to be stocked at Chattahoochee River National Recreation Area in an effort to restore this population to historic levels of abundance (Long, 2007).

Reviewed and provided comments on draft Floodplain and Wetlands Statement of Findings, Wetland Mitigation Plans, and Environmental Assessments involving river docks replacement project.

Obtained funding from Georgia Power and from NPS Challenge Cost Share to conduct pond renovation project at Chattahoochee Nature Center to prevent the spread of the Asian swamp eel.

Guest lectured at Chattahoochee Nature Center on the fish biodiversity in the Chattahoochee River.

Guest lectured at The Walker School on the health of the watershed of the Chattahoochee River.

Coordinated interns from the Student Conservation Association and volunteers to survey for trout reproduction in several small tributaries of the Chattahoochee River. Presented a final report to the park and drafted a

manuscript for publication.

SCA Intern Blair Anderson electrofishing to document trout reproduction, Chattahoochee River National Recreation Area (Tupy, 2007).

Chickamauga and Chattanooga National Military Park

Attended a meeting and site visit to assess wetland impacts resulting from the proposed Moccasin Bend Bank Stabilization Project and investigated possible mitigation sites.

Congaree National Park

Assisted with FERC re-licensing by attending stakeholder meeting to develop an ecologically sustainable flow prescription for Saluda Dam.

Attended a regional meeting on FY 2006 surveys for the Ivory-billed woodpecker.

Participated in a meeting involving federal, state agencies and public utility company along with environmental organization regarding the Saluda Dam Relicensing Project and implementation of the EWSM negotiation process.

Cumberland Gap National Historic Park

Worked with the University of Georgia to obtain funding from NPS Challenge Cost Share to investigate resource management of protected lands on blackside dace populations inside and outside of the park.

Cumberland Island National Seashore

Reviewed and provided comments on draft Floodplain and Wetlands Statement of Findings for the North End Access and Transportation Management Plan.

Fort Pulaski National Monument

Worked with park staff and I&M Aquatic Ecologist to address recurring fish kills in the moat surrounding the fort.

Great Smoky Mountains National Park

Reviewed the draft Floodplain Statement of Findings and provided comments regarding the document and assessment of impacts to the park staff and contractor for the Tremont Institute Construction Project.

Reviewed and provided comments on draft Floodplain and Wetlands Statement of Findings, Wetland Mitigation Plans, and Environmental Assessments involving wetland/floodplain impacts on Oconoluftee Visitor Center Improvement Project.

Reviewed and provided comments on the draft Final EIS for the North Shore Road.

Gulf Islands National Seashore

In collaboration with Southeast Region Coastal Morphologist, developed a *Technical Report on Indirect Impacts to Wetland Habitats and Coastal Processes along J. Earle Bowden Way* as a result of the proposed road construction project.

Reviewed and provided comments to the revised draft Environmental Assessment for both the Fort Pickens Road and the J. Earle Bowen Way road construction projects.

Reviewed and provided comments to natural resource staff on contractor's proposals for wetland delineations on the Fort Pickens Road project.

Developed recommendations with Southeast Region Coastal Morphologist to avoid signifi-

cant wetland and floodplain impacts, including loss of sea turtle habitat for the Ship Island construction project.

Jean Lafitte National Historical Park and Preserve

Reviewed and provided comments on draft Floodplain and Wetlands Statement of Findings, Wetland Mitigation Plans, and Environmental Assessments involving Debris Removal and Dredging of Canoe Trails.

Provided review and comments on the park position statement for the Louisiana Coastal Protection and Restoration Program.

Kennesaw Mountain National Battlefield Park

Conducted wetland delineation and mitigation proposal for proposed Trail Management Plan.

Natchez Trace Parkway

Reviewed and provided comments on Draft Floodplain and Wetlands Statement of Findings, Wetland Mitigation Plans and Environmental Assessments involving wetland/floodplain impacts for final draft EA for the Multi-Use Trail.

Natchez National Historical Park

Provided a report to the park with recommendations for managing the fisheries of the ponds at Melrose Estate.

Cypress Pond at the Melrose Estate, Natchez National Historical Park (Long, 2007).

Salt River Bay National Historical Park and Ecological Preserve

Reviewed and provided comments on the draft Environmental Assessment and Wetlands and Floodplains Statement of Findings for the Proposed Marine Research and Education Center.

Reviewed and provided comments on draft Floodplain and Wetlands Statement of Findings, Wetland Mitigation Plans, and Environmental Assessments for Plan to Mitigate Coastal and Wetlands Vegetation during SARI Old Hotel Demolition and Restoration of Peninsula.

San Juan National Historic Site

Worked with park and cooperator to resolve permitting issues for the Save-A-Gato project.

Timucuan Ecological and Historic Preserve

Reviewed and provided comments on the DEA and Draft Wetlands SOF for the Proposed Visitor Contact Station at Cedar Point project.

Vicksburg National Military Park

Coordinated invasive fish eradication project with Mississippi State University cooperators.

Crayfish chimneys at Mint Springs Creek, Vicksburg National Military Park (Long, 2007).

APPENDIX B

SUMMARY OF WATER RESOURCES DIVISION FUNDING

FY2007 base funding for the Water Resources Division was $12,399,000 (Figure 1). These funds are distributed among five principal categories: Water Resource Projects (Water Resource Protection; Competitive Projects; and Other); Water Quality Monitoring; Water Resource Protection – Aquatic Resource Professionals; Watershed Condition Assessment Program (including projects); and Water Resource Technical Assistance (Figure 2). The Water Resources Division also co-administers the NPS-USGS Water Quality Partnership Program that was initiated under the Clean Water Action Plan and is funded by the USGS Water Resources Daiscipline. This program provided $745,200 for projects in FY2007.

Figure 1 - Water Resources Program FY2007 Funding

Funding Available in FY2007	$ 12,325,000
Pay Increase	74,000
	$ 12,399,000
Net across-the-board reductions	-196,000
Total available in FY2007	$ 12,203,000

Figure 2 - Water Resources Program - FY2007 Base Funding by Category

Water Resource Projects		
Water Resource Protection		$ 954,700
Other Projects		14,500
Water Quality Monitoring		2,781,300
Water Resource Protection – Aquatic Resource Professionals		1,205,000
Watershed Condition Assessment Program		2,649,300
Competitive Projects	($507,800)	
Critical Projects	($287,600)	
Coastal Projects	($422,000)	
Natural Resource Condition Assessments	($813,100)	
Marine Science Advisor	($146,000)	
Other Projects	($472,800)	
Water Resource Technical Assistance		4,794,200
Total		$ 12,399,000

WATER RESOURCE PROJECTS

The projects category includes three areas: Water Resource Protection Projects, WRD Competitive Projects, and Other Projects that are non-competitive. Water resource projects are funded in the areas of general water resources, water quality, wetlands protection, and water rights.

WATER RESOURCE PROTECTION PROJECTS

The Natural Resource Challenge resulted in an increase of $823,000 in the water resource protection projects budget beginning in FY2001. As shown in Table 1, FY2007 expenditures for this budget increase continued the NPS' capability to fund data collection and analyses that can be used to describe surface- and ground-water flow regimes and investigate the dependence of park resources upon water in support of the Department of Interior Water Quantity Strategic Goal. These efforts are targeted toward development of scientific information that will contribute to decisions that protect or restore surface- or ground-water systems. Decisions are made by federal managers, court judges, or state administrators, such as state engineers. Priorities are determined by the requirements of federal or state law. Presentation of results may occur in state or federal regulatory process documents, such as rights-of-way and Clean Water Act permits, state water rights process documents, such as applications, protests, or administrative hearing records, or federal or state court process documents, such as adjudication claims, objections, or court hearing records. Results are also intended to support settlement negotiations, which are conducted to avoid contested case hearings, litigation, contested land use decisions, or to support the implementation of settlements.

Studies are conducted by scientists with expertise in fields that are appropriate for the park resources being examined. Hydrologic characterization is a need common to all water resources protection issues addressed by this budget. The majority of FY2007 project funds were used to support ongoing studies designed to characterize surface- or ground-water flow systems. In the western U.S., ongoing projects are developing modeling capabilities for predicting effects of large-scale development in regional ground-water flow systems. In the eastern U.S., hydrologic studies are developing information on the effects of impoundments on surface river systems. These tools are needed by decision makers to understand the potential for impacts to park water resources in the future from a number of existing water development proposals. In addition, hydrologic data is often required to implement settlement agreements.

Project funds are also used to study the relationships between water quantity and flow timing and water-dependent park resources. In FY2007, water-dependent resources that were studied include riparian vegetation, fish migration, anchialine ponds, and geomorphology. These results are needed by decision makers to understand the potential effect on the water-dependent resource of potential changes in stream or ground-water flow.

Finally, the results of these studies must be presented to decision makers in written or verbal format, often in a forum dictated by law or regulation. For this reason, a portion of the water resources protection project funds were used to support the Department of the Interior Office of the Solicitor in providing legal advice and representation to the NPS.

Many of the issues being studied are also of concern to the programs of other federal managers, such as the endangered species and National Wildlife Refuge programs of the U.S. Fish and Wildlife Service, the Southern Nevada Public Lands Management Act and other programs of the Bureau of Land Management, and the water supply programs of the Bureau of Reclamation and U.S. Army Corps of Engineers, and the research program of the U.S. Geological Survey (USGS). In many cases, these other federal programs also provide funding for studies that are useful for resolving NPS issues. When this occurs, NPS coordinates its water resources protection funding with that of the other agencies to avoid duplicating studies.

To increase the effectiveness of its water resource protection funding, NPS partners with other non-federal entities. Some studies occur as a result of collaboration with state or private entities with common science objectives. For example, hydrologic data collected by NPS studies for Lake Mead National Recreation Area, Death Valley National Park, and Great Basin National Park are shared with the Nevada State Engineer, southern Nevada water purveyors, and private developers, thereby contributing to the larger-scale knowledge of regional aquifers and ground-water availability in southern Nevada. In another example, data and other science information collected at Chickasaw National Recreation Area contributes to an on-going state-federal study of the Arbuckle-Simpson Aquifer in southeastern Oklahoma. In yet another example, hydrogeologic analyses conducted for Great Sand Dunes National Park and Preserve is being used in conjunction with work being conducted by The Nature Conservancy and local water conservation districts to support water rights protection for the park.

Table 1. Water Resource Protection Projects - FY2007

Park	Region	PROJECT TITLE(S)	FY07 Funding $(000s)
ALL	ALL	Support to the Office of the Solicitor	183.2
CHIC	IMR	Hydrologic Data Collection	10.0
WICA	IMR	Ground-water Study	46.6
MOCA	IMR	Hydrologic Data Collection for the Verde River Adjudication	47.3
MT Parks	IMR	Implementation of the Montana-NPS Compact	1.5
SAGU	IMR	Investigation of Hydrology and Water Related Values	1.2
ARCH	IMR	Hydrologic Data Collection	18.1
KAHO	PWR	Investigation of Hydrology and Water Dependent Values	65.0
GRSA	IMR	Hydrogeologic Data Analysis	39.6
THRO	MWR	Collection of Hydrologic Data	4.3
DEVA	PWR	Participation in Ground-water Model Development	12.0
GRTE	IMR	Investigation of Hydrology of the Gros Ventre River	6.2
GRBA	PWR	Investigation of Hydrogeology and Hydrologic Data Collection	81.6
TUZI	PWR	Hydrogeology Study	23.5
NIOB	MWR	Investigation of Water Dependent Resources	50.0
BLCA	IMR	Monitoring of Riparian System	30.0
OBRI	SER	Investigation of Water Dependent Values	17.6
ALL	ALL	Technical Support to All Projects and Technical Assistances	226.0
ALL	ALL	Administrative Support to Projects and Technical Assistances	91.0
		TOTAL FOR WATER RESOURCE PROTECTION PROJECTS	**954.7**

WATER RESOURCES DIVISION COMPETITIVE PROJECTS

Water Resources Division competitive projects support many park-based activities, including the design of information management systems, regulatory assessments, riparian/stream and watershed restoration and protection projects with water quality goals, or other water quality improvement projects. Projects may also include design and implementation of Clean Water Act best management practices required to improve water quality to meet State-mandated polluted runoff or non-point source pollution control or other park water quality goals and

objectives. In addition, projects may encompass one-time assessments or inventories of water quality baseline conditions or contaminants. Projects support National Park Service Strategic Goals Ia4A (water quality), Ia4B (water quality), and Ia4D (water quantity) and the Department of Interior Strategic Planning Goals for Land Health Ia1A and Ia1D.

Projects also may include ground-water assessment and monitoring, well and spring inventories, stream and riparian habitat restoration, wetland assessment, management or restoration, stream function assessments, channel and bank stability investigations, stream type classifications, watershed condition assessments, watershed management, surface-water hydrology studies, floodplain assessments, river management, water resources management planning, and other water resources related projects.

WRD competitive project funding for FY2007 totaled $507,800. This funding was provided by the WRD Watershed Condition Assessment Program. WRD's base funding is no longer adequate to sustain the competitive project program; therefore, it will become inactive after FY2007. Over the past ten years, in order to meet increased salary costs per FTE and budget rescissions, WRD has had to reduce funding to its project programs by $1.4 million. This has resulted in WRD's inability to support the WRD competitive project program.

Fully-Funded Projects: Fully-funded projects are projects that received the final funding installment in FY2007. Although these projects will not receive additional funding from WRD beyond FY2007, fieldwork, data analysis, report writing, or peer review may continue into the next year. A total of 11 projects received their last year of funding in FY2007 (Table 2). Appendix A contains a summary of these fully-funded projects.

Table 2. Water Resource Division Competitive Projects
Final Year Funded Projects - FY2007

Park	Region	PROJECT TITLE	FY2007 Funding $(000s)
KAHO	PWR	Determine Subterranean Ground-water Nutrient Input to Kaloko Honokōhau NHP's Coastal Ocean Ecosystem	27.0
BUFF	MWR	Map and Characterize the Geology of Tomahawk Creek, Buffalo National River	50.0
MULTI	PWR	Pre-Disaster Preventative Planning in MORA/OLYM	45.0
YELL	IMR	Norris Geyser Basin: Effects of the Shallow Ground-water System on Visitor Safety	50.0
MULTI	PWR	Assessment of Ground-water Resources in the Mojave Network	69.9
CUVA	MWR	Biological Assessment of Primary Headwater Streams	47.2
SACN	MWR	Manage Nonpoint Pollutants through Watershed Modeling	69.5
GRTE	IMR	Baseline Water Quality of Four Western Tributary Streams in the Upper Snake River Basin	23.9
MULTI	PWR	Map Wetlands in Small NPW Parks	48.7
BIBE	IMR	Determine the History of Channel Change of the Rio Grande River at Big Bend NP	41.6
EBLA	PWR	Conduct Hydrologic Assessment of Ebey's Prairie, Ebey's Landing National Preserve	35.0
		Total	**507.8**

OTHER PROJECTS

Cooperative Academic Program for Fisheries: Because of the limited professional fishery expertise within the National Park Service, this program uses a small amount of WRD base funding to further develop and increase cooperative relationships between the academic community and the NPS fisheries program. Funds are set aside to help foster graduate student research at National Park System units and to help cooperatively fund fishery students engaged in NPS park projects. Potential high priority projects suitable for graduate student research are identified through the NPS PMIS project need data system and matched to student availability through discussions with fishery professors. The program helps introduce top caliber fishery students to National Park Service programs, as well as expanding the level of expertise made available to parks. In FY 2007, a project at the University of Montana received funding through this program. (Summary provided below).

Project Title: Assessment of cutthroat trout survival and growth in irrigation ditches off the Gros Ventre River and population connections to the Snake River, Grand Teton National Park – Water diversions can influence the quantity and quality of habitat available to fish within a river system, and often may be a source of mortality. Adult trout habitat in the lower Gros Ventre River is limited by the effects of at least 13 irrigation diversions. Such a large proportion of the river flow is diverted that fish habitat (and flow) is often completely eliminated near the Highway 191 Bridge. This may reduce the quantity and quality of trout habitat in the Gros Ventre River and serve as a barrier to fish movement between the Gros Ventre River and the Snake River systems. A previous study examining water diversions in the Gros Ventre River found mountain whitefish, cutthroat trout, speckled dace, and longnose dace in several of the diversion ditches. Thus, understanding the role of these diversions on the potential habitat availability, mortality, and movement of cutthroat trout in the Gros Ventre River system is crucial for the conservation of this population. This project is examining 1) the growth and survival of fish entrained within the irrigation ditches and 2) if cutthroat trout are moving between the Gros Ventre and Snake River systems. It was initiated in FY2007 and will continue in FY2008. Total project cost in FY2007 was $14,500, all of which was funded through the Water Resources Division. All of the money was obligated in accordance with the project's approved Scope of Work.

WATER QUALITY MONITORING

In FY2007, the Water Resources Division received $2,781,300 for the Water Quality Monitoring component of the Natural Resource Challenge. This was the seventh year of funding for a program specifically intended to track and support the attainment of water quality standards in units of the National Park System as required by the NPS and DOI Strategic Plans. The program is "fully-funded," minus rescissions and across the board cuts.

The National Park Service is committed to a servicewide and DOI strategic goal to significantly reduce the number of stream and river miles and acres of lakes and marine areas that do not meet water quality standards. As part of this goal, the NPS is also committed to protecting unimpaired water quality in parks from future impairment, including waters classified as Outstanding National Resource Waters (ONRW) or State-equivalent listed waters. Additionally, the NPS is committed to working with State Clean Water Act programs, as well as taking appropriate management actions within parks, to support the restoration of impaired water bodies in parks to an unimpaired condition. Presently, about 120 park units have one or more waterbodies that do not meet state water quality standards for one or more pollutants

on approximately 1,800 miles of rivers and streams and 1,066,000 acres of lakes, reservoirs, estuaries and marine areas. Planning and design of the program continues to be implemented in full integration with the NPS Park Vital Signs Monitoring Program. This is because water quality is a key vital sign in determining overall aquatic ecosystem health. In addition, by fully integrating the design of these programs, considerable cost efficiencies have and will continue to be realized in staffing, planning and design, administration, implementation, data management, and reporting.

Full program funding was allocated to all 32 Park Vital Signs Networks in FY2007 (Table 3). In addition, funds supported the development of an NPS servicewide water quality data management program within the U.S. Environmental Protection Agency (EPA) STORET national water quality database. While not shown in Table 3, WRD reallocated 20 work months, involving five Division staff to support program administration and the development of program technical guidance, technical protocols, detailed study plan and Quality Control/ Quality Assurance Plan guidance, and database management.

Table 3. Allocation of Water Quality Park Vital Signs Monitoring Funding - FY2007 (continued on next page)

Network	Region	Number of Parks in Network	FY2007 Funding $(000s)
Central Alaska	Alaska	5	95.7
Heartland	Midwest	15	80.0
NE Coastal and Barrier	Northeast	8	87.9
National Capital	National Capital	11	69.3
Cumberland/Piedmont	Southeast	14	57.6
Appalachian Highlands	Southeast	4	68.3
North. Colorado Plateau	Intermountain	16	105.4
Greater Yellowstone	Intermountain	3	69.3
Sonoran Desert	Intermountain	11	62.5
North Coast & Cascades	Pacific West	7	80.0
San Francisco Bay	Pacific West	6	68.3
Mediterranean Coast	Pacific West	3	74.2
Southwest Alaska	Alaska	5	135.7
Northeast Temperate	Northeast	10	58.6
Southern Colorado Plateau	Intermountain	19	121.0
Pacific Islands	Pacific West	9	147.4
Great Lakes	Midwest	9	120.1
Gulf Coast	Southeast	8	86.9
Rocky Mountain	Intermountain	6	59.5
Sierra Nevada	Pacific West	3	61.5
Eastern Rivers and Mountains	Northeast	9	61.5
Arctic	Alaska	5	147.4

Table 3. Allocation of Water Quality Park Vital Signs Monitoring Funding - FY2007 (continued)

Network	Region	Number of Parks in Network	FY2007 Funding $(000s)
Klamath	Pacific West	6	74.2
Southeast Coast	Southeast	17	118.1
Upper Columbia Basin	Pacific West	8	48.8
Southern Plains	Intermountain	10	28.3
Mojave Desert	Pacific West	6	78.1
Southeast Alaska	Alaska	3	41.0
South Florida/Caribbean	Southeast	6	143.5
Mid-Atlantic	Northeast	11	43.0
Chihuahuan	Intermountain	6	71.3
Northern Great Plains	Midwest	13	79.1
TOTAL: 2007 Network Monitoring	**7 NPS REGIONS**	**272**	**2643.5**
Servicewide Data Management			137.8
GRAND TOTAL			**2,781.3**

Vital Signs Monitoring Networks: In FY2007, 32 Park Vital Signs Monitoring Networks fully committed their water quality funding to compilation of background information, analysis of issues and threats, detailed program planning, and supporting synoptic-level field assessments, and five networks initiated field-level monitoring. Network planning approaches included personnel hiring, in-house allocation of staff, university cooperative agreements, and USGS Interagency Agreements. In addition, some equipment acquisitions were made. All 32 Networks accomplished one or more of the following activities:

- Network water quality planning workshops
- Historic data compilations and analyses
- Information on state-listed impaired waters and park "outstanding" waters
- Documentation of significant water quality stressors/threats
- Synoptic inventory studies in support of detailed statistical design
- Database management and GIS support programs
- Development of water quality monitoring protocols
- Field monitoring

Individual network accomplishments are summarized in Appendix C (detailed budgets are provided in individual NPS Network Administrative Reports).

Servicewide Data Management: The Water Resources Division continued to support network water quality monitoring programs by providing national program administration and reporting, establishing baseline inventories and analyses of available water quality data, supporting digitization of legacy data from analog reports and other archival materials, maintaining a servicewide water quality database in the EPA-STORET national water quality database, and enhancing the means to flow data from the networks into STORET. Four water

quality research associates worked to support the database development, management, and reporting activities through cooperative agreements with Colorado State University. The servicewide STORET database archive has served as the starting point for most network water quality data compilation and analysis efforts. A contract with Research Triangle Institute and Horizon Systems to revamp automated water quality data retrieval procedures and reporting software to inventory and analyze water quality data from the three major national water quality databases (EPA legacy and modern STORET and the USGS National Water Information System) ended. WRD will now complete the procedures and software. Much effort went into enhancing the two mechanisms by which networks report water quality monitoring data to WRD for upload into STORET: NPSTORET and the NPS Electronic Data Delivery format specifications (NPSEDD). NPSTORET v.1.50, a series of Microsoft Access-based templates for entering, managing, reporting, and analyzing water quality data (projects, stations, metadata, and results) in a STORET compatible format, was released. NPSTORET v.1.50 also includes import routines to allow users to import their own data or stations as well as data and stations from the three major national water quality databases. Additional capability was added including the ability to filter the Results Template and to enter the results of QC-specific activities. A new version (v.1.10) of NPSEDD, a set of Microsoft Excel-based spreadsheets that provide an electronic data deliverable content and format specification for those parks and networks that don't employ NPSTORET, was released. This new version included guidance for automatic data loggers.

WATER RESOURCE PROTECTION - AQUATIC RESOURCE PROFESSIONALS

In FY2005, the NPS received $1,205,000 to fund aquatic resources specialists in the field. Fifteen positions were fully funded in FY2007. Twelve of the positions are duty-stationed in parks and one each is located in the Sonoran Network Office, the Center for Urban Ecology in the National Capitol Region, and the Utah State Office. The specific aquatic resource disciplines represented by the new professionals, their duty stations, and their primary areas of focus are identified in Table 4.

Table 4. Water Resource Protection - Aquatic Resource Specialists (continued on next page)

REGION	DUTY STATION	GEOGRAPHIC FOCUS AREA
AKR	Yukon-Charley Rivers NPres. - Aquatic Ecologist	Central and NW Alaska Network Parks
AKR	Lake Clark NP - Fishery Biologist	SW and SE Alaska Network Parks
IMR	Utah State Coord. Office - Fishery Biologist	Upper Colorado River Basin Parks
IMR	Sonoran Desert Network - Ground-water Hydrologist	Arizona and New Mexico Parks
IMR	Grand Teton NP – Hydrologist	Vacant
IMR / MWR	Chickasaw NRA – Ground-water Hydrologist	Southern Plains, Heartland Network Parks
MWR	Saint Croix NSR - Aquatic Ecologist	Great Lakes Network Parks
MWR	Isle Royale NP - Fishery Biologist	Great Lakes Network Parks
NER / NCR	Center for Urban Ecology - Aquatic Ecologist	National Capitol / Mid-Atlantic Network Parks

Table 4. Water Resource Protection - Aquatic Resource Specialists (continued)

REGION	DUTY STATION	GEOGRAPHIC FOCUS AREA
NER	USGS Water Resources Office (Atmospheric Deposition), Troy, NY - Hydrologist	Northeast Region
NER	Fire Island NS - Marine Ecologist	NE Temperate / NE Coastal & Barrier Network Parks
PWR	Point Reyes NS - Aquatic Ecologist	San Fran. Bay / Sierra / Klamath/ Mediterranean Coast Network Parks
PWR	Mount Rainier NP - Geomorphologist	North Coast & Cascades / Klamath Network Parks
PWR	Lake Mead NRA – Ground-water Hydrologist	Mojave Desert Network Parks
SER	Chattahoochee River NRA - Fishery Biologist	SE Coast / Gulf Coast / Appalachian Highlands / Cumberland-Piedmont Network Parks
SER	Chattahoochee River NRA - Wetlands Ecologist	SE Coast / Gulf Coast / Appalachian Highlands / Cumberland-Piedmont / S. Florida – Caribbean Network Parks

WATERSHED CONDITION ASSESSMENT PROGRAM

The Natural Resource Program Center's Water Resources Division (WRD) received $2.65 million in FY2007, as part of the Natural Resource Challenge, to assess watershed resource conditions in parks. WRD's Watershed Condition Assessment Program (WCAP) provides technical guidance and accountability oversight for this effort. By FY2014, the WCAP hopes to fund a comparable "natural resource condition assessment" project for each of the 270-plus parks in the NPS Vital Signs Monitoring Program.

Parks receiving these assessments will be in an improved position to 1) define natural resource conservation indicators and targets via park planning and 2) report to "overall resource condition" performance accountability measures (e.g., land health goals in the Department of Interior's Strategic Plan). Relying on existing data from multiple sources and best professional judgment, each assessment provides an interdisciplinary synthesis and report-out on current condition status, critical data gaps, and existing or emerging vulnerability/risk factors for important park natural resources. Assessments also strive to develop overall condition ratings for park areas, at the geographic scale(s) requested by the receiving park (e.g., by park watersheds, habitat types, or management zones).

FY2007 projects benefited greatly from academic partnerships with universities in Cooperative Ecosystem Studies Units (CESUs), as well as from collaboration with federal agencies that provided essential expertise in varied aspects of ecological assessment and reporting.

Significant program accomplishments in FY2007 are described below. Table 5 shows the budget allocation in FY2007 for the WCAP.

Table 5. Watershed Condition Assessment Program FY2007 Budget

Program Element	FY2007 Funding $(000s)
Water Resources Competitive Project Program	507.8
Natural Resource Condition Assessments	813.1
WRD Watershed Condition Assessment – Critical Projects	287.6
Coastal Park Natural Resource Assessments	422.0
Marine Science Advisor	146.0
Other (incl. staff)	472.8
TOTAL	**2,649.3**

Implementation of long-range program plan: Two full-time staff members provided dedicated support to implement the program plan to fund, during the time frame of FY2006-FY2014, a comparable natural resource condition assessment at each of the 270-plus parks in the NPS Vital Signs Monitoring Networks. Staffing to implement this assessment project series included one Federal employee, who served as Program Coordinator, and a Coastal Resource Analyst, who assisted in the coordination of resource assessments in NPS managed coastal/marine environments. The WCAP plan is being implemented in close coordination with other NPS programs and activities related to resource planning, strategic planning and performance reporting, inventory and monitoring, and disturbed lands restoration. In FY2007, the WCAP initiated assessments at 17 additional parks and provided supplemental funding to assessments started in previous years at four other parks (Table 6).

Table 6. Natural Resource Condition Assessment Project Funding - FY2007

REGION	AGENCY OR UNIVERSITY PARTNER	STATE	PARKS	FY2007 FUNDING $(000s)
Intermountain	Rocky Mountains CESU/Utah State University	WY	GRTE	75.0
Intermountain	Rocky Mountains CESU/Colorado State University	CO	ROMO, FLFO (supplement - phase 3 funding)	130.0
Midwest	Great Plains CESU/University of Nebraska	SD, NE	MORU, NIOB	127.0
Midwest	Upper and Middle Mississippi Valley CESU/University of Missouri	IA, MO	EFMO, OZAR (supplement)	22.1
National Capital	Chesapeake Watershed CESU/ University of Maryland	District of Columbia	ROCR	34.0
Northeast	Piedmont - South Atlantic CESU/ North Carolina State University	VA, MD	GEWA, THST	67.0
Northeast	North Atlantic Coast CESU/University of Rhode Island	MA	MIMA	35.0
Pacific West	Northwest Management, Inc.	ID, MT, OR, WA	JODA, LARO, NEPE, WHMI	187.0
Southeast	Southern Appalachian CESU/ Virginia Polytechnic Institute and State University	GA, FL, SC	FOPU, FOFR, FOSU, CHPI, CASA, FOMA	136.0
Total			**21 parks**	**813.1**

Coastal Park Natural Resource Assessments: In FY2003, the WCAP initiated assessments of coastal water resources and watershed conditions in National Parks. As of FY2007, the WCAP has initiated assessments in 47 coastal parks, with plans to complete assessments for a total of 55 parks that manage significant ocean and Great Lakes resources by FY2014. Reports from these assessments characterize the relative health or status of upland, wetland, riparian, marine, estuarine, and Great Lakes resources within the National Park system. Comprehensive assessments are achieved through academic partnerships in Cooperative Ecosystem Studies Unit Networks and collaborations with federal agencies, to engage experts in oceanography, ecology, hydrology, geographic information systems (GIS), and marine and estuarine sciences.

To date, final reports have been published for a total of 24 coastal and Great Lakes parks. In FY2007, reports were published for Aniakchak National Park and Preserve (AK), Katmai National Park and Preserve(AK), Apostle Islands National Lakeshore (WI), Pictured Rocks National Lakeshore (MI), Redwood National and State Parks (CA), Ebey's Landing National Historic Reserve (WA), San Juan Island National Historical Park (WA), and Lewis and Clark National Historical Park (OR, WA). Completed reports are available at: http://www.nature.nps.gov/water/watershed_reports/WSCondRpts.cfm. In FY2007, the WCAP initiated assessments in six additional coastal parks and provided supplemental funding to assessments started in previous years in 15 other parks (Table 7).

Table 7. Coastal Watershed Condition Assessment Funding-FY2007

REGION	AGENCY OR UNIVERSITY PARTNER	STATE	PARKS	FY2007 FUNDING $(000s)
Northeast	North Atlantic Coast CESU/ University of Maine	ME	CACO, BOHA, SAIR	75.0
Northeast	North Atlantic Coast CESU/ University of Rhode Island	RI	BOHA, CACO, SAIR (GIS data-base development)	60.0
Northeast	U.S. Geological Survey	NJ/NY	FIIS, GATE, SAHI (supplement)	45.0
Midwest	Great Lakes and Northern Forest CESU/ University of Wisconsin, Stevens Point	MI	SLBE	80.0
Southeast	South Florida and Caribbean CESU/ Florida International University	FL	BISC	84.0
Pacific West	Southern Appalachian Mountains CESU/ Southern Appalachian Man & Biosphere Foundation	CA	PORE, GOGA (supplement)	16.0
Pacific West	Pacific Northwest CESU/University of WA	WA/OR	EBLA, LEWI, OLYM, SAJU (supplement)	24.0
Alaska	Pacific Northwest CESU/ University of AK Southeast	AK	KEFJ, KATM, ANIA, LACL (supplement)	38.0
TOTAL			**21 parks**	**422.0**

Water Resources Competitive Project Program: There remains a backlog of watershed resource and water quality assessment projects identified in the NPS Project Management Information System. In FY2007, the WCAP funded approximately 11 of these projects through the WRD Competitive Project Program process. These projects are summarized in Appendix A.

WRD Watershed Condition Assessment – Critical Projects: In FY2007, WRD funded projects that addressed emerging, high-priority, park watershed condition issues that, because of the applicable timeframes, could not be appropriately directed through the competitive project funding program. Examples of FY2007 projects include assessing the condition of the Pecos River riparian corridor prior to implementing a public fishing program at Pecos National Historic Park; support for an All Risk Incident Team to prepare a quagga mussel detection, prevention, and response planning guide for the Pacific West and Intermountain Regions; and bottom sediment and water quality baseline for assessing removal of Cornell Dam on the Niobrara National Scenic River. Partnering with other Federal agencies, state agencies, and/or local watershed groups in carrying out these projects was emphasized. Table 8 shows the funding allocated from the WCAP to support these projects.

Table 8. WRD Watershed Condition Assessment Critical Projects Funded in FY2007 (continued on next page)

REGION	STATE	PARK	PROJECT TITLE	FY2007 Funding $(000s)
Intermountain & Pacific West	Multiple	Multiple	All Risk Incident Team to Prepare a Quagga Mussel Detection, Prevention, and Response Planning Guide	15.0
Intermountain	AZ, UT	GLCA	Emergency Measures to Prevent the Introduction of Quagga and Zebra Mussels to Glen Canyon National Recreation Area	55.0
Intermountain	WY	GRTE	Develop water Budget for the Lower Gros Ventre River-Grand Teton National Park	10.5
Intermountain	NM	PECO	Assess the Condition of the Pecos River Riparian Corridor Prior to Implementation of a Public Fishing Program	35.7
Midwest	NE	NIOB	Assess Sediment Quantity and Quality as a Basis for Removing Cornell Dam on the Niobrara National Scenic River	12.6
Midwest	SD	MNRR	Modeling a Channel Migration Corridor for the 59-Mile Segment of the Missouri National Recreation River – Phase I: Development of Migration Simulation Code	36.2
Midwest	MI	SLBE	Determine Factors Contributing to Recent Large-Scale Outbreaks of Type E Botulism at Sleeping Bear Dunes National Lakeshore	25.2
Midwest	MN	VOYA	Characterize Pre-Bythotrephes Invasion Zooplankton Communities in Interior Lakes at Voyagers National Park	4.4
Northeast	PA, NY	UPDE	Assist Local Agencies in Evaluating Stream Restoration and Flood Mitigation Projects Following 2006 Flood Event	14.0
Pacific West	CA	SEKI	River Restoration Design for Bridge Replacement Project at Sequoia and Kings Canyon National Parks	20.0
Pacific West	HI	KAHO	Recommendation for Construction of New Ground-Water Monitoring Wells, Kolo-Honokōhau National Historic Park	10.0

Table 8. WRD Watershed Condition Assessment Critical Projects Funded in FY2007 (continued)

REGION	STATE	PARK	PROJECT TITLE	FY2007 Funding $(000s)
Southeast	AL	LIRI	Development of a Geo-Referenced Database to Identify and Inventory Wetlands at Little River Canyon National Preserve	25.0
Servicewide	Multiple	Multiple	Funding for USGS-NPS Liaison to Facilitate Interagency Partnerships and Project Support	24.0
Total		**11 + Parks**		**287.6**

A summary of the Critical Projects that were funded in FY2007 is included in Appendix C.

Marine Science Advisor: The program continued to support Natural Resource Stewardship and Science's Senior Scientist/Marine Science Advisor for an additional year.

WATER RESOURCE TECHNICAL ASSISTANCE

This was the fundamental component of the Water Resources Program before the Natural Resource Challenge, and it has not been expanded with Challenge funding. Through this effort, the Water Resources Program provides direct assistance to parks on high priority needs, using a combination of its own staff and expertise acquired through cooperative agreements. Over 160 parks obtained technical assistance from the Water Resources Division in 2007. (See Appendix A)

NPS-USGS WATER QUALITY PARTNERSHIP PROGRAM

The NPS-USGS Water Quality Partnership Program was initiated under the Clean Water Action Plan and is funded by the USGS Water Resources Division Office of Water Quality. Since 1999, more than $18 million has been allocated for partnership water quality projects in parks. Through 2007, 136 partnership projects have been initiated in 103 national park units; 110 of these projects have been completed. Thirteen new projects were funded in FY2007 for a total of $745,200, including one that provided partial support for the USGS Liaison Position. Additional information on the program is available at http://water.usgs.gov/nps_partnership/.

Table 9. USGS Water Quality Partnership Program Projects
Continuing Funded Projects – FY2007

NPS REGION	PARK	PROJECT TITLE	FY2007 Funding $(000s)
Alaska	DENA	Limnology and Water Quality of Wonder Lake and Other Selected Lakes	100.00
Alaska	WRST	Water-Quality Monitoring in Support of the McCarthy Road	100.00*
Intermountain	GLAC	Baseline Assessment of Water Quality and Aquatic Communities of the North Fork of the Flathead River	99.90*
Intermountain	ROMO	Assessment of Nitrogen Saturation and Episodic Acidification Status	99.50*
Midwest	OZAR	Assess Threats to Water Quality	99.80
Midwest	MULTI	Determine Nutrient Conditions, Cycling, and Biological Effects in Two Riverine Parks, SACN and MISS	99.80*
National Capital	ROCR	Organic Wastewater Chemicals in Rock Creek Park	100.00*
Northeast	SAIR	Real-Time Monitoring of Sodium and Chloride	19.00*
Northeast	UPDE	Define Existing Water Quality in Streams for Development of Special Protection Waters Standards	99.90
Pacific West	OLYM	Construct a Nutrient Budget for Lake Crescent to Assess the Impact of Human Nutrient Enrichment	100.00
Pacific West	OLYM	Monitoring Suspended Sediment in the Elwha River	50.00
Pacific West	PRES	Analyze Sulfur and Mercury Biogeochemistry in Crissy Marsh	50.00*
Pacific West	YOSE	Water-Quality Monitoring in Support of Establishing User Capacities	100.00
Southeast	CONG	Investigate Influence of Seasonal Flood Waters on Mercury Methylation	77.00*
		TOTAL	**1194.90**
		* New Projects in FY2007	

Table 10. USGS Water Quality Partnership Program Projects
Final Year Funded Projects – FY2007

NPS REGION	PARK	PROJECT TITLE	FY2007 Funding $(000s)
Alaska	SITK	Develop a Strategy and Plan to Monitor the Indian River	20.00*
Intermountain	AMIS	Water Quality and Biological Assessment Along the Rio Grande	49.50
Intermountain	BIBE	Salinity and Source of Nutrients in the Rio Grande/Rio Bravo between Presidio and Amistad Reservoir	67.70
Intermountain	CURE	USGS Data Collection and Analysis of Required Water Quality Parameters: Outstanding Waters Designation	48.80
Intermountain	GLAC	Effects of Wildfire on Water Quality	100.00
Intermountain	WASO	Program & Coordination Support Through an Interagency Liaison Position	20.00*
Midwest	NIOB	Assess Sediment and Water Quality as a Basis for Removing Cornell Dam	20.00*
Northeast	CACO	Defining Nutrient Fluxes to Estuaries to Assess Alternatives for Nutrient Loading Remediation	99.90
Northeast	SHEN	Assess Effects of Human Activities and Recreational Use on Bacteria Concentrations in Streams	50.00
Northeast	SHEN	Publication of USGS Fact Sheet on Acidification Vulnerability Modeling	20.00*
Pacific West	MOJA	Determine the Susceptibility of Springs in the Mojave Network to Climate Change and Development	81.10
Pacific West	MORA	Develop Multivariate Tool for Classifying Aquatic Ecosystems and Predicting Response to Climate Change	20.00*
Pacific West	SEKI	Fire Impacts on Nutrients and Sediments in Redwood Creek Watershed and Lilburn Cave	46.90
		TOTAL	**643.90**
		* New Projects in FY2007	

APPENDIX C

SUMMARIES OF WATER QUALITY MONITORING PROGRAM FUNDING IN PARK VITAL SIGNS MONITORING NETWORKS

Appalachian Highlands Network (APHN)

The APHN received $68,300 in funding from WRD for water quality monitoring in FY2007. The APHN Hydrologist substantially completed a second draft of the Network Water Quality Monitoring Plan and initiated pilot sampling to field test sampling equipment and to refine techniques. The draft protocol describes, on a park-by-park basis, the justification for monitoring, the monitoring design, and the data collection, analysis, and reporting procedures.

During FY2007, APHN developed a scope of laboratory services for water quality analyses and entered into an Interagency Agreement with the USFS Air Resource Management Laboratory in Fort Collins, CO, and developed a draft protocol for evaluation of fluvial sediment dynamics at monitoring sites consistent with that of the USGS and the Federal Interagency Sediment Project. The APHN Hydrologist collaborated with USGS personnel to acquire field experience operating streamflow gages and took a USGS sponsored course in gage records maintenance in preparation for assuming responsibility for four gages within OBRI and BISO.

As part of a project to identify target sites for incorporation into the Network's water quality monitoring protocol, work was continued to characterize high elevation aquatic resources along BLRI. In conjunction with the Southern Appalachian Man and the Biosphere Foundation, 50 sites were sampled on BLRI. The sites were chosen by overlaying prior records of rare taxa, plant community data, aquatic resource maps, and lithologic models at high elevations (where acid deposition is likely to be a factor affecting water quality). Several additional significant discoveries were made during limited aquatic macroinvertebrate sampling, including two genera and five species new to science. Combined with previous year's results, the project has yielded a total of three genera and roughly 20 species new to science.

Arctic Network (ARCN)

The ARCN received $147,400 in funding from WRD for water quality monitoring in FY2007. With this funding, the Network hired an aquatic ecologist to survey the literature for relevant information and synthesize what is known about aquatic ecosystems in ARCN, compiled an exhaustive list of relevant fisheries and aquatics literature through the hire of a University of Alaska graduate student, and initiated an overview of the literature on water quality studies. From these surveys, a draft bibliography of select water quality studies in the ARCN was created. Physical, chemical, and biological water quality data collected during the 1970s and 1990 was converted from documents into tabular form to add to the Network historical database.

Work by Drs. Mike White and Chris Luecke of Utah State University continued to develop and assess techniques to catalogue aquatic ecosystems and classify watersheds using previously collected remotely sensed and spatial/synoptic geographic information system (GIS data). Cooperators submitted a report recommending the use of LIDAR for classifying lake ecosystems and estimating timing of lake ice-off. A Cooperative Agreement with Dr. Breck Bowden from the University of Vermont was extended so that he, together with the Woods Hole Marine Biological Laboratory and Utah State University cooperators, could develop standard operating procedures for sampling small lakes and

streams in the Network.

Continued water quality data mining efforts coupled with collection of baseline data, water quality protocol development, and pilot project initiation and development of a water quality monitoring plan are priorities in FY2008. Further studies are also anticipated on the effects of thermokarsts on freshwater streams and their direct impact on stream and lake ecosystems as the rate of thermokarst development increases with rapid warming of the arctic.

Central Alaska Network (CAKN)

In FY2007 the Central Alaska Network received $95,700 for water quality monitoring after a 1% rescission by the Water Resources Division (WRD). These funds were expended on implementation of the second year of shallow lake monitoring at 28 lakes in DENA and 7 lakes in YUCH during the summer months. A full suite of variables, including water chemistry, were collected at each site. Collaboration with USGS scientist Chris Arp was undertaken to monitor water quality and lake level in the large lakes of DENA. This included the deployment of water level loggers in Lakes Minchumina and Chilchukabena and two other lakes used to establish long term monitoring trends and better understand the hydrodynamics of wetlands in DENA. Dr. Dave Verbyla with the University of Alaska Fairbanks calculated surface-water area in DENA throughout the growing season using RADARSAT imagery. These data show the highly variable nature of water levels in lakes of this region and provide important information to scientists estimating lake surface area using remote sensing. Study results will be presented at the 2007 American Geophysical Union Meeting.

Stream sampling continued in WRST in FY2007 and included the sampling of 10 remote streams in July using the Firepro helicopter. This work documented 1) a high density of Dolly Varden in a very unstable and turbid braided glacial stream (Moonshine Creek) and 2) the presence of rainbow trout and sockeye salmon in the Gilahina River, where they had not been previously reported, and extended the ADF&G Anadromous Waters Catalog by documenting the presence of coho salmon in a tributary of the Nizina River approximately 5 miles upstream of their previous known extent. FY2007 was also the pilot year for stream sampling in DENA carried out by Dr. Sandy Milner.

Looking ahead to FY2008, the CAKN is taking part in discussions with the USGS to integrate the CAKN stream monitoring program with the USGS Yukon Basin Initiative, a multi-agency effort to understand the effects of climate change on the Yukon River Basin. The network plans to continue to utilize water quality funding most effectively by combining field sampling efforts for water quality with freshwater fish monitoring.

Chihuahuan Desert Network (CHDN)

The network received $71,300 for water quality monitoring in FY2007. A Water Quality and Quantity workshop was held to delineate specific metrics for each measurement and to identify specific existing protocols. Information from this workshop assisted CHDN in selecting the most effective indicators. The Texas Commission on Environmental Quality, along with Dr. Glenn Longley (Texas State University, Edwards Aquifer Research Center) through a Cooperative Agreement, will collaborate and participate in the development of the Network's water quality monitoring plan. Additionally via another Cooperative Agreement, Dr. Elizabeth Walsh of the University of Texas at El Paso is contributing to sample design and writing the SOP for the protocol development summary on monitoring aquatic invertebrates.

Cumberland Piedmont Network (CUPN)

The network received $57,600 in FY2007. Water quality monitoring included a total of 334 samples taken at five parks in accordance

to the Network's water quality monitoring plan. These samples included measures of the core-four parameters (water temperature, pH, specific conductance, and dissolved oxygen) as well as selected parameters that address specific park issues (*E. coli*, atrazine, nutrients, and turbidity). Sampling included re-occupation of sites in three parks (CARL, COWP, and KIMO) and the implementation of monitoring in two others (CUGA and LIRI). Two "Topical Studies" were also initiated: "Examination of Dissolved Oxygen Deficiencies at SHIL" and "Examination of Diurnal Fluctuations of Water Quality Parameters at CUGA." Both studies will assist with interpretation of findings of routine water quality monitoring. In addition, nine Natural Resource Reports were published and submitted to parks. These reports–part of an annual CUPN series–display and interpret water quality results to park staff.

Eastern Rivers and Mountains Network (ERMN)

The ERMN received $61,500 from WRD in FY2007. The Network reached a significant milestone by completing the ERMN Ecological Monitoring Plan. The Monitoring Plan is published as an NPS Natural Resource Report. The ERMN also completed a draft, peer reviewed Data Management Plan to ensure the long-term integrity of monitoring data. A draft protocol narrative and all SOPs are completed for the Louisiana Water Thrush and Riparian Birds Protocol. Pilot data (58 transects/watersheds) were collected in five of nine ERMN parks this summer. Protocol development for the Water Quality and Surface-Water Hydrology vital signs continued with a January 2007 workshop, summer field work, and a draft protocol narrative nearing completion. A beta version of an interactive website that allows ERMN and member park personnel to locate, query, and download weather data and view a full suite of summary statistics is nearing completion. An ArcGIS standard mapping procedure to download, evaluate, report, and display a suite of (natural resource related) socioeconomic indicators for the counties and census blocks surrounding ERMN parks is nearing completion.

Scott Sheeder and Caleb Tzilkowski of Pennsylvania State University completed an Aquatic Resource Assessment for FONE and FRHI. This project provides a baseline assessment and reference to evaluate restoration efforts and/or detect future improvement or degradation of aquatic communities throughout FONE and FRHI through monitoring.

Great Lakes Network (GLKN)

In FY2007, the Network received $120,100 from WRD to support its water quality monitoring program. Funds were spent primarily on salaries and laboratory analyses, and to a lesser degree on cooperative agreements, equipment, and supplies. The protocol for monitoring water quality of large rivers was finalized in January 2007 and implemented at SACN. Work continued to develop other protocols for monitoring water quality of smaller wadeable streams and for using diatoms as bio-indicators in monitoring water quality. The protocol and SOPs for monitoring water quality of inland lakes has been revised and is nearly complete. Initial inland lake monitoring occurred at six parks. Network staff worked with the US Fish and Wildlife Service to complete a report synthesizing the current understanding of the distribution and life history characteristics for 12 aquatic nuisance species (ANS) present in or encroaching on GLKN parks. Several 2007 accomplishments related to nutrient and eutrophication issues. At SACN, historically low flow conditions in the St. Croix River basin persisted until late summer. Total phosphorus levels were lower than in recent years, especially in the lowest stretch of the river, likely due to reduced non-point runoff. At Richie Lake, a remote lake on ISRO, an unusual blue-green algal bloom developed in mid-summer and is being tested for dangerous cyanotoxins.

Greater Yellowstone Network (GRYN)

The Network received $69,300 for water quality monitoring in FY2007. Water quality monitoring took place at 25 permanent stations located on selected perennial rivers and streams in YELL, GRTE, and BICA in order to provide resource managers critical information needed to interpret the physical and biotic condition of aquatic resources so action can be taken to protect and maintain clean water. At GRTE, three alpine lakes sensitive to atmospheric deposition were added to the annual monitoring schedule. Additionally, monitoring took place on water quality impaired streams (303(d)), including Soda Butte and Reese Creek in YELL and the Shoshone and Bighorn Rivers in BICA, following the Regulatory WQ protocol V.1.2. Monitoring data were compared with state water quality standards and the results shared with Wyoming and Montana state agencies to aid in the development of Total Maximum Daily Loads and, in places where state standards are continually met, to provide evidence that will lead to removing the segment from the state 303(d) listing.

Data from the 2006 water year were entered into NPSTORET, and verification and validations reports were completed, following the protocol Quality Assurance/Quality Control Standard Operation Procedures. This critical step helps ensure that data used to assess water quality are credible and also serves to identify areas of improvement. NPSTORET data was forwarded to WRD for upload to EPA STORET.

Gulf Coast Network (GULN)

In FY 2007, the GULN received $86,900 in funding from WRD for water quality monitoring. Significant planning and program design occurred during FY2007 that places the Network in position to implement water quality monitoring in five of its eight parks in FY2008. The draft Water Quality Monitoring Program for the inland parks, with associated protocols and SOPs, was completed as part of the Network's Vital Signs Monitoring Plan. Training of park staff for in-house water quality monitoring was completed at VICK and PAAL.

Contracts are in place with two of the participating organizations in the Texas Commission on Environmental Quality's Clean Rivers Program, San Antonio River Authority and Lower Neches River Authority, to expand their existing monitoring programs to include routine water quality monitoring sites within the park boundaries at SAAN and BITH. By working with the local river authorities, the Network will acquire high quality, park-specific data, while also participating in a watershed-level monitoring program, benefiting both entities.

The WRD also provided the Network with $55,000 to conduct a water quality inventory at NATR. This 450-mile long park crosses eight watersheds and three states. The water quality inventory will assist the Network in developing a viable monitoring plan for that park. The inventory is being conducted through a cooperative agreement with Mississippi State University.

Heartland Network (HTLN)

In FY2007 the Network received $80,000 from WRD to support its water quality monitoring program, most of which went into the salary for a full time water professional who oversaw all water quality work. The network published a protocol for monitoring aquatic invertebrates of rivers and tributaries at 24 sites at BUFF and OZAR. Additional invertebrate monitoring was conducted at GWCA, HOME, PIPE, and WICR. Data-sonde logging of basic water quality parameters at each park was completed. Associated habitat data was entered in the database and subjected to QA/QC. Invertebrate sample processing is on-going. A draft monitoring protocol addressing water quality, aquatic vegetation, invertebrates, and fish in large springs at OZAR was submitted for peer review, follow-

ing pilot monitoring. Fish community and habitat monitoring was completed at BUFF, OZAR, PIPE, TAPR, GWCA, and WICR. Results from previous data collections were summarized, and revisions on the current Prairie Fish Protocol and associated database were completed. The Ozark Rivers Fish Community Protocol was completed and is being published by the USGS. A protocol for monitoring contaminant metals (Ni, ZN, Co, Cd, Pb) within OZAR and an associated database were developed by the USGS and are in peer review. Work continued to develop a protocol for hellbenders at OZAR and a Wetlands Protocol for CUVA.

Klamath Network (KLMN)

FY 2007 funding totaled $74,200. A summary of the existing water quality information in Network parks, entitled "Klamath Network Water Quality Report (Phase II)," was revised and submitted in early FY2007. A review of the development of the Phase III water quality appendix to the Klamath Network Vital Signs Monitoring Plan, titled "Supplemental Plan for Water Quality and Aquatic Community Monitoring," and the goals and objectives of the plan were presented to the Network Board of Directors and Resource Chiefs by USGS scientist Robert Hoffman at the annual Board of Directors Meeting. Network parks' resource staff was enlisted to help refine the sampling frames and target populations for the freshwater ecosystems to be monitored as part of the plan. A draft Supplemental Plan for Water Quality and Aquatic Community Monitoring was completed and sent out for peer review. A revised draft plan was completed based on the peer review comments and suggestions of the previous draft plan and the results of a plan strategy meeting attended by Network and park staff, a statistician working with the Network, and one representative from WRD.

Mediterranean Coast Network (MEDN)

In FY 2007 the Network received $74,200 from WRD to support its water quality monitoring program. The majority of these funds supported a Network Technician conducting amphibian monitoring in the streams of SAMO, with the rest being spent on cooperative agreements, monitoring, equipment, and travel. Water quality data from streams in the SAMO collected by local stakeholders were reviewed and analyzed to evaluate analytical methods and investigate issues related to power and required sample sizes to detect changes of a magnitude of concern. A draft protocol for monitoring surfacewaters in SAMO had been reviewed by NPS WRD staff and is undergoing revision prior to full peer review. Baseline water quality sampling and field sampling procedures are being conducted in SAMO to evaluate the sampling regimen proposed in the draft protocol. Data on stream morphology at sampling sites was collected to evaluate the dynamics of the changing morphology of the streams in the Santa Monica Mountains. Baseline inter-tidal marine water quality was conducted twice at CABR in FY2007. Data gathered will be used in the development of the marine water monitoring protocol for CABR and CHIS.

Mid-Atlantic Network (MIDN)

MIDN received $43,000 in FY2007. The Network continued working through a Cooperative Agreement with the Department of Environmental Sciences, University of Virginia, to develop a water quality monitoring plan. As part of the Phase 3 report, the cooperators initiated water quality protocol development for the Network. In addition, MIDN received a one time allotment of year-end funding ($36,000) to support water quality protocol development.

The Cooperative Agreement was established to develop monitoring objectives that will address Network water quality and quantity issues; define parameters to be measured; develop specific statistical sampling objectives for the water quality and quantity monitoring protocol; review and evaluate existing water quality monitoring programs and

protocols; highlight ways to build upon and integrate with established programs; conduct appropriate data and cost analyses/simulations to assist the development and/or revision of the monitoring design and sampling objectives; design the sampling network, monitoring strategy, routine data analysis procedures, and other elements; work with MIDN to ensure that the water quality and quantity monitoring design and protocol is sufficiently rigorous and cost effective to meet stated program objectives; develop specific standard operating procedures for the water quality and quantity protocol; and develop a full protocol and standard operating procedures. In addition, the cooperative agreement was established to evaluate the range of water quality monitoring probes and develop recommendations for use by the Network. During 2007, the probe scoping was completed and equipment ordered.

Mojave Network (MOJN)

FY2007 funds totaled $78,100, which was used to fund a task agreement with Dr. Christopher Caudill of the University of Idaho to refine objectives for ground-water and surface-water vital signs, write Protocol Development Summaries, and develop a protocol to monitor water related vital signs. This section overlaps with efforts to integrate groundwater and surface-water vital sign protocol development with water quality monitoring. Dr. Caudill met with park staff from DEVA, GRBA, JOTR, LAME, MOJA, and PARA to discuss park concerns and issues related to groundwater and surfacewater. Dr. Caudill developed and presented a framework for addressing water related vital signs to park staff and the Water Resources Working Group at the MOJN Science Day; the Working Group provided feedback on the Network funded task agreement with Caudill for FY2008 testing and refinement of protocol.

National Capital Region Network (NCRN)

The network received $69,300 in FY 2007. Monthly stream monitoring was continued at all sites, and two new monitoring sites were added at PRWI. Drought conditions throughout the NCRN made monitoring a challenge as many streams approached zero flow. Analysis of the FY 2006 data showed that most streams in the NCRN were in poor condition with high levels of phosphorous being a primary pollutant. In addition, staff continued with planning for new sites, seasonal habitat assessments, periodic stream channel measurements, and pilot-testing new equipment.

North Coast and Cascades Network (NCCN)

The NCCN received $80,000 from WRD for water quality monitoring. The Network's primary focus in 2007 was on protocol development and implementation for the five aquatic vital signs: mountain lakes and ponds, large lowland lakes, wadeable streams, large rivers, and intertidal and marine waters. Protocols are mostly complete for monitoring lake and pond water quality and biological integrity at NOCA, MORA, and OLYM. In addition, the NCCN completed testing field methods for water chemistry, temperature, chlorophyll-a, fish, amphibians, zooplankton, watershed characteristics, shoreline habitat, and large woody debris in 23 lakes at NOCA and MORA: five reference lakes at OLYM were sampled. For large lowland lakes, the draft Large Lakes Monitoring Protocol went through technical peer review by academic scientists and WRD. The draft protocol was accepted with moderate revisions requested. Monthly water quality sampling consistent with the draft protocol standard operating procedures was conducted for Lake Crescent (OLYM). This sampling included physical/chemical profiles of the water column at five permanent stations in the lake, in addition to zooplankton and chlorophyll-a sampling.

Protocol development was finalized for two of the major intertidal protocol components, sandy beach monitoring and intertidal temperature. Seven sandy beaches were sampled,

nine sites were monitored continuously for intertidal water temperature, and 28 coastal sites were monitored for shoreline change in collaboration Dr. Rob Young, Western Carolina University. Protocol development also occurred for rocky platform monitoring, and rocky platform methods were adopted from the Partnership for the Interdisciplinary Study of Coastal Oceans.

Northeast Coastal and Barrier Network (NCBN)

In FY2007 the Network received $87,900 for water quality monitoring activities. Through a cooperative agreement with investigator Scott Nixon from the University of Rhode Island (URI), an extension of the Nitrogen Loading Model (NLM-E) was completed using the most accurate and recent land use data (1992) for Network parks. This model was run for each park, including a 30-year historical analysis for ASIS with data ranging from 1980-2000. The cooperators submitted a draft final report to NCBN staff for review in FY2005. Comments were provided to the cooperators by Network staff and potential peer reviewers contacted, but URI cooperator Scott Nixon and staff have yet to complete the final report incorporating comments.

USGS cooperators submitted their reply to peer review comments on the Network's nutrient enrichment protocol. The final draft of the protocol was submitted to the Network in August 2007. Currently the document is being formatted for publication in the National Natural Resource technical reporting series. Through a cooperative agreement with the Seagrass Ecology Lab at SUNY Stony Brook, the Network's estuarine nutrient monitoring protocol was implemented at FIIS. The Network hired a bio-technician, in cooperation with CACO, to assist in their water quality lab. Water samples collected at other Network parks (GATE, ASIS and FIIS) are analyzed in the CACO lab.

Northeast Temperate Network (NETN)

WRD transferred $58,600 to the NETN in FY2007 to conduct its water quality monitoring program. Due to the emphasis placed on water resources by NETN, this amount paid for approximately half of the lake and stream monitoring performed, with the remaining money coming from Vital Signs funds. Lake and stream monitoring is one of three core monitoring protocols in its second year of implementation. Field monitoring highlights included the monthly (May-October) collection of stream and lake monitoring data from 11 stream and 11 lake sites at ACAD and stream (22) and pond (3) monitoring data at most NETN parks, with nutrient samples collected and analyzed twice. Pilot wetland monitoring sites were also established and monitored in ACAD and SARA to test draft wetland monitoring methods.

Other water quality FY2007 highlights include the approval of the NETN Water Quality Protocol by the Regional I & M Coordinator, completion of the NETN Freshwater Wetland Protocol in draft form, the initiation of the Rocky Intertidal Protocol Project, and the development of a Water Quality database for lake and stream data. In addition, the NETN maintained a source of continuous record stream flow data from the Otter Creek gage, which may be viewed near real-time at the USGS NWIS web site. The launch of the Appalachian Trail MEGA-Transect includes a water sampling initiative as an example of one form that the wide-ranging participant cooperation may take.

Northern Colorado Plateau Network (NCPN)

The Network water quality monitoring program was funded with $105,400 by the WRD. The protocol development focus in FY2007 was that for large rivers so as to capitalize on existing work being conducted by the USGS and universities working in DINO and BLCA. FY2007 was also the third and final year of an agreement with Dr. Anne Brasher, USGS-WRD, to test monitoring methods for

aquatic invertebrates. Water quality monitoring continued at existing sites in 10 of the 16 network parks and an agreement was continued with the USGS to provide support to the NCPN hydrologist and to conduct water quality monitoring at two sites in DINO. The highly beneficial partnership with the Utah Department of Environmental Quality to perform lab analyses on samples in exchange for monitoring data was also continued.

Information transfer to park management occurred via the completion of a water quality brief and the Network Hydrologist greatly facilitated transfer of documents and information exchange among all NPS networks and water quality monitoring staff through the development of an I&M web page in conjunction with WRD. The network continued to enhance its legacy NCPN Water Quality Database to improve its functionality, usability, and robustness for long-term storage and access of data. Legacy lab data was also loaded to this database for several monitoring sites in Utah. The analysis of the legacy water quality data uncovered an unknown source of total phosphorous contamination in the Green River between DINO and CANY near the town of Jensen, UT.

A major achievement was the increased level of protection obtained under the Clean Water Act gained for the Virgin River and its tributaries as a result of data collected by the Network. The network in conjunction with the SCPN and the USGS also documented an unexpected large diversity of macroinvertebrates through two years of pilot monitoring in diverse stream habitats across the Colorado Plateau.

Northern Great Plains Network (NGPN)

In FY2007, the Network received $81,900 from WRD for its water quality monitoring program. Most of these funds went into salary for the Network Coordinator and to purchase data-sondes to collect basic water quality parameters. A draft Water Quality Monitoring Plan (version 1) was received from Dr. Troelstrup of South Dakota State University in December 2006. The plan included estimated field, lab, and salary costs and summarized historical background information on water resources in the 13 Network parks and a summary of the park baseline surveys. A general list of monitoring objectives and a sampling design using the EMAP Western Pilot protocols sampling design were suggested in the report for rivers and streams. Based on this information, the Network Coordinator drafted a second version of the Network Water Quality Monitoring Plan. The Network Coordinator also assisted AGFO, DETO, and WICA with their deployment of ground-water level monitoring probes.

Pacific Island Network (PACN)

In FY2007 the Network received $147,400 from WRD to support its water quality monitoring program, with most of the funding going to support a full time water professional to oversee the program and a cooperative agreement with USGS. The USGS-WRD Pacific Island Water Science Center completed water quality data summarization, a water resources report, and database for the PACN. A final report of US EPA EMAP/NCA samples collected in FY2004 at NPSA and the territorial waters of American Samoa was completed in February 2007 and reviewed by the PACN. The aquatic ecologist collected additional information to extend the current knowledge of existing water quality programs relevant to PACN. Field testing of monitoring strategies and resource condition assessments was conducted in PACN parks for freshwater animal communities, water quality, benthic marine, and marine fish, including water quality testing for HALE in partnership with the Hawaii Department of Health. The Water Quality Protocol and Database with power analyses of current PACN park data was completed and submitted to peer review in February: comments were received in September. The Benthic Marine

Protocol was revised after peer review and approved in September. The Freshwater Animal Communities Vital Sign was split into an anchialine pool protocol and a freshwater stream protocol. A biological technician was hired for aquatic related protocol field work, and the Hawaii Volcanoes coral reef scientist was reassigned to the I&M program to provide review and planning support for the marine-related protocols and serve as a liaison with academic and research scientists for the Network.

Rocky Mountain Network (ROMN)

The Rocky Mountain Network received $59,500 in FY2007 from WRD. This funding was used to initiate a significant pilot monitoring effort in GLAC for Stream Ecological Integrity (SEI) and the development of wetland ecological integrity (WEI) protocols in 2007. The SEI is an integrated, probabilistic based survey design protocol that includes aspects of high priority ROMN Vital Signs "Water Chemistry," "Surface Water Dynamics," "Freshwater Communities," etc. to be monitored in all Network parks. ROMN has been a leader among all networks in applying such a monitoring approach.

Highlights of ROMN Water Quality work in FY2007 include the hosting of a Stream Protocol development workshop in Lakewood, CO, February 20-21, 2007, that involved 39 representatives from Federal, state, local and other stakeholders. Network staff also presented the monitoring stream protocol and design at the George Wright Society meeting, and at a meeting of state and Federal water resource managers in Missoula, MT. ROMN staff also assisted in the development of a long term monitoring plan for the Flathead River Basin in Montana to support the securing of monitoring funding where major mineral development is planned in the British Columbia portion of the drainage.

Major fieldwork involved the implementation of a pilot SEI monitoring program in the North Fork of the Flathead River at GLAC. At each site, samples were taken for benthos, periphyton, and water quality (36 measured parameters). Detailed longitudinal and cross section in situ physiochemistry data (five core WQ parameters), along with quantitative instantaneous discharge measurements, were also collected at each site. To complement this major milestone in the implementation and testing of a survey site design and data set development, similar data was collected at four gradient sites and five sentinel stream sites. Lessons learned from this pilot program will be the basis for implementing network-wide SEI for streams in the remaining parks and in finalizing the SEI protocol for wadeable streams. In 2008, protocol development and survey design methods for non-wadeable streams is planned along with continuation of the pilot work in GLAC.

San Francisco Bay Area Network (SFAN)

In FY2007 the Network received $68,300 from WRD to support its water quality monitoring program, $54,620 of which went into the salary for a full time water professional who oversaw all water quality work. The rest of the funding was spent on laboratory contracts for water quality testing, equipment and supplies, meetings and training, vehicle expense, and travel. The Freshwater Quality Monitoring Protocol was finalized after extensive peer review and is now considered by NPS national coordinators to be a model that might be followed by other networks. Monthly water quality sampling was conducted at 26 sites throughout the Network, including PORE, GOGA, JOMU, and PINN. A new bacteria analysis lab at the Pacific Coast Science and Learning Center was started to improve quality and efficiency of our monitoring. The lab also increases opportunities for collaboration with partner organizations (e.g., Tomales Bay Watershed Council) and is a great educational tool for school groups who come to PORE to conduct scientific inquiry lessons.

Sierra Nevada Network (SIEN)

The Network received $61,500 in water quality funds from WRD in FY2007. These funds were primarily used for salary, travel, equipment/supplies, and other support costs for the Network's term Physical Scientist, who is coordinating the Network's water resources monitoring planning and protocol development. The first draft of the Sierra Nevada Network Lake Monitoring Protocol was completed. Protocol development was led by SIEN Physical Scientist Andi Heard in collaboration with park staff, USFS cooperators monitoring lakes in National Forest lands, USGS hydrologists, State of California Department of Water Resources scientists, university cooperators, and a private contractor, who did database development. Sample design, power analysis, and data analysis approaches were developed with University of Idaho cooperators. A University of California-Riverside cooperator recommended analytical methods, measurement quality objectives, Quality Assurance/Quality Control methods, drafted the Quality Assurance Project Plan, and reviewed the protocol. While the water chemistry objectives of the lake protocol determined the overall sample design, the water and amphibian work groups successfully developed a strategy to co-locate some amphibian monitoring with lake chemistry monitoring. The protocol was submitted to both Dr. James Sickman and Barry Long for internal review in October 2007.

In addition, the SIEN Physical Scientist coordinated a data sharing strategy with the California Department of Water Resources and with the California Surface Water Ambient Monitoring Program. A contract was established with Dr. Rosamonde Cook to adapt the Network's database so it may be used by SIEN. Primary adaptations are incorporating metadata included in NPSTORET and the ability to store continuous streamflow data. The adaptation of this database will greatly facilitate the Network's ability to share water resources monitoring data with the State of California.

Sonoran Desert Network (SODN)

The Network received $62,500 in FY2007. A draft SODN Seeps and Springs Monitoring Protocol was developed for high-priority seeps and springs in the Network. Pilot work was conducted for Apache Springs, Shake Springs, Cave Canyon, and Shay Springs (FOBO, CHIR, TONT, and TUZI, respectively). Pressure transducer systems were established in spring boxes (at the first two locations) and in a piezometer in the third. The sampling design was modified in FY2007 to include two stage sampling: a small number of high priority springs and seeps will be monitored on a quarterly basis as before, whereas lower priority and more dispersed springs and seeps will be sampled on a rotating basis using a subset of measures.

South Florida/Caribbean Network (SFCN)

In FY2007, the Network received $143.500 from WRD to support its water quality monitoring program, $107,700 of which went into 1) the salary for a full time aquatic ecologist, who oversaw water quality work and indicator protocol development, and 2) part of the salary for a fisheries biologist. Smaller amounts of the funding were spent on a data manager salary (for water quality aspects), logistical support, and monitoring equipment. A reef temperature monitoring protocol was developed. Reef water temperature is a critical parameter because coral reef ecosystems are very sensitive to extreme temperatures and reef water temperature has been found to be a critical covariate when trying to analyze the long-term coral reef monitoring results. There are now 11 sites with long term water temperature monitoring occurring at reef depth, including existing sites at VIIS and new sites at BUIS, BISC and DRTO. To help document quality assurance data comparability, samples were sent to two labs. Network water quality staff is continuing to assess the meaning of past water quality data by working cooperatively with other experts,

developing watershed assessment reports for DRTO, BISC, and VIIS.

Southeast Alaska Network (SEAN)

WRD supported the Network's water quality monitoring with $41,000 for FY2007. With these funds, the Network initiated a CESU agreement to complete for all applicable SEAN parks: Protocol Development Summaries for freshwater quality monitoring and the field data collection portion of a contaminants assessment of freshwater resources and intertidal resources. The analysis of and reporting on the latter is to be completed in FY2008. The Network also received a final report, completed under a CESU agreement, which recommended actions for the development of the water quality component of the monitoring program. That report summarizes the water quality data, identifies data gaps, and presents recommendations for developing a fully integrated water quality monitoring plan. The Network initiated a CESU agreement to secure technical assistance related to freshwater 1) water quality, 2) contaminants, 3) benthic macroinvertebrates and algae, and 4) surface-water dynamics. The Network also initiated two additional agreements to deliver a baseline water quality assessment, technical assistance on protocol development, and selection of appropriate long term protocols. SEAN also partnered with University of Alaska-Fairbanks to collect essential baseline contaminants data for all three network parks. The network participated in studies to assess the health and disease status of harbor seals using the contaminant loads observed in this upper-trophic predator (which will be the first systematic study of the recent population decline).

In FY2008, SEAN expects to complete an integrated water quality monitoring plan component in conjunction with delivery to I&M of its Phase III Report. The network has also made arrangements with the Borough of Sitka and ADF&G to provide continuous flow record in support of water quality and quantity monitoring on the Indian River.

Southeast Coast Network (SECN)

In FY2007 the Network received $118,100 from WRD to support its water quality monitoring program. The network implemented fixed-station water quality monitoring at CAHA, CALO, FOPU, CUIS, TIMU, CANA, and CONG in collaboration with multiple park, state, non-governmental organizations, and Federal agency partners. Monitoring equipment, including data sondes for fixed site monitoring, was purchased. Monitoring of marine sediment and water quality at FOPU and CUIS was completed using a probabilistic survey design in partnership with the University of Georgia and USEPA. Network staff assisted in the completion of a Watershed Condition Assessment for MOCR. The University of Georgia continued developing stream flow discharge protocols and SOPs with water quality funding. Several amphibian species were sampled in SECN parks for the presence of a Chytrid fungus, a pathogen suspected to be related to large-scale amphibian population declines. The pathogen was detected for the first time in Southern Two-lined Salamander, a common species in rocky streams, at HOBE. As monitoring continues, the known presence of this pathogen may help aid our understanding of amphibian population fluctuations.

Southern Colorado Plateau Network (SCPN)

In FY2007, the Network received $121,000 in funding from WRD. The SCPN Water Quality Monitoring Program is fully integrated with the design and implementation of the Network-based Vital Signs Program. The Vital Signs Monitoring Plan, completed in October 2006, is a single, integrated monitoring plan that incorporates riparian vital signs, aquatic macroinvertebrates, and water quality components; both pristine sites and sites with known water quality impairments are included. During FY2006-2007 the SCPN conducted a baseline survey of streamflow

and water quality in the Rito de los Frijoles at BAND. The objectives of the survey were to document status of hydrologic characteristics of the stream, describe spatial and temporal variability in streamflow and water quality, and contribute to an improved understanding of surface-water/ground-water relationships at the park. To achieve these objectives, a set of basic hydrologic measurements (discharge, temperature, pH, conductivity, dissolved oxygen, and turbidity) was collected at approximately six week intervals at ten locations distributed throughout the perennial reach of the stream. The SCPN Hydrologist will complete the Network Water Quality Monitoring Plan and Protocols and develop the QA/QC plan in 2008.

A comprehensive water quality database for SCPN parks was produced under an interagency agreement with USGS in FY2005. This database has proved to be a valuable tool for the Network in identifying water-quality issues and data gaps. A final USGS interpretive report summarizing data included in the database will be published early in FY2008. A rapid assessment of 44 springs at CACH was completed in 2007, including collection of water quality field parameters and biologic data. A report describing this effort will be delivered to the park early in FY2008. Collaborative work with NCPN and USGS scientists Drs. Mike Scott and Anne Brasher to develop riparian and aquatic macroinvertebrate protocols concluded in FY2007. Pilot reports of field trials for riparian and aquatic macroinvertebrate monitoring were completed by USGS. The macroinvertebrate field trials focused on comparing quantitative and qualitative sampling, and on collecting multiple samples within the reference period. Riparian field trials focused on evaluating the efficiency and effectiveness of various ecological measures and measurement techniques for riparian ecosystems.

Southern Plains Network (SOPN)

Network water quality monitoring funds for FY2007 totaled $28,300. Legacy water quality from park units was converted to usable format and incorporated into the master database. Also, Texas State University submitted a preliminary report containing recommendations for surface-water quality and quantity, and ground-water quantity protocols.

Southwest Alaska Network (SWAN)

The Network received $135,700 in FY2007. Water quality funding was spent on developing and testing protocols for water chemistry and lake fish monitoring, surface hydrology protocol testing with assistance from the USGS-WRD-Alaska, and salary and support of a Network Aquatic Ecologist.

One year of continuous water temperature monitoring was completed in 2007 for Lake Clark. This vertical temperature array will allow SWAN to monitor trends in ice cover formation and break-up and thermocline development, two processes that directly influence lake productivity. Water temperatures at the surface averaged 4.2 oC (maximum 13.0 oC, minimum 0 oC) between August 2006 and June 2007. Additional vertical temperature arrays will be deployed in other SWAN lakes in the future. Ten individuals each of seven species of fish from Lake Clark were analyzed for total mercury, arsenic, cadmium, chromium, lead, nickel, and selenium. A small subsample of individuals will be tested for dioxins, PCBs, and organochlorine compounds.

Discharge rating curves were developed for Naknek and Brooks Lakes in KATM and for Twin, Telaquana, and Crescent Lakes in LACL through an Interagency Agreement with the USGS-WRD. Rating curves will allow Network staff to estimate seasonal hydrographs for these lakes through the use of water level pressure transducers. Water quality monitoring (protocol currently under development), coupled with discharge estimates at lake tributaries and outlets, will allow nutrient and contaminant loadings to be calculated for SWAN lakes.

Upper Columbia Basin Network (UCBN)

The Network received $48,800 FY2007 funding from WRD for water quality monitoring. UCBN strives to fully integrate the water quality component with other Vital Signs monitoring so all components for the water quality monitoring plan appear in the Network Vital Signs Monitoring Plan, a major milestone completed in August 2007. UCBN, through a Cooperative Agreement with the University of Idaho, has obtained the expertise of research scientist Dr. Chris Caudill to develop a water quality monitoring protocol. The protocol will largely focus on data collected from macroinvertebrate sampling along with continuous monitoring measures of core water quality parameters from targeted locations (judgmental monitoring design) in the Network's nine parks to address specific monitoring questions. A draft water quality monitoring protocol has been completed and is in the peer review stage going into FY2008.

Plans for FY2008 include the continuation of the funding of a Task Agreement with Dr. Caudill to complete the water quality monitoring protocol and its full integration with other Vital Signs protocols, the development of an Access database for storing water quality monitoring data, QA/QC of new and any existing data collected to date, and its upload to the National STORET database.

APPENDIX D

PRESENTATIONS/PUBLICATIONS/ AWARDS

PRESENTATIONS

Albright, J.S. 2007. NPS Watershed Condition Assessment Program – Assessing Natural Resource Conditions in I&M Parks. George Wright Society Biennial Conference on Parks, Protected Areas and Cultural Sites, St. Paul, MN. April 16-20, 2007.

Back, J. 2007. PowerPoint presentation: Updated report of Amargosa Valley Hydrographic Basin 230 ground-water conditions. Presented September 5, 2007, Nevada State Engineer hearing, Carson City, NV, in support of National Park Service Protests of Amargosa Desert Hydrographic Basin 230 Change Applications 69836, 69837, 70383, 72012, 72095, 72239, 72962, 73862, 73501, 74307,74308, 74531, 74532, 74533, 74534 and 74535. National Park Service, Fort Collins, CO

Back, J. 2007. PowerPoint presentation: Antelope Spring Discharge and Water Levels in the Arbuckle Simpson Aquifer. In the matter of the Application No. 2006-601 of Meridian Aggregates Company, a Limited Liability Partnership, for a Permit to Use Groundwater in Johnston County, OK. National Park Service, Fort Collins, CO.

Bower, M.R. 2007. PowerPoint presentation: Expert Witness Report: Summary of current hypotheses to explain the observed decline in the single wild population of Devils Hole pupfish. Presented September 5, 2007, Nevada State Engineer hearing, Carson City, NV, in support of National Park Service Protests of Amargosa Desert Hydrographic Basin 230 Change Applications 69836, 69837, 70383, 72012, 72095, 72239, 72962, 73862, 73501, 74307,74308, 74531, 74532, 74533, 74534 and 74535. National Park Service, Fort Collins, CO.

Cutillo, P. A. and W.P. Van Liew. 2007. Safe yield and water-rights protection, are they compatible? 2007 South Dakota Western Hydrology Conference Program and Abstracts, Rapid City, SD.

Cutillo, P.A., 2006. Comparison of analytical and numerical estimates of the response of a coastal aquifer system to decreasing recharge, Geological Society of America Abstracts with Programs, **38**(7): 158.

Cutillo, P.A., 2006. PowerPoint presentation: Potential Impacts to Wind Cave National Park with Regard to Applications No. 2580-2 & 2585-2. Submitted to South Dakota Water Management Board in the Matter of Future Use Water Permit Application No. 2580-2 and Water Permit Application No. 2585-2, Filed by the Southern Black Hills Water System, in Custer and Fall River Counties. National Park Service, Fort Collins, CO.

Cutillo, P.A., 2006. PowerPoint presentation: Potential Impacts to Wind Cave National Park with Regard to Applications No. 2580-2 & 2585-2. Presented November 30, 2006, South Dakota Water Management Board Administrative Hearing, Pierre, South Dakota, in the Matter of Future Use Water Permit Application No. 2580-2 and Water Permit Application No. 2585-2, Filed by the Southern Black Hills Water System, in Custer and Fall River Counties National Park Service, Fort Collins, CO.

Davis, G. November 1, 2006. Keynote address: Persistence and Special Places. Virgin Islands National Park 50th Anniversary Conference on Scientific Research, St. John, USVI.

Davis, G. February 8, 2007. Ocean Park Stewardship and "Vital Signs' Monitoring. Fisheries and Oceans Canada, Maurice Lamontagne Institute Conference, Mon Joli, Quebec, Canada.

Davis, G. March 20, 2007. Keynote address: A Strategy for Marine Protected Areas in the U. S. National Park System. Parks Canada Marine Strategy Workshop, Victoria, British Columbia, Canada.

Davis, G. May 3, 2007. Marine Protected Areas in the U. S. National Park System. Video Conferencia sobre Gestión de Parques Marinos y Costeros Embajada de Estados Unidos de América, Lauro Müller 1776, Montevideo, Uraguay.

Davis, G. June 26, 2007. Ecosystem Vital Signs Monitoring Design, Implementation, and Applications from Theory to Practice: A Case Study from the U. S. National Park System, Conservation Design at Protected Areas and Buffer Zones, University of Sao Paulo, Brazil.

Davis, G. April 17, 2007. Commission on Environmental Cooperation's North American Marine Protected Areas Network Update. George Wright Society Biennial Conference on Parks, Protected Areas and Cultural Sites, St. Paul, MN. April 16-20, 2007.

Fisk, T. T. 2007. PowerPoint presentation: Updated report of Amargosa Desert Hydrographic Basin 230 hydrogeology. Presented September 5, 2007, Nevada State Engineer hearing, Carson City, NV In support of National Park Service Protests of Amargosa Desert Hydrographic Basin 230 Change Applications 69836, 69837, 70383, 72012, 72095, 72239, 72962, 73862, 73501, 74307, 74308, 74531, 74532, 74533, 74534 and 74535. National Park Service, Fort Collins, CO.

Glase, J. and B. M. Lafrancois. 2007. Nonnative species in the Great Lakes. George Wright Society Biennial Conference on Parks, Protected Areas and Cultural Sites, St. Paul, MN. April 16-20, 2007.

Harrill, J.R., and M.S. Bedinger. 2007. Factors Controlling Ground-Water Level Fluctuations in Devils Hole, Death Valley National Park, Nevada. Annual Meeting of the American In-

stitute of Hydrology, Reno, NV, April 23, 2007.

Inglis, R.R. 2007. Watershed Condition Assessment Program. Poster presentation. George Wright Society Biennial Conference on Parks, Protected Areas and Cultural Sites, St. Paul, MN. April 16-20, 2007.

Irwin, R.J. and P.E. Penoyer. April 8, 2007. Water Quality Monitoring Highlights. George Wright Society Biennial Conference on Parks, Protected Areas and Cultural Sites, St. Paul, MN. April 16-20, 2007.

Keteles, K. 2007. Variation in Cd Bioavailability in the Buffalo National River Watershed. Rocky Mountain Chapter of the Society of Environmental Toxicology and Chemistry Annual Meeting.

Keteles, K. and C. McCreedy. 2007. A Collaborative Approach to Assessing Watershed Conditions in Coastal National Parks. George Wright Society Biennial Conference on Parks, Protected Areas and Cultural Sites, St. Paul, MN. April 16-20, 2007.

Lafrancois, B. M. 2007. The St. Croix: this river, this time. Presented as part of the Arcola Mills Concert-Lecture Series, August 18, 2007, Stillwater, MN.

Lafrancois, B. Moraska, L. Triplett, J. Sieracki, B. Karns, D. Francis, and C. Stewart. 2006. Oxygen Depletion in Lake St. Croix: Modern and Paleolimnological Insights. 17th Annual St. Croix River Research Rendezvous. Marine on St. Croix, MN, October 16, 2006.

Larsen, A. 2007. Understanding a dynamic system: monitoring distribution and limnology of shallow lakes in interior Alaska. Northern Latitude Lake Change Workshop.

Lawrence, J.E. and G.M. Hornberger. 2006. Soil Moisture Variability and Critical Moisture Levels at Big Meadows, Shenandoah National Park, VA. Poster Presentation. Fall meeting of the American Geophysical Union, San Francisco, CA.

Long, J. 2007. History of fisheries management in the Chattahoochee River. 4th International Reservoir Symposium, the Reservoir Committee, Southern Division American Fisheries Society.

Lord, E.H., 2007. PowerPoint presentation: Water rights: Amargosa Desert Hydrographic Basin (230). Presented September 5, 2007, Nevada State Engineer hearing, Carson City, NV For water rights hearing on change applications 69836, 69837, 70383, 72012, 72095, 72239, 72962, 73862, 73501, 74307,74308, 74531, 74532, 74533, 74534 and 74535. National Park Service, Fort Collins, CO.

McCreedy, C. 2007. Session Chair, Dealing with Marine Recreational Impacts: We're all in the Same Boat. George Wright Society Biennial Conference on Parks, Protected Areas and Cultural Sites, St. Paul, MN. April 16-20, 2007.

McCreedy, C. 2007. Session Chair, Marine and Coastal Resources. George Wright Society Biennial Conference on Parks, Protected Areas and Cultural Sites, St. Paul, MN. April 16-20, 2007.

McCreedy, C. 2007. Marine Education: Charting a Course for Stewardship. George Wright Society Biennial Conference on Parks, Protected Areas and Cultural Sites, St. Paul, MN. April 16-20, 2007.

Rafferty, P. 2006. Collaborative Ecosystem Restoration at Jamaica Bay Marsh Islands. 82nd Meeting of the Coastal Engineering Research Board, Long Branch, NJ, October 11-13, 2006.

Rafferty, P. 2006. Jamaica Bay Marsh Islands Ecosystem Restoration Monitoring Program. Jamaica Bay: Plight and Promise: A sharing of research perspectives, Brooklyn College

Campus, October 29, 2006.

Rafferty, P. 2007. Understanding Marsh Loss and Restoration in Jamaica Bay. Herbert Johnson Lecture Series, Jamaica Bay Wildlife Refuge, Gateway National Recreation Area, March 7, 2007.

Rafferty, P. 2007. Marsh Loss and Restoration in Jamaica Bay. Estuarine Biology 575 course, Brooklyn College, May 17, 2007.

Rosenlieb, G.W. 2007. Overview of the Clean Water Act and the NPS Water Quality Vital Signs Monitoring Program. National Park Service Eastern Rivers Summit, Shepherdstown, WV. February 27 – March 1, 2007.

Smillie, G.M. 2007. Floodplain Management in the National Park Service. National Park Service Eastern Rivers Summit, Shepherdstown, WV. February 27 – March 1, 2007.

Tilmant, J.T. 2006. National Park Service Fisheries Management in Wilderness Backcountry Lakes. Web-cast Presentation. Wilderness Lakes Management Session, National Conservation Training Center, Shepardstown, WV.

Tilmant, J.T. 2007. Addressing Recreational Fisheries in Marine Parks through Interagency Cooperative Fishery Management Plans. George Wright Society Biennial Conference on Parks, Protected Areas and Cultural Sites, St. Paul, MN. April 16-20, 2007.

Tilmant, J.T. 2007. Introduced and Invasive Aquatic Species: A Problem of Increasing Magnitude within the National Park System. George Wright Society Biennial Conference on Parks, Protected Areas and Cultural Sites, St. Paul, MN. April 16-20, 2007.

Wagner, J.I. 2007. Director's Order 77-1 and Section 404 of the Clean Water Act: Tools for Protecting Wetlands. National Park Service Eastern Rivers Summit, Shepherdstown, WV. February 27 – March 1, 2007.

Vana-Miller, D. L. and D. P. Weeks. 2007. Management and Planning of Fluvial Resources: The "New" NPS Water Resources Planning Program. Poster Presentation. National Park Service Eastern Rivers Summit, Shepherdstown, WV. February 27 – March 1, 2007.

Weeks, D. P. and D. Vana-Miller. 2007. The New Water Resources Planning Program. Poster Presentation. George Wright Society Biennial Conference on Parks, Protected Areas and Cultural Sites, St. Paul, MN. April 16-20, 2007.

PUBLICATIONS

Ault, J.S., S.G. Smith, and J.T. Tilmant. 2007. Fishery Management Analysis for Reef Fish in Biscayne National Park: Bag and Size Limit Alternatives. University of Miami, Rosenstiel School of Marine and Atmospheric Sciences, Miami, FL.

Back, J. 2007. Expert Witness Report: Updated report of Amargosa Valley Hydrographic Basin 230 ground-water conditions. Submitted to Nevada State Engineer in support of National Park Service Protests of Amargosa Desert Hydrographic Basin 230 Change Applications 69836, 69837, 70383, 72012, 72095, 72239, 72962, 73862, 73501, 74307, 74308, 74531, 74532, 74533, 74534 and 74535. National Park Service, Fort Collins, CO.

Back, J. 2007. Expert Witness Report: Antelope Spring Discharge and Water Levels in the Arbuckle Simpson Aquifer. Submitted to Oklahoma Water Resources Board in the Matter of the Application No. 2006-601 of Meridian Aggregates Company, a Limited Liability Partnership, for a Permit to Use Groundwater in Johnston County, OK. National Park Service, Fort Collins, CO.

Beschta, R.L. and W.L. Jackson. 2008. Forest

practices and sediment production in the Alsea Watershed Study. Chapter 4 in J. Stednick, editor. Hydrological and Biological Responses to Forest Practices: The Alsea Watershed Study : Ecological Studies 199. Springer Publishers, New York, NY.

Beschta, R.L. and W.L. Jackson. 2008. Sedimentation studies following the Alsea Watershed Study. Chapter 12 in J. Stednick, editor. Hydrological and Biological Responses to Forest Practices: The Alsea Watershed Study : Ecological Studies 199. Springer Publishers, New York, NY, Ecological Studies 199.

Bills, D.J., M.E. Flynn, and S.A. Monroe. 2007. Hydrogeology of the Coconino Plateau and Adjacent Areas, Coconino and Yavapai Counties, Arizona; US Geological Survey Scientific Investigations Report 2005-5222.

Borgeld, J.C., G. Crawford, S.F. Craig, E. D. Morris, B. David, D.G. Anderson, C. McGary, and V. Ozaki. 2007. Assessment of Coastal and Marine Resources and Watershed Conditions at Redwood National and State Parks (California). Natural Resource Technical Report NPS/NRWRD/NRTR-2007/368. National Park Service, Fort Collins, CO.

Bower, M.R. 2007. Efforts to understand and recover the Devils Hole pupfish after a decade of population of decline. State Engineer in support of National Park Service Protests of Amargosa Desert Hydrographic Basin 230 Change Applications 69836, 69837, 70383, 72012, 72095, 72239, 72962, 73862, 73501, 74307,74308, 74531, 74532, 74533, 74534 and 74535. National Park Service, Fort Collins, CO.

Brenkman, S.J. and S.C. Corbett. 2007. Use of Otolith Chemistry and Radiotelemetry to Determine Age-Specific Migratory Patterns of Anadromous Bull Trout in the Hoh River, Washington. Transactions of the American Fisheries Society 136:1-11.

Briggs, M. 2007. Quantifying instream flow required to maintain middle Rincon Creek's bottomland plant communities and pool system, studies in support of an application for permit to appropriate public water of Arizona, instream-flow maintenance, middle reach of Rincon Creek, Saguaro National Park.

Cadol, D.D. 2007. Aerial Photographic Analysis of Channel Change and Riparian Vegetation Establishment in Canyon de Chelly National Monument, AZ, 1935-2004. Masters Thesis, Department of Geosciences, Colorado State University, Ft. Collins, CO.

Chaney, S. 2006. Witness Statement: Summary of Opinions to be Expressed at Trial, Basis Therefore, and Data and Information Considered: in support of National Park Service water right claim, Case No. 2004CW35, prepared for District Court, Water Division No. 3, Colorado, Alamosa County Courthouse, Alamosa, Colorado: Great Sand Dunes National Park and Preserve, Alamosa, CO.

Coache, R., editor. 2007. Regional Tour of the Carbonate System Guidebook: Nevada Water Resources Association.

Coleman, M.A. and K.D. Fausch. 2007. Cold Summer Temperature Regimes Cause a Recruitment Bottleneck in Age-0 Colorado River Cutthroat Trout Reared in Laboratory Streams. Transactions of the American Fisheries Society **136**:639-654.

Coleman, M.A. and K.D. Fausch. 2007. Cold Summer Temperature Limits Recruitment of Age-0 Cutthroat Trout in High-Elevation Colorado Streams. Transactions of the American Fisheries Society **136**:1231-1244.

Cooper, D.J. 2006. Witness Statement: Summary of Opinions to be Expressed at Trial, Basis Therefore, and Data and Information Considered: in support of National Park Service water right claim, Case No. 2004CW35, prepared for District Court, Water Division

No. 3, Colorado, Alamosa County Courthouse, Alamosa, Colorado: Colorado State University, Fort Collins, CO.

Crosby, B.J., J.R. Webb, J.N. Galloway, and F.A. Deviney. 2006. Acid Deposition Impacts on Natural Resources in Shenandoah National Park. Natural Resource Technical Report NPS/NER/NRTR-2006/066. National Park Service, Philadelphia, PA.

Culhane, T. and L. Martin 2000. Geochemical Investigation of Source of Saline Groundwater at Springs Associated with Puccinellia howellii Habitat, Whiskeytown National Recreation Area, Shasta County, California. Natural Resource Technical Report NPS/NRPC/WRD/NRTR-2007/375.

Cutillo, P.A., 2007. Expert Witness Report: Potential hydrologic impacts due to proposed ground-water withdrawals. Submitted to Oklahoma Water Resources Board in the Matter of the Application No. 2006-601 of Meridian Aggregates Company, a Limited Liability Partnership, for a Permit to Use Groundwater in Johnston County, Oklahoma. National Park Service, Fort Collins, CO.

Cutillo, P.A., 2007. Expert Witness Report: Report on predicted effects of change applications in the Amargosa Desert. Submitted to Nevada State Engineer in support of National Park Service Protests of Amargosa Desert Hydrographic Basin 230 Change Applications 69836, 69837, 70383, 72012, 72095, 72239, 72962, 73862, 73501, 74307, 74308, 74531, 74532, 74533, 74534 and 74535. National Park Service, Fort Collins, CO.

Cutillo, P.A. 2007. Potential hydrologic impacts due to proposed ground-water withdrawals. Submitted to Oklahoma Water Resources Board in the matter of the Application No. 2006-601 of Meridian Aggregates Company, a Limited Liability Partnership, for a Permit to Use Groundwater in Johnston County, Oklahoma. National Park Service, Fort Collins, CO.

Cutillo, P.A. 2007. Preliminary Drawdown Analysis in Regard to Application for Beneficial Water Use Permit No. 30025710-76LJ for Edward J. Langton. Submitted to Montana Department of Natural Resources and Conservation in the matter of Application No. 30025710-76LJ of Edward J. Langton for a permit for beneficial water use in Flathead County, Montana. National Park Service, Fort Collins, CO.

Cutillo, P.A. 2007. Preliminary Drawdown Analysis in Regard to Application for Beneficial Water Use Permit No. 76I-30026172 for Belton Mercantile. Submitted to Montana Department of Natural Resources and Conservation in the matter of Application No. 76I-30026172 of Belton Mercantile for a permit for beneficial water use in Flathead County, Montana. National Park Service, Fort Collins, CO.

Cutillo, P.A. 2007. Review of "Water Development Impacts for the Shores at Kohanaiki, Hawaii". Submitted to County of Hawaii in the matter of Special Management Area Use Permit No. 439, Condition of Approval 41, Filed by Rutter/KW Kohanaiki, LLC. National Park Service, Fort Collins, CO.

Cutillo, P.A., J. Bennett, and S. Braumiller. 2007. Overview Report - Groundwater management issues and the results of groundwater modeling for BIBE, RIGR and AMIS, including recommendations for protecting groundwater discharge to the Rio Grande and its major tributaries. National Park Service, Fort Collins, CO.

Dakin, E.E., B.A. Porter, B.J. Freeman, and J.M. Long. 2007. Genetic integrity of an isolated population of shoal bass (*Micropterus cataractae*) in the upper Chattahoochee River basin. Natural Resource Technical Report NPS/NRWRD/NRTR-2007/366. National Park Service, Fort Collins, CO.

Davis, G., C. Rogers, and C. McCreedy. National Parks and Caribbean Marine Reserves Research and Monitoring Workshop: St. John, U.S. Virgin Islands, July 11-13, 2006, Technical Report NPS/NRPC/WRD/NRTR-2007/015.

Engelhardt, K.A.M. and A.H. Elmore. 2007. Final Report to NPS: Should We Restore Dyke Marsh? – A Management Dilemma Facing George Washington Memorial Parkway. Appalachian Laboratory, U. of Maryland Center for Environmental Science, Frostburg, MD.

Fisk, T. T. 2007. Expert Witness Report: Updated report of Amargosa Desert Hydrographic Basin 230 hydrogeology. Submitted to Nevada State Engineer in support of National Park Service Protests of Amargosa Desert Hydrographic Basin 230 Change Applications 69836, 69837, 70383, 72012, 72095, 72239, 72962, 73862, 73501, 74307, 74308, 74531, 74532, 74533, 74534 and 74535. National Park Service, Fort Collins, CO.

Frohnauer, N.K., C.L. Pierce, and L. W. Kallemeyn. 2007. Population Dynamics and Angler Exploitation of the Uniwue Muskellunge Population in Shoepack Lake, Voyageurs National Park, Minnesota. North American Journal of Fisheries Management **27**:63-76.

Frohnauer, N.K., C.L. Pierce, and L. W. Kallemeyn. 2007. Simulated Effects of Recruitment Variability, Exploitation, and Reduced Habitat Area on the Muskellunge Population in Shoepack Lake, Voyageurs National Park, Minnesota. North American Journal of Fisheries Management **27**:77-88.

Gaiser, E.E., A. Zafiris, P.L. Ruiz, F.A.C. Tobias and M.S. Ross. 2006. Tracking Rates of Ecotone Migration Due to Salt-Water Encroachment Using Fossil Mollusks in Coastal South Florida. Hydrobiologia **569**:237–257.

Gerber, G. 2007. Investigators Annual Report for Reporting Year 2006, the Lower Gros Ventre River Water Rights and Water Budget Investigation, Grand Teton National Park, Wyoming. National Park Service, Fort Collins, CO.

Goforth, C.L. and D. Walker. 2007. Aquatic macroinvertebrates and their relationship to water availability and streamflow in middle Rincon Creek, Saguaro National Park East. National Park Service, Fort Collins, CO.

Haley & Aldrich, Inc. 2007. Hydrology of the middle reach of Rincon Creek, Pima County, Arizona. National Park Service, Fort Collins, CO.

Haley & Aldrich, Inc. 2007. Potential effects of groundwater withdrawals on the hydrogeologic system and water-related resources along the middle reach of Rincon Creek, Pima County, Arizona. National Park Service, Fort Collins, CO.

Harmon, E.J. 2006. Witness Statement: Summary of Opinions to be Expressed at Trial, Basis Therefore, and Data and Information Considered: in support of National Park Service water right claim, Case No. 2004CW35, prepared for District Court, Water Division No. 3, Colorado, Alamosa County Courthouse, Alamosa, Colorado: HRS Water Consultants, Inc., Denver, CO.

Harmon, E.J. and J.A. Schenk. 2006. Numerical Ground Water Model of Great Sand Dunes National Park and Preserve, Colorado: HRS Water Consultants, Inc., Denver, CO.

Hoover, D.J. and C. Gold. 2006. Assessment of Coastal Water Resources and Watershed Conditions at Pu'ukoholō Heiau National Historical Park (Hawaii). Technical Report NPS/NRWRD/NRTR-2006/359. National Park Service, Fort Collins, CO.

Hopfensperger, K.N., K.A.M. Engelhardt,

and S.W. Seagle. 2006. The Use of Case Studies in Establishing Feasibility for Wetland Restoration. Restoration Ecology 14(4): 578–586.

Hornberger, G.M. and J.E. Lawrence. 2007. Hydrology of Big Meadows, Shenandoah National Park, VA: Assessment of a Sensitive Wetland System in the Blue Ridge Mountains. Department of Environmental Sciences, University of Virginia, Charlottesville, VA.

Information Technology Experts, Inc. 2007. Bug fixes and recommendations for the Docket Project Processing Application technology update. Reports prepared for the National Park Service. Fort Collins, CO. Electronic files.

Johnson, R.H., E.H. DeWitt, L. Wirt, and L.R. Arnold. 2007. Draft. Identifying the source of groundwater to Montezuma Well, central Arizona. Open-File Report. US Geological Survey, Lakewood, CO.

Karle, K. F. 2007. Water Resources Stewardship Report, Denali National Park and Preserve. Natural Resource Technical Report NPS/NRPC/WRD/NRTR-2007/051. .National Park Service, Fort Collins, CO.

Keteles, K. and C. McCreedy. 2007. Assessing Coastal Watershed Conditions in the National Parks, National Coastal Condition Report, 2007. U.S. Environmental Protection Agency.

Kirby, S. 2007. Summary of Ground-Water Sampling in the Courthouse Wash Area, Grand County, Utah: Utah Geological Survey, Department of Natural Resources, Salt Lake City, UT.

Klinger, T., D. Fluharty, K. Evans, and C. Byron. 2006. Assessment of Coastal Water Resources and Watershed Conditions at San Juan Island National Historical Site (Washington). Technical Report NPS/NRWRD/NRTR-2006/360. National Park Service, Fort Collins, CO.

Klinger, T., D., C. Fluharty, K. Byron, K. Evans, and J. Coyle. 2007. Assessment of Coastal Water Resources and Watershed Conditions at Ebey's Landing National Historical Reserve (Washington). Technical Report NPS/NRWRD/NRTR-2007/369. National Park Service, Fort Collins, CO.

Klinger, T., R. Gregg, J. Kershner, J. Coyle, and D. Fluharty. 2007. Assessment of Coastal Water Resources and Watershed Conditions at Lewis and Clark National Historical Park. Technical Report NPS/NRWRD/NRTR-2007/055. National Park Service, Fort Collins, CO.

Kraft, G.J., C. Mechenich, D.J. Mechenich, and S.W. Szczytko. 2007. Assessment of Coastal Water Resources and Watershed Conditions at Apostle Islands National Seashore (Wisconsin). Natural Resource Technical Report NPS/NRWRD/NRTR-2007/367. National Park Service, Fort Collins, CO.

Kynard, B., M. Breece, M. Atcheson, M. Kieffer, and M. Mangold. 2007. Status of Shortnose sturgeon in the Potomac River; Part 1. - Field studies. USGS, Biological Resources Division, S.O. Conte Anadromous Fish Research Center, Turner Falls, MA.

Lafrancois, B.M., D.L. Vana-Miller, and S.P. Johnson. 2007. Water Resources Information and Issues Overview – Mississippi National River and Recreation Area. Natural Resource Technical Report NPS/NRWRD/NRTR-2007/364. National Park Service, Fort Collins, CO.

Larson, S.P. 2006. Witness Statement: Summary of Opinions to be Expressed at Trial, Basis Therefore, and Data and Information Considered: in support of National Park Service water right claim, Case No. 2004CW35, prepared for District Court, Water Division

No. 3, Colorado, Alamosa County Courthouse, Alamosa, Colorado: S.S. Papadopulos & Associates, Inc., Bethesda, MD.

Leonard, J.B.K. 2007. Stock coaster brook trout and examine interactions with exotic salmonids in stream habitats at Pictured Rocks. Northern Michigan University, Marquette, MI.

Livo, L.J. 2006. Witness Statement: Summary of Opinions to be Expressed at Trial, Basis Therefore, and Data and Information Considered: in support of National Park Service water right claim, Case No. 2004CW35, prepared for District Court, Water Division No. 3, Colorado, Alamosa County Courthouse, Alamosa, Colorado: University of Colorado, Boulder, CO.

Long, J.M. 2007. Assessment of the Melrose pond fisheries and recommendations for management: Natchez National Historical Park. Technical Assistance Report. National Park Service, Southeast Region, Atlanta, GA.

Long, J.M. and C.R. Martin. 2007. The evolution of fisheries management of the upper Chattahoochee River in response to changing water management. Fourth International Reservoir Symposium, Atlanta, GA. Abstract published.

Long, J.M., D. Lairson, C. Martin, and B. Couch. 2007. Evidence of rainbow trout spawning in small, warmwater tributaries of the Chattahoochee River. Proceedings of the 2007 Georgia Water Resources Conference, Paper 4.1.5.

Long, J.M., S. Reynolds, and R. Slade. 2007. Chattahoochee River National Recreation Area: a case study in NPS water resource issues. National Park Service Eastern Rivers Summit, Shepherdstown, WV. February 27 – March 1, 2007. Abstract published.

Lord, E.H. 2007. Witness Statement, In support of National Park Service Protests of Amargosa Desert Hydrographic Basin 230 Change Applications 69836, 69837, 70383, 72012, 72095, 72239, 72962, 73862, 73501, 74307,74308, 74531, 74532, 74533, 74534 and 74535. National Park Service, Fort Collins, CO.

Marston, R.A. and T. Halihan. 2007 Final Report: Geomorphic Adjustment of the Washita River, Washita Battlefield National Historic Site, Oklahoma. Department of Geography, Oklahoma State University, Stillwater, OK.

Martin, L. 2007. Summary of Spring Flow Decline and Local Hydrogeologic Studies, 1969-2007, Pipe Spring National Monument. Natural Resource Report NPS/NRPC/WRD/NRTR-2007/365. National Park Service, Fort Collins, CO.

Martin, L. 2007. Assessment of Potential Saltwater Encroachment in the Herring River Basin, Cape Cod National Seashore. Natural Resource Report NPS/NRPC/WRD/NRTR-2007/370. National Park Service, Fort Collins, CO.

Martin, L. 2007. Hydrogeology and Water Supply Wells, Lava Beds National Monument. Natural Resource Report NPS/NRPC/WRD/NRTR-2007/373. National Park Service, Fort Collins, CO.

Martin, L. 2007. Hydrogeology and Water Supply Wells, Catoctin Mountain Park. Natural Resource Report NPS/NRPC/WRD/NRTR-2007/374. National Park Service, Fort Collins, CO.

Martin, L. 2007. Hydrogeology and Potential Well Construction at Hurricane Ridge. National Park Service, Fort Collins, CO.

Mechenich, C., G.J. Kraft, S.W. Szczytko,and D.J. Mechenich. 2006. Assessment of Coastal Water Resources and Watershed Conditions at Pictured Rocks National Lakeshore.

Natural Resource Technical Report NPS/NRWRD/NRTR-2006/361. National Park Service, Fort Collins, CO.

Meeuwig, M.H. and C.S. Guy. 2007. Evaluation and Action Plan for Protection of 15 Threatened Adfluvial Populations of Bull Trout in Glacier National Park. USGS, Montana Cooperative Fishery Research Unit, Montana State University, Department of Ecology, Bozeman, MT.

Nagorski, S., G. Eckert, E. Hood, and S. Pyare. 2007. Assessment of Coastal Water Resources and Watershed Conditions at Aniakchak National Monument and Preserve (Alaska). Natural Resource Technical Report NPS/NRWRD/NRTR-2007/371. National Park Service, Fort Collins, CO.

Nagorski, S., G. Eckert, E. Hood, and S. Pyare. 2007. Assessment of Coastal Water Resources and Watershed Conditions at Katmai National Park and Preserve (Alaska). Natural Resource Technical Report NPS/NRWRD/NRTR-2007/372. National Park Service, Fort Collins, CO.

National Park Service. 2007. Final Report – Wild and Scenic Rivers: Charting the Course, Navigating the Next 40 Years of the Wild and Scenic Rivers Act, Recommendations of the Wild and Scenic Rivers Task Force to the National Leadership Council. National Park Service, Fort Collins, CO.

National Park Service. 2007. Groundwater levels record for Water Year 2006 for Station No. 343017096561501, East Observation Well, Chickasaw National Recreation Area. National Park Service, Fort Collins, CO.

National Park Service. 2007. Groundwater levels record for Water Year 2006 for Station No. 343022096565701, West Observation Well, Chickasaw National Recreation Area. National Park Service, Fort Collins, CO.

National Park Service. 2007. Streamflow records for Water Years 1989-1998, 2005 for Station No. 362727116401401, Texas Spring in Furnace Creek Wash, Death Valley National Park. National Park Service, Fort Collins, CO.

National Park Service. 2007. Streamflow records for Water Years 2002-2004 for Station No. 362532116172701, Devils Hole at Death Valley National Park. National Park Service, Fort Collins, CO.

National Park Service. 2007. Streamflow records for Water Years 2005-2006 for Station No. 320741110370001, Rincon Creek Well 3 Near Madrona Ranger Station. National Park Service, Fort Collins, CO.

National Park Service. 2007. Streamflow records for Water Years 2005-2006 for Station No. 320743110370001, Rincon Creek Well 2 Near Madrona Ranger Station. National Park Service, Fort Collins, CO.

National Park Service. 2007. Streamflow records for Water Years 2005-2006 for Station No. 320745110365701, Rincon Creek (Pool A) Near Madrona Ranger Station. National Park Service, Fort Collins, CO.

National Park Service. 2007. Streamflow records for Water Years 2005-2006 for Station No. 320745110370101, Rincon Creek Well 1 Near Madrona Ranger Station. National Park Service, Fort Collins, CO.

National Park Service. 2007. Survey Report for Rincon Creek Near Madrona Ranger Station. National Park Service, Fort Collins, CO.

Patterson, L. and D.J. Cooper. 2007. The Use of Hydrologic and Ecological Indicators for the Restoration of Drainage Ditches and Water Diversions in a Mountain Fen, Cascade Range, California. Wetlands, **27**(2): 290-304.

Perger, B. 2007. Rincon Creek water moni-

toring summary 2003-2006. National Park Service, Saguaro National Park, Tucson, AZ.

Prudic, D.E. 2006. Response to memorandum by Rowley and Dixon regarding US Geological Survey report titled "Characterization of surface-water resources in the Great Basin National Park area and their susceptibility to ground-water withdrawals in adjacent valleys, White Pine County, Nevada": US Geological Survey Open-File Report 2006-1342.

Scheirer, D.S., W.R. Page, and J.J. Miller. 2007. Geophysical studies based on gravity and seismic data of Tule Desert, Meadow Valley Wash, and California Wash basins, southern Nevada: US Geological Survey Open-File Report 2006-1396.

Schenk, J.A. 2006. Witness Statement: Summary of Opinions to be Expressed at Trial, Basis Therefore, and Data and Information Considered: in support of National Park Service water right claim, Case No. 2004CW35, prepared for District Court, Water Division No. 3, Colorado, Alamosa County Courthouse, Alamosa, Colorado: HRS Water Consultants, Inc., Denver, CO.

Stimmel, S.P. 2006. Migratory Activity of Two Strains of Brook Trout (Salvelinus fontinalis) in Pictured Rocks National Lakeshore Characterized Using Stationary RFID Systems. M.S. Thesis. Northern Michigan University, Marquette, MI.

Stitt, E.W. and D.E. Swann. 2006. Aquatic herpetofauna and surface water availability in Rincon Creek, Saguaro National Park, Pima County, Arizona. Draft report prepared for the National Park Service. Fort Collins, Colorado, USA.

Tessel, S., T. Lookingbill, K. Engelhardt A. Elmore, and J. Churchill. 2007. Enhanced Wetland Inventory for Harpers Ferry National Historical Park, Final Report. University of Maryland Center for Environmental Science Appalachian Laboratory, Frostburg, MD.

Tilmant, J., C. McCreedy, R. Beavers, G. Davis, and K. Keteles. 2007. Servicewide Marine Benthic Habitat Mapping Program Implementation Plan. NPS National Inventory and Monitoring Program.

Tilmant, J.T., G. Reed, J. Wullschleger, and D. Malget. 2007. A rapid biological assessment of fish populations within Virginia Kendall Reservoir, Cuyahoga Valley National Park. National Park Service, Fort Collins, CO.

Usrey, F.D. and J.A. Hinsey. 2006. Characterization of Macroinvertebrate Community and Drift in Tributary of Buffalo National River.

Vana-Miller, D.L. 2007. Ozark National Scenic Riverways Water Resources Foundation Report. Natural Resources Report NPS/NRWRD/NRR-2007/363. National Park Service. Fort Collins, CO.

Weeks, D., D. Vana-Miller, M. Norris, and A. Banasik. 2007. Water Resources Stewardship Report, Monocacy National Battlefield. Natural Resource Technical Report NPS/NRPC/WRD/NRTR-2007/048. National Park Service, Fort Collins, CO.

Whisenant, S. and X.B. Wu. 2007. Final Report to NPS: Developing Strategies for Restoration of Resaca Wetlands and Associated Wet Prairie Habitats at Palo Alto Battlefield National Historic Site. Department of Rangeland Ecology and Management, Texas A&M University, College Station, TX.

Wolfe, W.J., K.C. Fitch, and D.E. Ladd. 2007. Alluvial bars of the Obed Wild and Scenic River, Tennessee: US Geological Survey Scientific Investigations Map 2007–2972.

Wullschleger, J. and M. Bower. 2007. The Most Endangered Fish: a Report on the

Effort to Save the Devils Hole Pupfish. Published Abstract. The George Wright Society Biennial Conference on Parks, Protected Areas and Cultural Sites. April 16-20, 2007. St. Paul, MN.

Young, D. 2007. The spawning distribution of sockeye salmon in a glacially influenced watershed: the importance of glacial habitats. Transactions of the American Fisheries Society **136**(2): 452-459.

Young, D. 2007. Dynamic in-lake spawning migrations by female sockeye salmon. Ecology of Freshwater Fish **16**(2): 155-164.

AWARDS

Jennifer Back received a STAR award for sustained superior performance during 2006 fiscal year for contributions to the advancement of on-going water rights protection projects at Death Valley National Park and Chickasaw National Recreation Area, specifically for generating timely and highly important work products to support NPS in negotiations and hearings.

Jennifer Back received a non-monetary award for developing and presenting excellent testimony at the September 5, 2007, Nevada State Engineer hearing on the NPS protests of change applications in the Amargosa Desert on Devils Hole.

Paul Christensen received an On-the-Spot award for his outstanding project management in debugging and updating the Water Rights Branch's Docket Project Processing Application.

Paula Cutillo received a STAR award for sustained excellent performance in analyzing and developing ground-water model documents in support of water rights actions at Great Basin National Park and Wind Cave National Park and for significant contributions to the advancement of water rights protection efforts at Death Valley National Park, Chickasaw National Recreation Area, and Kaloko-Honokōhau National Historical Park throughout 2006 and first quarter 2007.

Paula Cutillo received a non-monetary award for developing and presenting excellent testimony at the September 5, 2007, Nevada State Engineer hearing on the NPS protests of change applications in the Amargosa Desert on Devils Hole.

Peter Fahmy received a non-monetary award for his role in the preparation and presentation of NPS' case-in-chief at the September 5, 2007, Nevada State Engineer hearing on the NPS protests of change applications in the Amargosa Desert on Devils Hole.

Bill Hansen received a STAR award recognizing his outstanding leadership enhancing river management through his efforts to plan the Eastern Rivers Summit and co-chair the NPS Wild and Scenic Rivers Task Force.

Eric Lord received a non-monetary award for developing and presenting excellent testimony at the September 5, 2007, Nevada State Engineer hearing on the NPS protests of change applications in the Amargosa Desert on Devils Hole.

Larry Martin received an Exceptional Performance Award for sustaining a level of performance that exceeded the requirements of his position as a Hydrogeologist.

Cliff McCreedy received a STAR Award for support to national level marine management issues, including the development and implementation of the NPS Ocean Park Stewardship Action Plan.

Dan McGlothlin received a non-monetary award for managing the development and presentation of testimony at the September 5, 2007, Nevada State Engineer hearing on the NPS protests of change applications in the

Amargosa Desert on Devils Hole.

James Long received a STAR Award and the Award for Outstanding Achievement in Water Laws, Policy, and Regulation for work on Morgan Falls Dam relicensing, the latter from the Eastern Rivers Summit Planning Team.

Kevin Noon received a STAR Award in recognition of the technical support he has provided over the last two years regarding wetlands compliance issues pertaining to 14 proposed oil & gas exploration and/or development activities in Big Thicket National Park, Padre Island National Seashore, and Lake Meredith National Recreation Area.

Pete Penoyer received a STAR Award for his support provided to Indiana Dunes NL on the Bailly Generating Plant RCRA facility investigation by reviewing ground water quality sampling and the delineation of contaminated ground water plumes from a CERCLA site contaminated by the disposal of fly ash.

Gary Smillie received an Exceptional Performance Award for sustaining a level of performance that exceeded the requirements of his position as the Hydrology and Watershed Assessment Program Leader.

Dean Tucker received an Exceptional Performance Award for sustaining a level of performance that exceeded the requirements of his position as the Data and Information Program Leader for WRD.

Bill Van Liew received a STAR award for sustained superior performance during the 2006 fiscal year for contributions to the advancement of on-going water rights protection projects at Lake Mead National Recreation Area and Great Basin National Park, specifically for generating timely and highly important work products to support NPS in negotiations and hearings.

David Vana-Miller received a STAR Award for his efforts in developing a new paradigm for water resources to better support planning requirements brought about by the implementation of the new Park Planning Standards.

Joel Wagner received a STAR Award for his leadership of the NPS Servicewide Wetlands Protection Program and that program's successful efforts in overseeing and supporting restoration efforts in Rocky Mountain National Park, Sequoia National Park, and Golden Gate National Recreation Area.

Don Weeks received a STAR Award recognizing his efforts as lead author of the Monocacy National Battlefield Water Resources Stewardship Plan, the first of a new report series that was well received by the NPS planning community.

APPENDIX E

STAFF

OFFICE OF THE DIVISION CHIEF STAFF

Bill Jackson: Division Chief, PhD in Hydrology. Specialty areas include sedimentation processes, fluvial geomorphology, and river assessment, restoration, and management.

Sharon Kliwinski: Water Resources Washington Liaison, BS in Environmental and Pollution Sciences. Specialty areas include environmental legislation and regulations, natural resource policy issues, and mining laws, policies, and programs.

Debi Cox: Program Analyst, EEO Counselor, BA in Anthropology. Specialty areas include coordination of interagency and cooperative agreements and project funding.

Kris Parker: Lead Administrative Assistant, EEO Counselor. Specialty areas include conference and meeting planning and coordination, PMIS, and report coordination and editing.

Carol Liester: Purchasing Assistant. Specialty areas include procurement, property management, and GSA vehicle coordination.

Laura Pascavis: Colorado State University Archivist, Web Developer, MA in Archival Science, BA in History with specialization in environmental and western history.

Glenn Patterson: Colorado State University Research Associate serving as advisor to the NPS Water Resources Division for USGS Water Activities. Specialty areas include hydrology, water quality, sedimentation, and program coordination.

OCEAN AND COASTAL RESOURCES BRANCH STAFF

Gary Davis: Visiting Chief Scientist for Ocean Programs, Acting Branch Chief, MS in Marine Biology. Specialty areas include marine resource inventories and monitoring, ocean park stewardship, and international marine resource collaboration.

Kristen Keteles: Texas A&M University Coastal Watershed Condition Assessment Coordinator, PhD in Zoology, BS in Marine Science. Specialty areas include aquatic toxicology, marine ecology, assessment of coastal water resources, and trace metal contamination.

Cliff McCreedy: Marine Management Specialist, BA in Political Science with career emphasis on regulatory and ocean policy. Specialty areas include marine resource management and planning, marine protected areas, coral reefs, coastal watershed assessment, and interagency marine partnerships.

PLANNING AND EVALUATION BRANCH STAFF

Mark Flora: Branch Chief, Hydrologist, MS in Environmental Science (Water Resources). Specialty areas include water resources management planning, water quality, and watershed management.

Joel Wagner: Wetland Protection Program Team Leader, MS in Environmental Science (Water Resources). Specialty areas include wetlands science, hydrology, restoration, and regulatory issues.

Kevin Noon: Wetland Specialist, PhD in Wetland Ecology. Specialty areas include wetland evaluation, management, restoration, and regulatory issues.

Jim Tilmant: Fishery Management & Marine Resources Program Team Leader, MS in Wildlife and Fisheries. Specialty areas include aquatic and marine resources management, fish biology, and population dynamics.

John Wullschleger: Fisheries Biologist, MS in Fish and Wildlife Science. Specialty areas include freshwater invertebrates, marine intertidal biota, fluvial ecology, and stream habitat restoration.

David Vana-Miller: Water Resources Planning Program Team Leader, MS in Marine Biology. Specialty areas include water resources planning, aquatic and marine resources management, water quality, and measures of biotic integrity.

Don Weeks: Hydrologist, MS in Geology (Hydrologeology). Specialty areas include water resources management planning, ground-water monitoring, and wetland management.

Jeff Wagner: Fisheries Biologist, BS Candidate in Aquatic Biology with a minor in fisheries biology at Colorado State University.

Specialty areas include fisheries management and native fish restoration.

Lael Wagner: Administrative Assistant.

WATER OPERATIONS BRANCH STAFF

Gary Rosenlieb: Branch Chief, Water Quality Program Team Leader, MS in Water Resources. Specialty areas include water quality (chemistry and microbiology), ground-water quality, and hazardous materials management.

Jeff Albright: Watershed Condition Assessment Program Coordinator, MS in Watershed Management. Specialty areas include hydrology data collection and data management protocols, watershed assessments, integration of science and policy in resource protection/restoration programs.

Gary Smillie: Hydrology Program Team Leader, Hydrologist/Hydraulic Engineer, MS in Civil Engineering. Specialty areas include flood frequency analysis, open channel hydraulics, floodplain management, and sediment transport.

Dean Tucker: Information Management Program Leader, Natural Resource Specialist, PhD in Forestry. Specialty areas include data management and reporting, hydrographic analysis, computer graphics, and water resources applications in GIS.

Larry Martin: Hydrogeologist, MS in Hydrology. Specialty areas include ground-water management, ground-water modeling, surface-water/ground-water interactions, water supply development, and source water protection.

Pete Penoyer: Hydrogeologist, Associate in Hazardous Materials, MS in Geology, Professional Degree in Hydrogeology. Specialty areas include ground-water analysis, ground-water contamination, site assessments under CERCLA, and water quality monitoring.

Rick Inglis: Hydrologist, BS in Watershed Science. Specialty areas include field hydrologic data collection and analysis, watershed condition and riparian zone assessment and management, and stream restoration.

Michael Martin: Hydrologist, BS in Environmental Geology, MS in Watershed Science. Specialty areas include open channel flow, geomorphology, flood analysis, wetlands hydrology, geochemistry, and water quality.

Barry Long: Hydrologist, BS in Watershed Sciences, MS in Forest Hydrology. Specialty areas include physical-chemical aspects of water quality.

Roy Irwin: Senior Contaminants Specialist, PhD in Biology. Specialist in environmental contaminants, ecological/biological aspects of water quality, monitoring study design and development, measurement uncertainty, and QA/QC issues.

Mike Matz: Colorado State University Research Associate, Water Quality Database Manager, MS in Civil Engineering. Specialty areas include water quality planning and management, inventory and monitoring, and data analysis.

Nathan Elder: Colorado State University Research Associate, STORET Database Project, BS in Watershed Science.

Hashem Faidi: Colorado State University Research Associate, Clean Water Act Designated Use and Impairment Database Manager, MS in Water Resources Engineering, PhD in Ground Water Engineering. Specialty areas include GIS applications in water resources and ground-water and contaminant transport modeling.

Paula Galloway: Colorado State University Research Associate, NPSTORET Database Project, PhD in Chemical Engineering.

Caroline Goughis: Colorado State University Research Associate, STORET Database Project, MS in Marine Sciences.

Tony Meneghetti: Colorado State University Student-Hourly Water Quality Data Analyst, STORET Database Project, MS candidate in Civil and Environmental Engineering.

Pat Wiese: Colorado State University Administrative Assistant, BS in Biology, MA in Public Administration. Specialty areas include editing and report production.

WATER RIGHTS BRANCH STAFF

Chuck Pettee: Branch Chief, Supervisory Hydrologist, MS in Watershed Science. Specialty areas include water rights establishment and protection and water resources policy.

Bill Hansen: Supervisory Hydrologist, Adjudication Program and Information Management Program Leader, BS in Watershed Science, MS in Hydrology. Specialty areas include water rights policy and adjudication, surface- water hydrology, and wild and scenic rivers.

Dan McGlothlin: Supervisory Hydrologist, Monitoring and Enforcement Program Leader, BS in Watershed Hydrology. Specialty areas include water rights establishment and protection and water resources policy.

Jennifer Back: Hydrologist, MS in Watershed Science. Specialty areas include ground- and surface-water interactions and stable isotopes.

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Water Resources Division

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