APPENDIX C: OVERVIEW OF WG/DIAP PARTICIPANTS'S MISSION/PURPOSE AND CAPABILITIES

This appendix provides background information on the Federal entity participants and affiliates of the Working Group for Disaster Impact Assessments and Plans: Weather and Water Data (WG/DIAP). For Federal participants, statutory authorities are noted where relevant.

The entries in the following index to Appendix A are hyperlinked to the relevant section of text.

FEDERAL ENTITY PARTICIPANTS IN WG/DIAP

Department of Agriculture (USDA)

Natural Resources Conservation Service (NRCS)

NRCS Mission

NRCS improves the health of our Nation's natural resources while sustaining and enhancing the productivity of American agriculture. NRCS achieves this mission by providing voluntary assistance through strong partnerships with private landowners, managers, and communities to protect, restore, and enhance the lands and waters upon which people and the environment depend.[1]

The NRCS leads the Federal commitment to the conservation of all natural resources by ensuring private lands are conserved, restored, and more resilient to environmental challenges, including climate change. NRCS works with landowners through conservation planning and assistance designed to benefit the soil, water, air, plants, and animals that result in productive lands and healthy ecosystems. The NRCS provides technical and financial assistance through local conservation districts to land users, communities, watershed groups, federal and state agencies, American Indian tribes, and others at their request. At the local level, the NRCS staff works alongside state and local conservation staff and volunteers in a partnership to care for natural resources on private lands. The NRCS develops comprehensive technical guidance for conservation planning and assistance.

Authorities and Capabilities Relevant to NPDIA Activities

The Rural Development Act of 1972, Public Law 92-419, Sec. 302, Title III (7 USC 1010a), August 30, 1972, authorized a land inventory and monitoring program, including studies and surveys of erosion, sediment damage, flood plain identification, and land use changes and trends. The NRCS informs the USDA of the extent of short-duration natural phenomena that affect health, safety, and agricultural production. Reports document impacts of NRCS activities on resources and describe the event in quantitative terms, including amount of precipitation and surface-wind speeds.

The Watershed Protection and Flood Prevention Act (PL 83-566, Statute 606) authorizes the Secretary of Agriculture to cooperate with State and local governments in planning and conducting improvements for soil conservation and other purposes. The NRCS can prepare reports on the impact of serious storms on the installed project measures.

The Snow Survey and Water Supply Forecasting Program, administered by NRCS, is found in the Code of Federal Regulations 7 CFS 612. NRCS is charged with the collection of snow data to develop monthly water supply forecasts from January through June in partnership with the NWS and with maintaining the data in a database and making it publically available. In partnership with other Federal, State, tribal, and local government agencies and utility companies, data are

[1] Mission statement taken from *USDA/NRCS 5 Year Strategic Plan: Fiscal Years 2011-2015*. PA-2030, April 2011. As of September 2015, an update to the NRCS Strategic Plan was not yet available.

collected through a network of over 1,200 manual snow courses (measured monthly) and 752 automated SNOw TELemtry (SNOTEL) stations located throughout Alaska, Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming. SNOTEL stations located at high elevations throughout the mountainous west collect data year round on air temperature, precipitation, barometric pressure, wind speed and direction, relative humidity, snow depth, and snow water equivalent. This network is the only high elevation climate data collection network in the United States.

NRCS also operates the 150-station Soil Climate Analysis Network (SCAN). Automated SCAN stations are scattered across the United States and are located primarily on agricultural lands. These stations collect soil moisture and temperature data in addition to air temperature, precipitation, barometric pressure, wind speed and direction, relative humidity, solar radiation, and if appropriate, snow depth and snow water equivalent.

Department of Commerce (DOC)

National Oceanic and Atmospheric Administration (NOAA)

NOAA Mission

To understand and predict changes in Earth's environment and conserve and manage coastal and marine resources to meet our Nation's economic, social, and environmental needs.

NOAA is the principal meteorological agency of the Federal government. By law, NOAA is responsible for reporting the weather of the United States, providing weather and flood warnings and forecasts to the general public, developing and furnishing applied weather services, and recording the climate of the United States. This mission is carried out within NOAA by the National Weather Service (NWS); National Environmental Satellite, Data, and Information Service (NESDIS); Office of Oceanic and Atmospheric Research (OAR); National Ocean Service (NOS); Office for Coastal Management (OCM); and NOAA Marine and Aviation Operations (NMAO).

NOAA Capabilities, by Responsible NOAA Agency

National Weather Service. The NWS provides weather, hydrologic, and climate forecasts and warnings for the United States, its territories, adjacent waters and ocean areas, for the protection of life and property and the enhancement of the national economy. NWS data and products form a national information database and infrastructure which can be used by other governmental agencies, the private sector, the public, and the global community.

The NWS consists of a national headquarters in Silver Spring, Maryland; 6 regional headquarters across the continental United States, Alaska, and the Pacific; 122 Weather Forecast Offices (WFOs); and 13 River Forecast Centers. The River Forecast Centers provide basin-specific forecast guidance on riverine and flash flooding. The NWS has two Tsunami Warning Centers that provide reliable tsunami detection, forecasts, and warnings in the United States. In addition, the NWS's National Centers for Environmental Prediction (NCEP) include the following service centers: Environmental Modeling Center, Storm Prediction Center (SPC), NCEP Central Operations, Hydrometeorological Prediction Center, Ocean Prediction Center, Tropical Prediction Center, Climate Prediction Center, Aviation Weather Center, and Space Environment Center. These service centers provide the expertise to produce focused guidance, modeling, and

numerical weather prediction for severe local storms, marine weather, tropical weather, climatic trends, aviation weather, and the space environment. This support provides basic information for both the NWS WFOs and external users, including other Federal agencies and Federal, State, and local emergency management officials.

In the event of tornadoes and other severe convective storms, flooding, and other weather-related natural disasters, NWS respondents can represent all strata of the NWS, depending on the type of event. Warning Coordination Meteorologists (WCM) at each of the NWS Weather Forecast Offices are often the initial NWS responders to all major weather events, documenting apparent damage and causal effects, as well as gathering commentary from witnesses.

The NWS provides a continuous weather watch throughout the Americas and the Pacific, with lesser amounts of data collected globally. Data are gathered via remote sensing (e.g., satellite-based instruments, weather radar, and vertical sounders) as well as from in situ sensing (e.g., surface observations). Observational and computational information is processed through computer-based models to produce numerical weather prediction and river forecast products, which are available to us**ers globally.**

National Ocean Service. The NOS works to provide science-based solutions through collaborative partnerships to address evolving economic, environmental, and social pressures on the Nation's oceans and coasts. This effort includes protecting coastal communities; monitoring oceans and coasts; promoting safe, efficient and environmentally sound marine transportation; reducing ocean and coastal health risks; and protecting coastal and marine places. NOS capabilities include the following:

- NOS provides products, services, and data. Examples include nautical charts, a framework for consistent geographic reference, and tidal and water-level monitoring
- NOS manages 14 national marine sanctuaries and one national monument and provides funding to coastal states to manage 27 national estuarine research reserves
- NOS participates in immediate response to hazardous spill events, damage assessment, and restoration activities
- NOS supports states in protecting resources and guiding economic development in coastal areas. NOS also supports training for state coastal managers participating in the program.
- NOS assesses, monitors, and predicts the consequences of natural and human-induced environmental hazards such as hurricanes, erosion, and sea-level rise.

The NOS has eight program offices and two staff offices that manage and preserve the Nation's ocean and coasts.

Office for Coastal Management. OCM was established in 2014 when NOAA combined the Coastal Services Center and the Office of Ocean and Coastal Resource Management. The basic missions of the two programs remain intact; the new organizational structure is providing value-added services to taxpayers.

In addition to implementing specific initiatives, a top priority for OCM is to unify efforts to make communities more resilient. Many organizations are involved, including the private sector, nonprofits, the scientific community, and all levels of government. OCM works to be a unifying force in these efforts, providing unbiased NOAA data and tools and providing opportunities for the community to come together to define common goals and find ways to work smarter by

working together. Issues run the gamut from protecting endangered species to erosion to generating better building codes for storm-resistant buildings.

The following OCM activities are of particular relevance to activities covered by the NPDIA:

- The **Digital Coast** initiative was developed to meet the unique needs of the coastal management community. The website, first released in 2007, provides not only coastal data but also the tools, training, and information needed to make these data truly useful. Content comes from many sources, all of which are vetted by NOAA. Data sets range from economic data to satellite imagery. The site contains visualization tools, predictive tools, and tools that make data easier to find and use. Training courses are available online or can be brought to the user's location. Information is also organized by topic—the top picks from the site, for instance, that relate to green infrastructure or climate adaptation.
- **Applied Science.** OCM is undertaking the study needed to provide coastal managers with the relevant information used in the decision making process. Among OCM areas for applied science study are the following:
    - Natural hazard vulnerability analyses and assistance on coastal zone management and building community resilience
    - Geospatial technology (e.g., geographic information system [GIS]) assistance and coastal inundation information, supporting application of GIS and remote sensing data
    - Ecosystem and damage assessments
- OCM provides **technical assistance to aid in response** to NPDIA-covered events, including the following:
    - Technical assistance in recovering fisheries, restoring habitat, and rebuilding coastal communities
    - Technical assistance for disaster response, recovery, and rebuilding efforts to include coastal resource management
    - Planning process support (includes community participation process design and facilitation) and assistance with recovery project development

For other OCM activities, see the Office for Coastal Management website.

The **Center for Operational Oceanographic Products and Services** (CO-OPS), which is part of NOAA/NOS, provides the national infrastructure, science, and technical expertise to monitor, assess, and distribute tide, current, water level, and other coastal oceanographic products and services that support NOAA's mission of environmental stewardship and environmental assessment and prediction. CO-OPS provides operationally sound observations and monitoring capabilities coupled with operational Nowcast Forecast modeling. It provides real-time water levels, currents, winds, and other oceanographic and meteorological measurements for major U.S. port areas. This infrastructure acquires and disseminates observations and predictions necessary to ensure secure, safe, efficient, and environmentally sound maritime commerce. The real-time tides information and current critical infrastructure support national security, safe navigation, sustainable coastal communities, and disaster response. Real-time water levels and current information are essential to post-incident environmental impacts and waterway evacuation.

CO-OPS Mission: To serve as the authoritative source for accurate, reliable, and timely tide, water level, current, and other oceanographic information to support safe and efficient navigation, sound ecosystem stewardship, coastal hazard preparedness and response, and the understanding of climate change.

CO-OPS provides the set of water level and coastal current products required to support NOS's Strategic Plan mission requirements and to assist in providing operational oceanographic data and products required by NOAA's other Strategic Plan themes. The CO-OPS manages the National Water Level Observation Network and a national network of Physical Oceanographic Real-Time Systems in major U.S. harbors. It establishes standards for the collection and processing of water level and current data, collects and documents user requirements that serve as the foundation for all resulting program activities, designs new and/or improved oceanographic observing systems, designs software to improve its data processing capabilities, maintains and operates oceanographic observing systems, performs operational data analysis and quality control, and produces and disseminates oceanographic products.

The **NOS Office of Response and Restoration** (OR&R) protects coastal and marine resources, mitigates threats, reduces harm, and restores ecological function. Its three divisions—Emergency Response, Assessment and Restoration, and Marine Debris—collectively provide comprehensive solutions to environmental hazards caused by oil, chemicals, and marine debris.

To fulfill its mission of protecting and restoring NOAA trust resources, OR&R performs the following activities of relevance to the NPDIA:

- Provides scientific and technical support to prepare for and respond to oil and chemical releases
- Determines damage to natural resources from these releases
- Protects and restores marine and coastal ecosystems, including coral reefs
- Works with communities to address critical local and regional coastal challenges

Of particular relevance to NPDIA activities, OR&R provides accurate, timely, and relevant scientific advice to organizations charged with responding to and mitigating the consequences of spills and other hazards that threaten coastal environments and communities. The hazardous materials (HAZMAT) scientific team provides key technical advice during spills of oil or hazardous materials in the coastal zone. To do this, the HAZMAT team is on call 24 hours a day, every day of the year. The HAZMAT team also responds to other technological and natural coastal hazards such as hurricanes and airplane crashes. HAZMAT carries out these functions under the National Response Plan and the National Oil and Hazardous Substances Pollution Contingency Plan. This group operates CAMEO (Computer Aided Management to Emergency Operations), a well-known NOAA software program that is in use at over 10,000 locations. CAMEO provides first responders and emergency planners with information to respond quickly to chemical accidents. OR&R provides on-scene Scientific Support Coordinators and supporting field teams and reach-back technical support and scientific guidance to assist in response and restoration efforts.

NOAA/National Geodetic Survey (NGS)

Mission Statement: The mission of the National Geodetic Survey (NGS) is understood to be:

1) To define, maintain, and provide access to the National Spatial Reference System (including the National Shoreline) to meet our nation's economic, social, and environmental needs, and
2) To be a world leader in geospatial activities, including the development and promotion of standards, specifications, and guidelines.

Authority:

- Coast and Geodetic Survey Act; codified at 33 U.S.C. 883 et seq,
- Hydrographic Service Improvement Act ff 1998, and 2002 Amendments; codified at 33 U.S.C. 883a et seq.

Capabilities: NGS and its predecessor agencies have been world leaders in geodesy and cartography, with a focus on enabling safe and efficient transportation. For decades NGS has collected remotely sensed aerial data to support two primary programs: the Coastal Mapping Program (CMP) and Aeronautical Survey Program (ASP). The CMP delivers accurate and up-to-date National Shoreline maps. In addition to promoting safe marine navigation, the National Shoreline provides the basis for a multitude of legal boundaries. The ASP delivers airport obstruction charts and other products used to design and validate the instrument approaches required for aircraft to land at U.S. airports during inclement weather. Through the capability to execute these programs, NGS provides emergency response imagery in the wake of national disasters.

Through the CMP and ASP, NGS utilizes both contracted and in-house assets to conduct end-to-end aerial surveys. NGS collects near-infrared and color (red, green, blue; RGB) imagery at a nominal one-foot ground sample distance (GSD). In conjunction with the NMAO Aircraft Operations Center, NOAA dedicates one specially modified turbojet aircraft to the NGS CMP and ASP and has several other aircraft that can be used on an as-needed basis. NGS's current emergency response workflow enables imagery to be processed and available via the Internet within 12 hours of collection. The speed with which NOAA can respond to an event depends upon several factors, the least controllable of which is weather. The imagery provided includes individual ortho-rectified RGB images in JPEG format. The resulting GSD after ortho-rectification is 0.5 m. Delivery of the full-resolution TIFF images is not feasible via the Worldwide Web due to bandwidth limitations, as individual images in TIFF format are over 150 MB each. Special requests for these products are addressed on a case-by-case basis.

NGS activities support Emergency Support Functions (ESFs) No. 1, 11, and 13 of the National Response Framework (see Appendix D).

National Institute of Standards and Technology (NIST)

Authority

Authority for NIST involvement in NPDIA activities is contained in the National Bureau of Standards Authorizing Act of 1986: "The National Bureau of Standards, on its own initiative, ... may initiate and conduct investigations to determine the causes of structural failures in structures which are used or occupied by the general public."

Mission

NIST promotes U.S. innovation and competitiveness by anticipating and meeting the measurement science, standards, and technology needs of the U.S. building and fire safety industries in ways that enhance economic security and improve the quality of life. Through its Materials and Construction Research Division, NIST conducts laboratory, field, and analytical research in structural engineering, including the investigation of important structural failures, the characterization of building loads during construction and during their service life, and structural response analyses. Extreme events, such as hurricanes and tornadoes, are viewed as opportunities to evaluate the performance of structures subjected to wind loads that may approach or exceed the ultimate limit states of the structure. Beginning with Hurricane Camille in 1969, the Structures Division has conducted post-storm assessments on its own or in collaboration with other Federal agencies, universities, and building research centers.

Capabilities

A well-equipped structural testing laboratory and computer facilities for modeling loads and structural response are maintained by the Materials and Construction Research Division of NIST. The division's capabilities for predicting and assessing wind effects on buildings and other structures include computer codes for the simulation of extreme wind speeds in atmospheric boundary layers. The division also maintains special equipment and supplies needed for the rapid deployment of investigative teams following major wind and earthquake disasters, structural collapses, and building fires.

The Process Measurement Division of the Chemical Science and Technology Laboratory within NIST maintains wind and water tunnels for fluid mechanics research. Of particular interest is the closed-return, low-speed, low-turbulence wind tunnel facility, which serves as the U.S. primary standard for anemometer calibration. Interchangeable test sections allow calibrations at wind speeds of up to 67 ms^{-1} (149.87 mph). State-of-the-art flow visualization techniques, hot-wire anemometry, and laser-Doppler velocimetry are available in this laboratory.

Department of Defense (DOD)

The DOD participates in NPDIA activities through elements of the U.S. Army and U.S. Air Force (USAF), primarily the U.S. Army Corps of Engineers, (USACE) and the Civil Air Patrol (CAP), a civilian auxiliary of the USAF. The CAP and the Air Force Reserve Command's 53rd Weather Reconnaissance Squadron (53rd WRS) serve principally in a supporting role to the other participating agencies. The USACE has primary responsibility for construction and maintenance of marine navigation in public waterways and coastal storm protection projects on public lands. USACE post-event activities are coordinated through the Office of Chief of Engineers and the Engineer Research and Development Center (ERDC).

Authorities

- For the U.S. Army Corps of Engineers, Public Law 71 (Coastal and Tidal Areas – Survey – Damages), 84th Congress, 1955.
- For the U.S. Air Force, Memorandum of Agreement (MoA) between the USAF Reserve and NOAA. First MoA dated May 4, 1992. Current MoA dated [TBA].

- For the Civil Air Patrol. The CAP is chartered under 36 U.S.C. 201 et. seq. as a civilian auxiliary of the USAF. The USAF is authorized under 10 U.S.C. 9441 to use the services of the CAP to fulfill its non-combat missions. A 5-year umbrella Memorandum of Understanding between the DOD and the OFCM was signed 4 May 2007.

U.S. Army Corps of Engineers Capabilities

The ERDC, in cooperation with participating USACE district offices, can provide data on near-shore wave conditions, winds, and water levels; beach profiles; lidar topographic and bathymetric surveys; aerial photography/imagery; damage assessment to marinas, coastal projects and navigation channels and structures; morphological changes to beaches; and identification of high-water marks.

The Joint Airborne Lidar Bathymetry Technical Center of Expertise executes the USACE National Coastal Mapping Program (NCMP), which provides lidar elevation and imagery data to support regional and scale management activities. The data are collected with a unique in-house survey capability that collects lidar topographic elevations and lidar water depths, both with concurrent digital aerial photography and hyperspectral imagery, for land use and habitat characterization. This capability was used in the aftermath of the 2004 and 2005 hurricane seasons to provide elevation and imagery data for more than 2,000 miles of shoreline, in addition to the 3,500 miles collected as part of the NCMP since 2004.

NCMP data support the quantification of economic, environmental, and engineering impacts of storms on the coastal zone. The data are delivered to the USACE coastal district in which they were collected and to the USGS Center for Coastal and Watershed Studies in St. Petersburg, Florida. The data are archived at the NOAA National Geophysical Data Center and USGS Earth Resources Observation and Science Center. All of the data are available online through the NOAA Coastal Services Center Lidar Data Retrieval Tool. The data are also delivered on demand to any local, State, or Federal agency that requests them. In addition to this unique in-house system and capability, the Joint Center maintains surveying contracts to obtain lidar and imagery from industry based systems. In all cases, the Joint Center coordinates operational plans with Federal and State stakeholders, such as USGS, NOAA, FEMA, National Aeronautics and Space Administration, and others, to prevent duplication and to ensure the widest dissemination of data and resulting products.

U.S. Air Force (USAF) and Civil Air Patrol (CAP)–USAF Auxiliary Capabilities in Support of NPDIA-covered Events

In the context of NPDIA-covered events, the CAP and the Air Force Reserve Command's 53rd WRS serve principally in a supporting role to other participating agencies. The CAP, through a Memorandum of Understanding between the DOD and OFCM, provides light aircraft, aircrews, and communications in support of disaster impact assessment flights. The NWS frequently uses CAP flights to survey ice damming, glacier-dammed lakes, weak levees, remote reservoirs, and tornado tracks. The services that CAP provides are more cost-effective than other available aerial capabilities. The CAP National Operations Center often is able to provide a flight within 24 hours of the request.

Funding for CAP must be provided on an annual basis by agencies that use CAP. Any Federal or State agency may request a CAP mission through OFCM by filling out the request form at http://www.ofcm.gov/wg-ndr-psda/index.htm and submitting it to nws.ofcm.cap@noaa.gov followed by a phone call to (301) 628-0045.

The 53rd WRS conducts aerial reconnaissance of tropical and extratropical cyclones to provide meteorological data on the geographic position of the storms; central sea-level pressure; vertical profiles of pressure, temperature, dew-point temperature, and wind speed and direction from the surface to flight level; geopotential heights of designated pressure surfaces; and other relevant data.

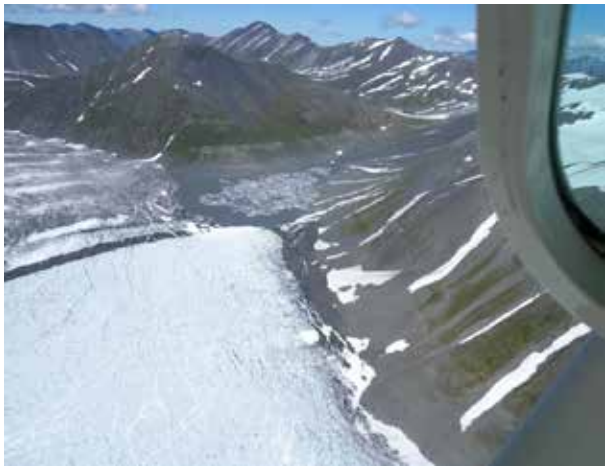

Photo taken by the Civil Air Patrol during an aerial survey of the Skilak Glacier dammed lake, August, 20, 2010. CAP aerial survey sorties are flown to assess and document water levels of glacier-dammed lakes and assess current hazard levels. Based on this photo, the Skilak lake level was determined to be low and not expected to release later in the year. Image courtesy Civil Air Patrol, Seward

Department of Homeland Security (DHS)

Federal Emergency Management Agency (FEMA)

DHS and FEMA within it are the federal coordinating agencies that respond to major disasters or threats in the United States and its territories.

FEMA Authority for NPDIA participation is stated in the agency's charter as "... providing the leadership and support to reduce the loss of life and property and protect our institutions from all types of hazards through a comprehensive, risk-based, all hazards emergency program of mitigation, preparedness, response, and recovery."

FEMA Capabilities. FEMA provides response and recovery and hazard mitigation assistance, emergency management preparedness training, flood insurance, and funding for related studies and services. Headquartered in Washington, DC, FEMA has 10 regional offices, with field offices and special facilities located nationwide. FEMA's website, http://www.fema.gov, includes the latest FEMA organization chart, as well as articles on FEMA and on Presidentially declared disasters.

When the President issues a disaster declaration for an event, FEMA establishes one or more Joint Field Offices (JFOs) to coordinate Federal disaster response and assistance. FEMA also employs a large contingent of temporary Disaster Assistance Employees when necessary, in addition to its authorized permanent staff. The **National Response Coordination Center** (NRCC), located at FEMA Headquarters in Washington, DC, assists in coordinating efforts among all Federal offices. ESF Coordinator positions within the NRCC are activated for exercises and emergencies. The ESF Coordinators, listed in Appendix C for each ESF, may be of assistance to NPDIA efforts.

FEMA is organized into eight primary directorates; Logistics Management, Disaster Assistance, Disaster Operations, Grant Programs, National Preparedness, U.S. Fire Administration, National

Continuity Programs, and Mitigation. The Mitigation Directorate, which includes the Federal Insurance Administration, coordinates Flood Insurance Studies for the National Flood Insurance Program and Hurricane Evacuation Studies for the National Hurricane Program.

Also within the Mitigation Directorate, the Risk Reduction Division, Building Science Branch, in coordination with the JFO Mitigation Branch Director, may elect to deploy a Mitigation Assessment Team (MAT) following a disaster. The objectives of the MAT are to inspect buildings and infrastructure, conduct forensic engineering analyses to determine causes of structural failure and success, and recommend actions that State and local governments, the construction industry, and building code organizations can take to reduce future damages and protect lives and property in hazard areas.

Department of the Interior (DOI)

U.S. Geological Survey (USGS)

Mission

USGS is the principal Earth science agency responsible for collection, assessment, and dissemination of information, regarding the geology, topography, mineral resources, hydrology, and biology of the U.S. USGS is a nationally recognized provider of water data and information for use by others to design, operate, manage, and regulate water resources, establish floodplain boundaries, issue flood warnings and river forecasts, and manage emergency operations. USGS real-time and long-term flow records and stage-discharge relationships (ratings) are key inputs for NWS forecast models and peak-flow data are fundamental to flood-frequency analyses on which the design of dams and the delineation of flood-insurance rate maps depend.

Authority

The Water Mission Area of the USGS is responsible for the coordination of the water-data acquisition activities of all federal agencies as mandated by Office of Management and Budget Memorandum No. M-92.01.

Capabilities

Streamflow Monitoring. Data on streamflow (the volume of water passing a specified point on a stream or other channel of moving water) are collected primarily by the USGS through the operation of some 8,100 streamgages, 2,400 stage-only gages, and some 27,000 peak-flow-only sites. The streamgaging network is operated by 42 water science centers, whose areas of operation usually correspond to State boundaries, through 160 field offices. Field offices are dispersed throughout the Nation and are strategically located near important rivers and streams. Real-time water-level and flow data for all USGS streamgages are available at the USGS Daily Streamflow Conditions website. Interactive maps of the current National and State level flow conditions (relative to flooding or drought) are available at the USGS WaterWatch website. Summaries of recent flood and high flow conditions are also available on WaterWatch.

Flood Measurements. Physical measurements of stream depth, width, and water velocities are used to compute flows. Although most flow measurements are made with conventional current meters, a large percentage of high-flow measurements are made by use of Acoustic Doppler Current Meters, which provide rapid and detailed depth, velocity, and flow data. These

instruments are routinely deployed to streamgages, but can be used to collect unique data for a variety of situations such as dam (and in some cases levee) breaks or leakages. USGS personnel are often called upon to make emergency measurements of flow by NWS forecasters, USACE dam operators, and emergency management personnel to aid in the management and assessment of floods. Summaries of recent flood measurements (width, depth, velocities, etc.) by State and by streamgage are distributed at the USGS Streamflow Measurements for the Nation web interface. Links to flood situational-awareness tools, flood-inundation maps, and other flood-related information is continually updated at http://water.usgs.gov/floods/index.html.

Flood Forensics. When direct flow measurements are not possible due to short notice or the inaccessibility of the site during a flood, the USGS collects detailed high-water mark and steam cross-sectional data afterwards and applies hydraulic models to estimate the peak flows. Multiple high-water marks are collected upstream and downstream of constrictions such as bridges or culverts to establish detailed flood profiles for hydraulic models. Accurate determinations of the elevations of the high-water marks are crucial to accurate determination of the flood flows: an elevation difference between high-water marks of just 0.10 feet could result in estimates that hence, high-water marks are surveyed to within +/- 0.10 feet. Indirect flow measurements are computed and summarized in nonpublished reports that may be viewed at the relevant USGS State office.

Storm-Tide Monitoring. The USGS developed a mobile storm-tide network to provide detailed time-series data for selected hurricane landfalls. The network was first deployed to monitor the landfall of Hurricane Rita in Southwest Louisiana in September 2005. It generally consists of hundreds of temporary water-level and barometric monitoring instruments that are deployed to areas around hurricane and Nor'easters landfall locations in the days and hours just prior to arrival of the storm. In the Southeast Atlantic and Gulf Coast areas deployment locations are "opportunistic" –established while "on-the-go". In the Northeast deployment locations are generally fixed placed and pre-established sites equipped for rapid instrument installation and setup. Most of the instruments collect water levels at 0.25-second intervals before, during, and after surge floods. Most of the storm-tide sensors log data for later analysis and use, but real-time units have been developed and deployed and could provide real-time on-site reconnaissance for selected facilities. Real-time storm-surge data (for periods during and immediately after the storm) can be viewed by accessing storm-surge sites listed in State streamflow summary tables at webpages with a URL of the form "http://waterdata.usgs.gov/XX/nwis/rt" where "XX" refers to the 2-letter postal abbreviation for the State of interest. As the storm passes, non-telemetered instruments are recovered and the data processed and posted to USGS storm-tide data viewers. These data and summary reports are typically available within 10 days.

Rapid-Deployable Gages. Often data are needed at ungaged sites. To provide data at short notice, the USGS developed small, rapidly deployable streamgages that provide real-time water-level data. These devices are equipped with satellite transmitters for real-time transmissions and solar panels and batteries to extend the deployment indefinitely. Data from these gages are available at webpages with a URL of the form: "http://waterdata.usgs.gov/XX/nwis/rt" where "XX" refers to the 2-letter postal abbreviation for the State of interest.

Flood Documentation. Personnel at the USGS Water Science Center are trained to flag and document high-water marks. USGS techniques differ from those more commonly used to develop flood-inundation maps. More effort is expended to flag multiple high-water marks needed to profile flood levels upstream and downstream of stream constrictions and the elevations are surveyed to within 0.01 feet to permit calibration of flood models and flood-inundation maps. For more information see URL: http://water.usgs.gov/osw/flood_inundation/.

The USGS has developed new rapidly deployable, mobile streamgages to provide short-term water-level data to critical areas lacking permanent streamgages. Image provided by USGS Office of Surface Water.

Shoreline Change. Through the Coastal and Marine Geology Program, the USGS Geologic Division investigates the geologic impacts of extreme storms and hurricanes on the physical coastal environment. A major objective of these investigations is to improve the capability to predict coastal erosion and other coastal changes caused by extreme storms. To conduct these investigations, Geologic Division personnel employ aerial photography and oceanographic techniques, emerging technologies like airborne scanning laser (e.g., LIDAR), recently available declassified instruments and data, and a USGS network of tide and environmental sensors. State-of-the-art research vessels, GPS satellites, and side-scan survey and velocity measurement equipment are used to collect post-storm data. Images and data are available at http://coastal.er.usgs.gov/shoreline-change/. Pre-landfall predictions of shoreline change, erosion, and dune overtopping are posted at http://marine.usgs.gov/coastalchangehazardsportal/.

NPDIA AFFILIATES

The American Association for Wind Engineering

The American Association for Wind Engineering (AAWE) is a national, nonprofit, technical society of engineers, meteorologists, architects, planners, public officials, social scientists, manufacturers and constructors. Included among AAWE members are researchers, practicing professionals, educators, government officials, and building code regulators. The AAWE members are wind and surge experts affiliated with research universities, industry, and private consulting. These experts collaborate to collect field data before, during, and after U.S. landfalling hurricanes; promote and investigate effective mitigation; and contribute to the development of national codes and standards for wind resistant design.

Data observed using the Texas Tech StickNet system for wind, rain, relative humidity, and barometric pressure can be used in damage assessments. Photo courtesy Sarah Dillingham, Texas Tech University

AAWE was originally established as the Wind Engineering Research Council in 1966 to promote and disseminate

technical information in the research community. In 1983 the name was changed to American Association for Wind Engineering and incorporated as a nonprofit professional organization. The multidisciplinary field of wind engineering considers problems related to wind and associated water loads and penetrations for buildings and structures, societal impact of winds, hurricane and tornado risk assessment, cost-benefit analysis, codes and standards, dispersion of urban and industrial pollution, wind energy and urban aerodynamics. AAWE membership consists of academic and industry experts in wind effects on structures, and stands ready to assist in the event of wind disasters.

Several of the AAWE partner institutions have a coordinated program to place robust and portable weather monitors in the path of hurricanes at landfall. Louisiana State University and Texas Technological University have also been using before- and after-storm satellite imagery to assess storm damage and to develop algorithms and procedures to gather high volume and high quality performance assessment data that complement on-ground data collection efforts.

Coasts, Oceans, Ports and Rivers Institute (COPRI)

COPRI is one of eight institutes under the American Society of Civil Engineering. COPRI focuses on specific civil engineering specialties by centering on the technical, educational, scientific and professional issues unique to coastal, ocean, ports, waterways, wetlands and riverine environments. COPRI strives to advance and disseminate scientific and engineering knowledge to its diverse membership.

Digital Hurricane Consortium (DHC)

Faculty from a number of universities and academic centers have come together to form the Digital Hurricane Consortium. DHC participants include the University of Florida (UF), Texas Technological University (TTU), Louisiana State University (LSU), University of Notre Dame, the University of Alabama at Huntsville (UAH), Oklahoma University (OU), the Center for Severe Weather Research (CSWR), Colorado University (CU), Clemson University, Florida International University (FIU), and the Applied Technology Council (ATC). The goals of the consortium include improving the response to severe weather events, especially hurricanes, by mobilizing field-deployed equipment to collect wind field and storm surge measurements that are extremely useful in determining not only the strength of the event but how the built environment responded to the event in terms of damage. Expertise in the consortium includes wind and structural engineering, coastal process monitoring and modeling (flooding and surge), atmospheric science, field measurement of hurricane winds, and structural vulnerability and mitigation assessments. Members of the consortium are also active in the AAWE.

The CSWR, OU, and UAH have mobile radar capabilities that add to the data collection strength of mobile anemometer towers. The mobile radar equipment has the ability to give the hurricane wind field three-dimensional depth, which anemometers cannot do. These radars will assist in gathering offshore wind speed information, which is now only possible for locations just offshore. Radar data on the vertical wind field could give us a much better idea of the wind layers above the ground layer where the built environment is located.

Retrieving a shallow water wave monitor. Photo courtesy University of Notre Dame.

UF manages the Florida Coastal Monitoring Program, a research program with the goal of characterizing the intensity and behavior of land-falling hurricanes with direct measurement of wind speed, wind direction, pressure, humidity and temperature at multiple ground level locations(10 meter) in the path of land fall via five portable weather monitoring platforms. TTU, LSU, and Clemson University also participate in this project and provide additional portable monitoring assets. Much of the data are relayed in real time to a public access website and via direct push to researchers in NOAA's Hurricane Research Division.

Since 1999, the high reliability of research-grade instrumentation and hurricane-hardened portable platforms has yielded the most dependable source of direct-measured overland ground-level wind data. Additional near-shore wave and surge monitoring assets have been developed by the University of Notre Dame to provide water elevation datasets that complement both the wind data collection as well as USGS surge monitoring efforts. Faculty at UF and the University of Notre Dame lead the current state of the art in coastal process modeling, including hurricane surge and inland flooding from heavy rainfall. UF and Florida Institute of Technology also deploy pressure measurement packages on the roofs and walls of homes along the coast of Florida to directly monitor the wind pressure experienced by structural components during land-falling hurricanes. This work is a leading source of information for refining the next generation of wind load provisions for minimum building code standards.

UF also offers an extensive infrastructure of laboratory apparatus to evaluate structural performance characteristics in hurricane winds and wind driven rain. The full-scale hurricane simulator at UF provides a means to develop and evaluate new construction methods as well as retrofit mitigation measures on existing building inventory. Home builders and product manufacturers work with the UF faculty to identify outstanding performance issues and identify cost effective and practical solutions to weaknesses in building performance.

During the process of equipment retrieval in the immediate aftermath of a landfalling hurricane, university teams provide an assessment of infrastructure damage prior to data-altering activities such as clean-up, blue-tarp, etc. In some circumstances (e.g., after Hurricane Charlie in 2004), UF and other university research groups remained in the field after equipment retrieval to conduct a more thorough quantitative building performance study.