

Water Resources

Dollars in Thousands	2018	2019	2020				
	Actual	CR Annualized	Fixed Costs	Internal Transfers	Program Changes	Request	Change from 2019
Water Resources¹	217,445	217,554	689	12,398	(50,719)	179,992	(50,030)
<i>FTE</i>	1,234	1,234	-	59	(233)	1,060	(233)
Water Resources Availability Program	[110,907]	[110,907]	348	110,907	(36,397)	74,858	(36,049)
<i>FTE</i>	[695]	[695]	-	695	(195)	500	(195)
Water Observing Systems Program	[112,545]	[112,545]	341	112,545	(7,822)	105,064	(7,481)
<i>FTE</i>	[597]	[597]	-	597	(37)	560	(37)
Water Resources Research Act Program	6,500	6,500	-	-	(6,500)	-	(6,500)
<i>FTE</i>	1	1	-	-	(1)	-	(1)
Water Availability and Use Science Program	46,052	46,052	-	(46,052)	-	-	-
<i>FTE</i>	331	331	-	-331	-	-	-
Groundwater and Streamflow Information Program	74,173	74,173	-	(74,173)	-	-	-
<i>FTE</i>	293	293	-	-293	-	-	-
National Water Quality Program	90,829	90,829	-	(90,829)	-	-	-
<i>FTE</i>	609	609	-	-609	-	-	-

¹ The amounts shown for 2018 and 2019 represent the old structure, in the new structure, the 2018 Actual and 2019 CR would be \$229,952.

The 2020 budget request for the Water Resources Mission Area is \$179,922,000 and 1,060 FTE.

The USGS monitors and assesses the amount and characteristics of the Nation's water resources, assesses sources and behavior of contaminants in the water environment, and develops tools to improve management and understanding of water resources. The information and tools provided by the USGS allow first responders, the public, water managers and planners, policy makers, and other decision makers to:

- Minimize loss of life and property as a result of water-related natural hazards, such as floods, droughts, landslides, and chemical spills.
- Manage freshwater, both above and below the land surface, for domestic, public, agricultural, commercial, industrial, recreational, and ecological uses.
- Protect and enhance water resources for human health, aquatic health, and environmental quality.
- Contribute to the effective development and conservation of the Nation's water resources for the benefit of present and future generations.

The 2020 budget makes targeted enhancements to the USGS water observing systems and strategic investments in modeling and assessments that support the advancement of the Nation's water prediction capabilities. To address higher priorities, the USGS is not requesting funds for the Water Resources Research Act Program. The Water Resources Mission Area will focus on the following water science priorities:

- ***Delivering integrated water availability assessments (IWAAAs).*** These multi-extent, stakeholder-driven assessments are designed to provide information to meet the goals of the National Water Census as established through the SECURE Water Act. When fully implemented, IWAAAs will: evaluate current water supply and demand, quality, and use; evaluate long-term trends in water availability; provide seasonal to decadal forecasts of availability; and inform water resource decisions through development of socioeconomic tools.
- ***Upgrading the USGS water observing systems.*** By coupling the high-fidelity, real-time data on water quantity and quality with the National Water Model and other advanced modeling tools, the USGS will provide state-of-the-art flood and drought forecasts and drive decisions support systems for water emergencies and daily water operations.
- ***Modernizing the National Water Information System (NWIS).*** The USGS is the authoritative source for consistent water information for the Nation. To ensure the NWIS continues to meet the needs of water science priorities, the NWIS data systems that house the water information will be modernized to upgrade to the newest technology. NWIS modernization will maximize data integrity, reliability, accessibility while simplifying data delivery to the general public.
- ***Building prediction capabilities for water quality.*** The USGS will use and advance the USGS observational network to guide the development of water-quality prediction capabilities. Efforts will be accomplished through collaborations with Federal partners and academia and will advance the prediction of temperature, surficial and in-channel transport processes, as well as improve existing hydrological process predictions from the National Water Model.

Cooperative Matching Funds

The cooperative matching funds (CMF) program provides funding to partner with nearly 1,600 local, State regional, and Tribal agencies to monitor and assess water in every State, protectorate, and territory. The 2020 request includes a total of \$57,710,000 of these funds across the mission area.

Water Resources Availability Program

Dollars in Thousands	2018	2019	2020				
	Actual	CR Annualized	Fixed Costs	Internal Transfers	Program Changes	Request	Change from 2019
Water Resources Availability Program	0	0	348	110,907	(36,397)	74,858	(36,049)
<i>Transfer from Toxic Substances Hydrology Program (EMEH)</i>	[12,398]	[12,398]		12,398			
<i>Transfer from Water Availability and Use Science Program</i>	[46,052]	[46,052]		46,052			
<i>Transfer from National Water Quality Program</i>	[52,457]	[52,457]		52,457			
<i>Mississippi Alluvial Plain Aquifer Assessment</i>	[4,000]	[4,000]			(2,797)	[1,203]	
<i>U.S.-Mexico Transboundary Aquifer Assessment</i>	[1,000]	[1,000]			(1,000)	[0]	
<i>Water Use Data and Research</i>	[1,500]	[1,500]			(1,500)	[0]	
<i>Cooperative Matching Funds - Water Use Research</i>	[2,000]	[2,000]			(1,000)	[1,000]	
<i>Water-Use Unconventional Oil and Gas</i>	[250]	[250]			(250)	[0]	
<i>Regional Water-Quality Assessments¹</i>	[4,100]	[4,100]			(4,100)	[0]	
<i>Water-Quality Trends²</i>	[10,072]	[10,072]			(635)	[9,437]	
<i>Harmful Algal Blooms</i>	[4,202]	[4,202]			(1,350)	[2,852]	
<i>Constituent and Contaminant Hydrology</i>	[10,848]	[10,848]			(10,848)	[0]	
<i>National Park Service Water-Quality Partnership</i>	[1,743]	[1,743]			(1,743)	[0]	
<i>Shallow and Fractured Bedrock Groundwater Research</i>	[300]	[300]			(300)	[0]	
<i>Research and Development to Advance Water Science³</i>	[16,889]	[16,889]			(10,874)	[6,015]	
Cooperative Matching Funds⁴	[21,397]	[21,397]			[-1,000]	[20,397]	[-1,000]
FTE	0	0		695	(195)	500	(195)

Program Description

The USGS Water Resources Availability Program (WRAP) fulfills the goals established by Congress in the SECURE Water Act (Public Law (P.L.) 111-11, Section 9508) by investing in research and assessments that improve the Nation's understanding of water availability. Specifically, the WRAP supports the National Water Census, an activity of the USGS designed to systematically provide information that will allow resource managers to assess the supply, use, quality, and availability of the Nation's water. WRAP will focus on conducting national and regional water availability assessments, inclusive of quantity and quality, for both human and ecological uses; developing methods to estimate water budgets, including water

¹ Formerly referred to as Regional Stream Quality Assessments

² Formerly part of NAWQA Status and Trends Assessments

³ Formerly the National Research Program

⁴ Cooperative Matching Funds are used to support research, data collection, and assessments activities across the Water Resources programs, and therefore are shown as a non-add component within the Mission Area.

withdrawals and consumptive uses; evaluating trends in water availability; and, developing new techniques to evaluate factors that limit water availability, the models and infrastructure that support assessments, and the tools that resource managers use to support resource planning activities.

2020 Activities

The 2020 budget request supports:

- Conducting research on water availability; synthesizing, predicting, and reporting information at regional and national scales; enhancing the Nation's water modeling and prediction capability; and compiling and reporting water information in ways that are useful to States.
- Continued development and delivery of the National Integrated Water Availability Assessment (IWAA), a near-real time census of water resources that will evaluate water availability for human and ecological use, infrastructure, security, and economic optimization.
- Continuing work on a pilot Regional IWAA in the Delaware River Basin focused on the impacts of severe drought on water availability for human and ecological uses.
- Incorporating models of current and projected water quality, including changes in nutrients, sediment, pesticides, and emerging toxins like those produced by harmful algal blooms (HABs), into National and Regional IWAAs.
- Continued evaluation of water availability indicators and trends, inclusive of both quantity and quality, and the factors driving observed trends in water availability.
- Continued development and application of models estimating withdrawal related to water use.
- Operationalizing field-scale evapotranspiration (ET) estimation techniques; developing new techniques to evaluate ecological flows in headwater streams; and, continued focus on drought research, including determining the changing importance of snowmelt in the hydrologic cycle.
- Continued development and application of field and modeling tools to better understand groundwater and surface-water interactions and to support evaluations of conjunctive management of these resources.
- Continued studies at Water Science Centers across the Nation in cooperation with State, local, regional, and Tribal partners that provide the data and tools necessary for resource managers to make management decisions regarding water availability now and into the future.

2020 Program Change Summary

The 2020 budget request for the Water Resources Availability Program (WRAP) is \$74,858,000 and 500 FTE, which includes:

- Mississippi Alluvial Plain Aquifer Assessment (-\$2,797,000 and -12 FTE)
- U.S.-Mexico Transboundary Aquifer Assessment (-\$1,000,000 and -4 FTE)
- Regional Water-Quality Assessments (-\$4,100,000 and -28 FTE)

- Water Use - Unconventional Oil and Gas (-\$250,000 and -1 FTE)
- Cooperative Matching Funds - Water Use Research (-\$1,000,000 and 0 FTE)
- Water Use Data and Research (-\$1,500,000 and -1 FTE)
- Water-Quality Trends Assessments (-\$635,000 and -5 FTE)
- National Park Service Water-Quality Partnership (-\$1,743,000 and -12 FTE)
- Shallow and Fractured Bedrock Groundwater Research (-\$300,000 and -2 FTE)
- Research and Development to Advance Water Science (-\$10,874,000 and -72 FTE)
- Constituent and Contaminant Hydrology (-\$10,848,000 and -49 FTE)
- Harmful Algal Blooms (-\$1,350,000 and -9 FTE)

Program Overview

The National Water Census (NWC): The USGS NWC is designed to systematically provide information on water availability that allows resource managers to assess the supply, use, and quality of the Nation's water resources. Through development of advanced techniques and new accounting methods, the WRAP strives to provide resource managers with more accurate and finer scale information to support near-real time management decisions related to water availability.

In efforts to further fulfill the requirements of the SECURE Water Act (P.L. 111-11, Section 9508), the USGS will re-prioritize NWC activities in 2020 to deliver National and Regional Integrated Water Availability Assessments (IWAAs). An IWAA is a multi-extent, stakeholder driven, near real time census and seasonal prediction of water availability for both human and ecological uses. When fully implemented, IWAAs will: (1) evaluate current water supply and demand, quality, and use; (2) evaluate long-term trends in water availability, inclusive of water quantity and quality; (3) provide seasonal to decadal forecasts of availability; and (4) inform water resource decisions through development of socioeconomic tools. It is these National and Regional IWAAs, in conjunction with efforts to provide overall Water Resources Trends and Forecasts, that will make up the major lines of work within the NWC.

National Integrated Water Availability Assessment: The WRAP supports the NWC through activities to improve our understanding of the quantity and quality of water resources in the United States. Traditionally, the USGS has done this as part of separate activities, not a fully coordinated effort. Through the National IWAA, the USGS will deliver a truly integrated assessment of water availability nationally that is inclusive of quantity, quality, and use. The National IWAA will convey current conditions, and National trends, regarding the quantity and quality of water available providing a basis to evaluate where limits to availability exist or may develop for human and ecological uses. The National IWAA assimilates the components above at nationally available scales and data and information gained from regional IWAAs (discussed below). The National IWAA is designed to provide periodic snapshots of water availability across the U.S. based on regional constraints in an evolving simulation as regional IWAAs are completed. In 2020, the WRAP will deliver a near-real time census of water availability as part of the National IWAA for quantity and begin implementation of models that will allow for the inclusion of quality by 2021.

Regional Integrated Water Availability Assessments: The USGS conducts assessment activities focused on individual factors that impact regional water availability: quantity, quality, and use. In 2020, work will continue to complete ongoing assessment activities. As these activities are completed, the USGS will begin integrated regional studies, referred to as Regional IWAAAs that will address water availability using a suite of predictive and modeling tools. In 2020, the USGS will continue work on a Regional IWAA pilot in the Delaware River Basin evaluating the impact of severe drought under current water supply and demand restrictions. This pilot will serve as a proof of concept and will help inform next-generation data collection, integrated model development, and provide feedback needed to refine the Regional IWAA framework for future pilot basins. A second pilot will be identified in 2020 in the West.

Water Resources Trends and Forecasting: The USGS monitors, collects, and estimates a wide array of surface water, groundwater, water quality, and water use data. The core goal of the WRAP is understanding how changes in water withdrawal, land use, climate, management actions, infrastructure, security, and economics have impacted and may potentially impact water availability, for both quantity and quality. In order to meet that goal, WRAP supports analyzing long term trends in floods and droughts and developing tools to allow visualization of change over time; evaluating short and long-term (decadal) trends in water-quality in streams, rivers, and aquifers across the Nation; and, evaluating trends in long-term water withdrawal for eight categories of water use.

In 2020, the WRAP will continue to focus on evaluating trends in water availability driven by human activities. These efforts will include exploring techniques to conduct integrated trend evaluations as part of IWAAAs.

Factors that Influence Water Availability: Water availability is influenced by a number of natural and human factors that can limit both the quantity and quality of water available for human and ecological uses. Drought reduces baseflow and recharge, and groundwater level declines can be exacerbated by increased withdrawal for use. Water resources affected by extreme drought may take decades to recover. Surface and groundwater resources throughout the Nation are subject to impaired water quality conditions caused by natural processes and human activities on the landscape. Nutrients, sediment, pesticides, and emerging contaminants such as algal toxins associated with harmful algal blooms (HABs) can pose a risk to human and ecosystem health and treatment, if possible, can be costly. Understanding how these, and other factors, limit water availability will be critical to fully implementing National and Regional IWAAAs in evaluating the availability of existing resources for human and ecological use, infrastructure, security, and economic optimization.

In 2020, the USGS will continue to conduct monitoring, modeling, and forecasting studies across the country, including an additional year of data collection for a large-river HABs pilot project started in 2017. In 2020, drought research will focus on determining the importance of snowmelt in the hydrologic cycle, and the USGS will work with the National Weather Service to incorporate seasonal climate forecasts into model predictions.

Model Development, Infrastructure, and Information Delivery: The USGS uses research and studies at the national and regional extent to support development of coordinated, comprehensive, and consistent

hydrologic modeling frameworks (Surface Water, Groundwater and Water Quality) for the conterminous United States. These modeling frameworks support implementation of IWAAAs through evaluation of water availability nationally, but also reduce initial costs for regional and local studies that use the infrastructure to build more refined models. The USGS has been a leader in the development and application of surface-water, groundwater, and water-quality modeling software; integration of these tools will be an important component of providing a complete assessment of water availability at both the National and Regional extents.

In 2020, the USGS will continue to collaborate with partners like the National Weather Service and National Center for Atmospheric Research to develop and improve national-scale prediction of surface water-groundwater interaction, stream water temperature, erosion and sediment transport, and selected water-quality constituents. Additionally, model development efforts will be focused on integrating these disparate systems into one fully integrated National Hydrologic prediction framework.

The National Water Information System (NWIS): The NWIS is a delivery system that is funded through both the WRAP and the Water Observing Systems Program. As a part of overall model development, infrastructure, and information delivery activities, the WRAP supports modernization, development, implementation, and maintenance of reliable systems that deliver real-time and historic information. The NWIS is the central USGS water information system, providing current conditions related to streamflow, floods, drought, water-quality conditions, and water-use data. The WRAP supports activities that ensure this system functions at peak efficiency and effectiveness, especially during hazard events. In 2020, the USGS will continue to upgrade its information technology resources to ensure computing capacity and data services can support integrated model performance and IWAAAs.

Water Observing Systems Program

Dollars in Thousands	2018	2019	2020				
	Actual	CR Annualized	Fixed Costs	Internal Transfers	Program Changes	Request	Change from 2019
Water Observing Systems Program	0	0	341	112,545	(7,822)	105,064	(7,481)
<i>Transfer from Groundwater and Streamflow Information Program</i>	[74,173]	[74,173]		74,173			
<i>Transfer from National Water Quality Program</i>	[38,372]	[38,372]		38,372			
<i>Research and Development to Advance Water Science⁵</i>	[2,467]	[2,467]			(1,540)	[927]	
<i>Urban Water Federal Partnership (CMF)</i>	[717]	[717]			(717)	[0]	
<i>Cooperative Matching Funds - Tribal Water</i>	[1,000]	[1,000]			(500)	[500]	
<i>National Groundwater Monitoring Network</i>	[3,929]	[3,929]			(2,395)	[1,534]	
<i>Groundwater Quality Monitoring Networks⁶</i>	[5,231]	[5,231]			(1,094)	[4,137]	
<i>National Atmospheric Deposition Program</i>	[1,576]	[1,576]			(1,576)	[0]	
Cooperative Matching Funds⁷	[38,530]	[38,530]			[-1,217]	[37,313]	[-1,217]
FTE	0	0		597	(37)	560	(37)

Program Description

Monitoring networks that generate data on the quantity and quality of the Nation’s water resources are the foundation for situational awareness and understanding the Nation’s water resources. The Water Observing Systems Program (WOSP) encompasses the Water Resources Mission Area’s objectives to collect, manage, and disseminate consistently high-quality and reliable water information in real-time and over the long-term, both of which are critical for managing the Nation’s water resources and anticipating and responding to water hazards that can result in loss of life and property. Serving as the largest water data holder in the world, the USGS partners with more than 1,600 Federal, regional, State, Tribal, and local agencies to maintain and manage its water monitoring networks. Furthermore, the WOSP is increasingly using integrated monitoring for multiple parameters at a single location providing continuous real-time water data used for decisions such as emergency response, flood forecasting, reservoir management, water-use restrictions, drinking water deliveries, permit compliance, water-quality studies, and recreational safety. The long-term data supplied by the program are a critical component to sustaining the viability of industries such as agriculture, fishing, and outdoor recreation and are used for decisions related to water-supply planning, aquifer storage and recovery, infrastructure design, floodplain and ecosystem management, energy development, and resolution of water disputes. In addition, the WOSP promotes the development and application of information and tools to minimize the loss of life and property due to hazards, including

⁵ formerly the National Research Program

⁶ formerly a part of NAWQA Groundwater Status and Trends Assessments

⁷ Cooperative Matching Funds are used to support research, data collection, and assessments activities across the WOSP, and therefore are shown as a non-add component within the Program

support for flood forecasting, informing drought and post-fire conditions, and monitoring debris flows and storm surge during hurricanes and floods.

2020 Activities

The 2020 budget request supports:

- Collection, management, and dissemination of high quality and reliable integrated hydrologic information in real time and over the long term for flood and drought planning, warnings, and forecasting; designing water infrastructure; operating waterways for power production and navigation; managing water rights issues; and assessing safety conditions for water recreational activities.
- A unified National Streamflow Network of more than 8,200 real-time streamgages operated year-round, including 3,460 Federal Priority Streamgages that support strategic Federal responsibilities.
- Long-term, nationally consistent monitoring of sediment, nutrients, and pesticides at 113 stream sites located on large inland and coastal rivers, as well as in small agricultural, urban, and minimally disturbed reference watersheds. These sites are used to track changes in the amounts of contaminants delivered to important receiving waters and how contaminant concentrations and loads are changing over time.
- Work to develop, refine, and apply hazard information and tools to minimize loss of life and property, such as Rapid-Deployment Gages (RDG's), Storm-Tide Sensors, and Wave-Height Sensors.
- Data collection and dissemination during hydrologic hazards (floods, droughts, hurricanes) and deployment of information tools for water managers to minimize loss of life and property.
- Improvement of flood forecast predictions, drought management, and development of National water prediction capabilities.

2020 Program Change Summary

The 2020 budget request for the Water Observing Systems Program (WOSP) is \$105,064,000 and 560 FTE, which includes:

- Research and Development to Advance Water Science (-\$1,540,000 and -10 FTE)
- Cooperative Matching Funds - Tribal Water (-\$500,000 and -3 FTE)
- Cooperative Matching Funds - Urban Waters Federal Partnership (-\$717,000 and -6 FTE)
- National Groundwater Monitoring Network (-\$2,395,000 and -2 FTE)
- Groundwater Quality Monitoring Networks (-\$1,094,000 and -6 FTE)
- National Atmospheric Deposition Program (-\$1,576,000 and -10 FTE)

Program Overview

The USGS Streamgaging Network: The USGS operates one of the largest streamgaging enterprises in the world. Water levels are measured at more than 10,000 streamgages across the Nation. Of these streamgages, streamflows are monitored year-round at about 8,200 sites, which are considered part of a National Streamflow Network (NSN) that is used in countless ways by governmental organizations, private industries, and the general public. Information provided through the NSN forms the scientific basis for decisions related to protecting life and property from water-related hazards, such as: flood response and drought planning; designing bridges, roads, and water-treatment plants; efficiently managing freshwater for drinking, irrigation, energy, industry, recreation, and ecosystem health; and promoting national, State, Tribal, and local economic well-being. The USGS makes approximately 80,000 streamflow measurements each year to ensure the accuracy of the streamflow data. The latest streamgage data is readily available through the National Water Information System: Web Interface (NWISWeb). Data can also be provided as alerts to users (<http://water.usgs.gov/waternow/>) by e-mail or text message and as real-time stream conditions (<http://waterdata.usgs.gov/nwis/rt>) updated at intervals of one hour or less. Annually, the USGS serves more than 670 million requests to NWISWeb for streamflow information.

In 2020, the USGS will continue needed infrastructure improvements and enhancements to the current monitoring networks with efforts focused on the Delaware River Basin, as a pilot watershed for implementing the USGS next-generation water observing system. The project on the Delaware River provides a model for the IWAAs and addresses a complex interstate river system that is both ecologically diverse and critical to the regional economy. These advancements will modernize the National Water Information System and enhance the monitoring infrastructure to advance modeling and water-prediction capabilities. In 2020, the USGS would continue to modernize data delivery (NWIS) and expand the type and temporal and spatial extent of its monitoring infrastructure.

Approximately 70 percent of the funding for the USGS Streamgaging Network is from reimbursable funding from local, State, and Tribal cooperators through jointly funded agreements (50 percent) and reimbursable funding from other Federal agencies (20 percent). The partnerships with 1,410 Federal, State, local, and Tribal stakeholders reflect widespread recognition of the Network's critical role and USGS's primary responsibility for collecting, analyzing, managing, and delivering streamflow information for the Nation.

The Streamgaging Network and Federal Priority Streamgages: One of the highest goals of the USGS is to maintain long-term stability of a "Federal needs backbone network" for long-term tracking and forecasting/modeling of streamflow conditions in response to changes in land use, water use, and climate. Specifically, consistent and systematically-collected information is paramount to meet the full gamut of Federal water priorities and responsibilities over the long term related to: forecasting extreme hydrologic events (floods and droughts); interstate agreements, compacts, court decrees and other legal obligations; streamflow tracking in major river basins and across borders; long-term streamflow forecasts that account for changes in population, land use, water use, and climate; and water-quality assessments on sources, transport, and fate of contaminants in rivers and estuaries.

To meet these strategic long-term Federal priorities and responsibilities, the USGS has identified 4,760 sites for a “Federal Priority Streamgauge” (FPS) network. In 2020, the USGS will work with partners to support approximately 3,460 of these streamgages.

The Streamgaging Network and Cooperative Matching Funds (CMF): The remaining streamgages in the Network are also integral to the USGS mission and national water priorities and are used to facilitate management decisions, operations, and responsibilities by other Federal agencies, States, localities, Tribes, regional commissions, industry, and non-governmental organizations. Most streamgages provide information to stakeholders serving more than one use, related to, for example:

- Water resource appraisals, allocations, and diversions (water supply/water use/water budgeting).
- Infrastructure planning and design for reservoirs, bridges, roads, culverts, and treatment plants.
- Operation of reservoirs, power plants, flood-control systems, and navigation locks and dams.
- Instream flow requirements for ecosystems and habitat.
- Management of groundwater pumping and depletion.
- Floodplain mapping and planning.
- Tide monitoring and prediction.
- Recreational safety and enjoyment.

Federal agencies rely on streamflow information to meet their respective obligations. This includes the National Weather Service for predicting floods using information from more than 3,600 streamgages; the Federal Emergency Management Agency for identifying flood-prone areas; the Bureau of Reclamation for dam and water conveyance systems operations; the National Park Service and the U.S. Fish and Wildlife Service for managing water resources and ecosystems; and the U.S. Army Corps of Engineers for operation of locks and dams.

Enhancing Water Monitoring Capabilities for Hazards Response: A critical application of Network data is its use in safeguarding communities from natural hazards. The WOSP promotes the development and application of information and tools to minimize the loss of life and property from hazards, including support for flood forecasting, storm surge monitoring during hurricanes and floods (using storm tide sensors and Rapidly Deployable Streamgages, known as RDGs), drought, debris flows, and fires. The USGS Flood Event Viewer (<https://water.usgs.gov/floods/FEV/>) provides a one-stop application for partners and the public to view flood data for current and past events, including USGS flood response, streamflow information, and high-water marks. A Floods Web page (<http://water.usgs.gov/floods/>) also provides access to a range of tools and data for flood events.

The WOSP continues to expand the use of storm-tide sensors and RDGs to prepare for and respond to floods and hurricanes. These sensors are part of a mobile network of rapidly deployable instruments that are used to observe and document the timing, extent, and magnitude of hurricane-induced storm-surge, waves, and tides. This network, known as the SWATH (<http://water.usgs.gov/floods/swath/>), consists of water-level and meteorological monitoring devices that are set up in the days and hours prior to a potential

storm-surge event, and then retrieved shortly after. High-water marks collected after flood events, and data from storm-tide sensors and RDGs are used by emergency managers, first responders, NWS forecasters, and others as they make decisions related to flood response and public safety, determine flood insurance maps and building codes, and to calibrate hurricane inundation models. To enable the USGS to more quickly deploy sensors in advance of future storm events, the USGS is installing storm tide sensor housings along U.S. coastlines. By 2022, the USGS would provide national coverage of sites along coastlines with capacity to temporarily install sensors and RDG's prior to major storms or tsunamis.

Water Data for Hazards Planning: At the opposite end of the hydrologic spectrum, information from over 5,000 long-term record streamgages is used by the USGS and partners to determine the extent, duration, and severity of droughts and to allocate water for critical uses. As the USGS strives to provide the data and science needed by communities to plan for, rather than react to, hydrological droughts, this information is necessary for decision makers to manage and mitigate the effects of drought. In addition, the USGS, in collaboration with Federal agencies, consulting firms, and universities, has developed new national flood flow frequency guidelines. Flood-frequency analysis provides quantitative, scientific information about the magnitude and frequency of flood discharges, which is used by water resource planners in the planning, design, and management of infrastructure along river corridors.

National Water Quality Network (NWQN) for Streams and Rivers: The NWQN is the only nationally designed monitoring network for tracking the quality of the Nation's rivers and streams with consistent and comparable methods at all sites. In 2020, the USGS would operate 113 NWQN sites located on large inland and coastal rivers, as well as in small agricultural, urban, and minimally disturbed reference watersheds. The USGS also augments its existing streamgage infrastructure with multi-sensor "Super Gages," which can deliver near-real-time data on flow, basic water-quality properties, and an increasing number of water-quality constituents that are measured directly or by surrogate measures such as nutrients and suspended sediment. This information can be used to identify sources of contaminants, monitor the effects of floods and other extreme hydrologic events on water quality, and to forecast harmful algal blooms and episodes of hypoxia in receiving waters.

Groundwater Data Collection: The quantity and quality of groundwater in an aquifer are important factors in determining water availability. The USGS works in collaboration with States, Tribes, universities, and localities to provide groundwater quality and level data through the National Groundwater Monitoring Network Data Portal, which supports a national understanding of groundwater availability. The Data Portal provides a valuable resource to water resource managers and other decision makers across the Nation as they plan, manage, and develop groundwater resources by providing access to historical groundwater well data. In addition, the WOSP supports a nationwide network of 690 groundwater monitoring sites called the Climate Response Network (CRN) that was established to specifically understand the effects of drought and other climate variability on long-term trends in groundwater levels across the Nation. An enterprise of 134 groundwater-quality monitoring networks are also maintained in strategically selected critical aquifers across the Nation to provide the data needed to answer the question: *"What is the status of the Nation's water quality, and is it getting better or worse?"*

The National Water Information System (NWIS): The NWIS is a delivery system that is funded through both the WOSP and the Water Resources Availability Program. The WOSP supports the development,

implementation, and maintenance of reliable systems for real-time and historic information delivery to stakeholders. At the center of the USGS water data products lies the NWIS, providing current conditions related to streamflow, flood and high flow, drought, and groundwater levels, in addition to water-quality and water-use data. WOSP funds ensure this system functions at peak efficiency and effectiveness, especially during hazard events. In 2020, the USGS would continue to enhance and modernize its water data management and delivery infrastructure and provide capabilities for managing real-time streamflow, water level and other field-transmitted data with a centralized platform meeting the Federal Cloud First Computing Strategy.

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