# Water Resources

<table>
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<th>2021 Fixed Costs</th>
<th>Internal Transfers&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Program Changes</th>
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The 2021 budget request for the Water Resources Mission Area is $180,809,000 and 1,034 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.

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1 Internal transfers are crosswalked from the old structure to this new structure in the Technical Adjustments section of this budget justification.
Water Resources

- Contribute to the effective development and conservation of the Nation's water resources for the benefit of present and future generations.

The 2021 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. Further, the budget maintains strategic activities that support the *Federal Action Plan for Improving Forecasts of Water Availability*. Released in October 2019, this plan outlines the actions and outcomes to be achieved by the Department of the Interior, Department of Commerce, and several partners to improve the modeling and forecasting capabilities related to water availability and water infrastructure projects. The Water Resources Mission Area will focus on the following science priorities:

- **Delivering integrated water availability assessments (IWAAs).** 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, IWAAs 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 USGS water observing systems.** The USGS will implement dense networks of high-fidelity, real-time data on water-quantity, quality and use necessary to support advanced models, modern water predictions, and decision support for daily water operations or water emergencies.

- **Modernizing the National Water Information System (NWIS).** The USGS is the authoritative source for consistent, reliable, and timely 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 continue to 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 integrated water prediction capabilities.** The USGS will use and advance the USGS observational networks to guide the development of integrated water prediction capabilities. Work will be accomplished through collaborations with Federal partners and academia and will advance the prediction of temperature, surficial and in-channel transport processes. In addition, efforts will improve existing hydrological process predictions from the National Water Model, a robust modelling framework that is maintained by NOAA’s Office of Water Prediction and supported by several academic and federal research partners.

To address higher priorities, the USGS is not requesting funds for the Water Resources Research Act Program.

**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 2021 request includes a total of $58,210,000 of these funds across the mission area.
## Water Resources Availability Program

<table>
<thead>
<tr>
<th>Water Resources Availability Program</th>
<th>2019</th>
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### 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, a USGS activity designed to systematically provide information that will allow resource managers to assess the supply, use, quality, and availability of the Nation’s water. The 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 withdrawals and consumptive uses; evaluating trends in water availability; and, developing new techniques.

\(^2\) Internal transfers are crosswalked from the old structure to this new structure in the Technical Adjustments section of this budget justification.

\(^3\) Formerly referred to as Regional Stream Quality Assessments.

\(^4\) 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.

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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.

2021 Activities

The 2021 budget supports:

- Research on water availability; synthesis, prediction, and reporting of information at regional and national scales; enhancements to the Nation’s water modeling and prediction capability; and the compilation and reporting of water information in ways that are useful to States.
- 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.
- 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.
- Implementing the first full Regional IWAA in the headwaters of the Colorado and Gunnison River Basin in collaboration and coordination with the Next-Generation Water Observing System (NGWOS) and the Integrated Water Prediction (IWP) program.
- Completion of National Water Census baseline estimates for nine water budget components by 2022.
- Integration of water quality models, such as those that look at changes in nutrients, water reuse, sediment, pesticides, and emerging toxins like those produced by harmful algal blooms (HABs), into national and regional IWAAs.
- Evaluation of water availability indicators and trends, inclusive of both quantity and quality, and the factors driving observed trends in water availability.
- Development and application of models that estimate withdrawal related to water use.
- Efforts to operationalize field-scale evapotranspiration (ET) estimation techniques; develop new techniques to evaluate ecological flows in headwater streams; and conduct drought research.
- Development and application of field and modeling tools to better understand groundwater and surface-water interactions and support evaluations of their conjunctive management.
- Cooperative 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 decisions regarding water availability now and into the future.

2021 Program Change Summary

The 2021 budget request for the Water Resources Availability Program (WRAP) is $71,857,000 and 403 FTE, which includes:

- Mississippi Alluvial Plain Aquifer Assessment (-$6,000,000 and -31 FTE)
- U.S.-Mexico Transboundary Aquifer Assessment (-$1,000,000 and -4 FTE)
Water Resources

- Regional Water-Quality Assessments (-$4,100,000 and -28 FTE)
- Cooperative Matching Funds - Water Use Research (-$1,000,000 and 0 FTE)
- Base Cooperative Matching Funds (-$606,000 and -5 FTE)
- Water Use Data and Research (-$1,500,000 and -1 FTE)
- Regional Groundwater Evaluations (-$303,000 and -2 FTE)
- Water-Quality Trends Assessments (-$458,000 and -4 FTE)
- National Park Service Water-Quality Partnership (-$1,743,000 and -12 FTE)
- Shallow and Fractured Bedrock Groundwater Research (-$300,000 and -2 FTE)
- Water Science Research and Development (-$12,368,000 and -82 FTE)
- Harmful Algal Blooms (-$1,348,000 and -10 FTE)
- Baseline Water-Quality Assessments of Transboundary Rivers (-$1,500,000 and -8 FTE)

The budget does not request funding for these activities in order to address other priorities.

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 will 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 is focusing NWC activities toward the delivery of National and Regional Integrated Water Availability Assessments (IWAAAs). 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, IWAAAs 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. These National and Regional IWAAAs, in conjunction with efforts to provide Water Resources Trends and Forecasts, will make up the major lines of work within the NWC.

National Integrated Water Availability Assessment: The WRAP supports the NWC through activities that improve our understanding of the quantity and quality of water resources in the United States. Through the National IWAA, the USGS will deliver an integrated assessment of water availability that is inclusive of quantity, quality, and use. By conveying current conditions and national trends of the quantity and quality of water, the National IWAA will provide a basis to evaluate where limits to availability exist or may develop for human and ecological uses. The National IWAA will assimilate the water availability components above at national scales with data and information gained from Regional IWAAAs (see below).
The National IWAA is designed to provide daily snapshots of water availability across the U.S. To do this, the USGS is using the water budget to quantify how much water is available. By modeling components of the water budget, the USGS can better understand the processes that change the water budget and eventually predict future scenarios. As of 2019, the USGS has completed work to provide daily estimates for four of nine targeted water budget components: precipitation, streamflow, soil moisture, and recharge. In 2020 and 2021, the USGS will continue this work with the goal of providing daily estimates for all nine water budget components by 2022. These estimates can then be used to provide indicators of water availability in the National IWAA.

In December 2019, the WRAP delivered the first map of the National IWAA representing a near-real time census of water availability for quantity. This map uses water storage as an indicator of water availability showing how current water storage compares to historical storage for any place in the U.S. In 2021, the USGS will continue to enhance the National IWAA by adding additional water availability indicators for quantity and will implement models for the inclusion of quality through development of a national water temperature model.

**Regional Integrated Water Availability Assessments:** The USGS conducts assessment activities focused on the individual factors – quantity, quality, and use – that impact regional water availability. In 2021, work will continue to complete ongoing, discipline-specific assessment activities. As these assessments are completed, the USGS is integrating these activities into regionally integrated studies, referred to as Regional IWAAs, that will address water availability using a suite of integrated predictive and modeling tools. In addition to being stakeholder-driven and informative at the local and regional levels, data and information from these Regional IWAAs will be assimilated into national-scale products of the National IWAA.

The USGS has initiated a pilot Regional IWAA in the Delaware River Basin (DRB) with the goal of evaluating the impact of severe drought under current water supply and demand restrictions. This pilot will serve as a proof of concept and will inform next-generation data collection, integrated model development, and the Regional IWAA framework for future pilot basins. To supplement these efforts, the USGS has provided Cooperative Matching Funds to six additional projects outside the DRB that are designed to improve the technical data and information needed to provide National and Regional IWAAs. These cooperative projects have the added benefit of working directly with State and local partners to leverage skills and ensure Regional IWAAs will provide the data, tools, and information that stakeholders need to make water-resource management decisions. In 2020, the USGS is continuing work on the DRB pilot and supporting cooperative projects but will also begin efforts for the first full-scale Regional IWAA in the headwaters of the Colorado and Gunnison River Basin. The 2021 budget supports the continuation of all these Regional IWAAs activities.

**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 WRAP then uses these data to map and better understand how changes in water withdrawal, land use, climate, management actions, infrastructure, and economics have impacted and may potentially impact water availability, for both quantity and quality. The 2021 budget maintains support for many of these activities. For example, the USGS will complete 3-D maps that show the concentrations of selected drinking water contaminants, such as nitrate, arsenic, and
uranium, in four of the Nation’s critical water-supply aquifers: the Central Valley, North Atlantic Coastal Plain, Lower Mississippi Embayment, and Glacial. In addition, the WRAP will focus on evaluating trends in water availability driven by human activities and water use needs and exploring techniques to conduct integrated trend evaluations as part of IWAA.

**Factors that Influence Water Availability:** Water availability is influenced by a number of 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. Water 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) and per- and polyfluoroalkyl substances (PFAS), can pose a risk to human and ecosystem health and treatment, if possible, can be costly. Understanding how to detect and characterize these contaminants and how they might limit water availability will be critical to evaluating the availability of existing resources for human and ecological use, infrastructure, security, and economic optimization through National and Regional IWAA.

The USGS addresses these information needs by investing in research that is focused on developing methods to detect emerging contaminants such as PFAS in water resources. In 2020, the USGS is operationalizing an analytical method designed to detect 34 of the most common PFAS compounds in the environment. In 2021, the USGS will continue efforts to assess PFAS and potential impacts to water availability. In 2021, 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 2021, drought research will focus on developing the capacity to predict drought onset and forecast extent and persistence considering the entire water budget. Additionally, the Colorado and Gunnison River Basin Regional IWAA will evaluate impacts of wildfire to both short-term and long-term water availability for both human and ecological uses.

**Model Development, Infrastructure, and Information Delivery:** The USGS has been a leader in the development of coordinated, comprehensive, and consistent hydrologic modeling frameworks for the conterminous United States. Through research and studies, the USGS develops and applies surface-water, groundwater, and water-quality modeling software. These modeling frameworks support the evaluation of water availability nationally, but also reduce the initial costs for regional and local studies that use the infrastructure to build more refined models.

In 2021, the USGS will continue collaborations with partners like the National Weather Service and National Center for Atmospheric Research to develop and improve national-scale prediction for surface water–groundwater interaction, stream water temperature, erosion and sediment transport, and selected water-quality constituents. The USGS will also continue collaborations with NOAA to add a shallow aquifer/groundwater module to the National Water Model. In tandem with these efforts, USGS will focus on integrating disparate modeling systems into one National Hydrologic prediction framework. For example, by 2021 the USGS will complete regional SPARROW models for the conterminous U.S. that support an understanding of the impacts of water quality on water availability for over 307 million people. Integrating models such as these will be an important component of providing IWAA.

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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. In 2021, 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**

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<th>Change from 2020</th>
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**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 activities such as agriculture, fishing, and recreation and are used for decisions related to water-supply planning, aquifer storage and recovery, infrastructure design, floodplain and ecosystem management, energy

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⁵ Internal transfers are crosswalked from the old structure to this new structure in the Technical Adjustments section of this budget justification.

⁶ 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.
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 support for flood forecasting, informing drought and post-fire conditions, and monitoring debris flows and storm surge during floods and hurricanes.

**2021 Activities**

The 2021 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 recreational activities.

- A unified National Streamflow Network of more than 8,400 real-time streamgages operated year-round, including 3,470 Federal Priority Streamgages that support strategic Federal responsibilities.

- Long-term, nationally consistent monitoring of sediment, nutrients, and pesticides at 113 sites located on large inland and coastal rivers, as well as small agricultural, urban, and minimally disturbed reference watersheds.

- A nationwide Climate Response Network of nearly 690 groundwater monitoring sites to understand the effects of drought and other climate variability on the Nation’s groundwater levels and an enterprise of approximately 100 groundwater-quality monitoring networks to understand the status of the Nation’s groundwater quality.

- Continued operation of the highest-priority sites of the Next-Generation Water Observing System (NGWOS) in the Delaware River Basin and initial implementation of NGWOS in the headwaters of the Colorado and Gunnison River Basin.

- Modernization of the National Water Information System (NWIS) data storage and delivery system with efforts focused on moving off of aging legacy systems.

- Work to develop, refine, and apply hazard information to minimize loss of life and property, such as Rapidly Deployable Gages (RDGs), 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.

- Monitoring activities to improve flood forecast predictions, and drought management, and inform development of National water prediction capabilities.

**2021 Program Change Summary**

The 2021 budget request for the Water Observing Systems Program (WOSP) is $108,952,000 and 631 FTE, which includes:

- Water Science Research and Development (-$2,102,000 and -14 FTE)
- High Plains Aquifer Assessment (-$80,000 and -1 FTE)
Water Resources

- U.S.-Canada Transboundary Streamgages (-$1,500,000 and -5 FTE)
- Cooperative Matching Funds (-$2,365,000 and -17 FTE)
- National Groundwater Monitoring Network (-$2,395,000 and -2 FTE)
- Next-Generation Water Observing System (-$2,960,000 and 0 FTE)
- Groundwater Quality Monitoring Networks (-$930,000 and -5 FTE)
- National Atmospheric Deposition Program (-$1,576,000 and -10 FTE)

The budget does not request funding for these activities in order to address other priorities.

Program Overview

The USGS Streamgaging Network: The USGS Streamgaging Network is comprised of more than 10,000 streamgages across the Nation. Of these sites, streamflows are monitored year-round at over 8,400 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.

Approximately 70 percent of the funding for the NSN is reimbursable funding from local, State, and Tribal cooperators through jointly funded agreements (approximately 50 percent) and reimbursable funding from other Federal agencies (approximately 20 percent). The partnerships with over 1,400 Federal, State, local, and Tribal stakeholders reflect widespread recognition of the Network’s critical role and the USGS’s responsibility for collecting, analyzing, managing, and delivering streamflow information for the Nation.

An important component of building an integrated predictive science capability is the Next Generation Water Observing System (NGWOS). NGWOS, which the USGS has been piloting in the Delaware River Basin since 2018, establishes an enhanced monitoring network integrated with other relevant data sets. This provides a dense network of high-fidelity, real-time data on water-quantity, quality and use necessary to support advanced models, modern water predictions, and decision support for daily water operations or water emergencies. The USGS has selected the headwaters of the Colorado and Gunnison as the next basin for deployment. Selected watersheds are representative of the Nation’s larger water-resource regions and instrumented to monitor a water quantity, quality, and use. These data will be coupled with the National Water Model and other modeling tools to improve prediction, and address a variety of other difficult water-resource questions in a given region. Further, the NGWOS will provide a foundational dataset as the USGS develops Integrated Water Availability Assessments (IWAAs).
Since 2018, the USGS has been piloting the NGWOS in the Delaware River Basin (DRB). In 2021, the USGS will focus monitoring efforts on a strategic set of sites that address the most critical water resource issues in the DRB. In addition, planning for implementing the NGWOS in the next watershed, the headwaters of the Colorado and Gunnison River Basin, will continue in 2021.

The Streamgaging Network and Federal Priority Streamgages: One of the highest priorities 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 systemically-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 Federal priorities and responsibilities, the USGS has identified 4,760 sites for a “Federal Priority Streamgage” (FPS) network. In 2021, the USGS will work with partners to support approximately 3,470 of these streamgages.

The Streamgaging Network and Cooperative Matching Funds (CMF): The remaining streamgages in the Network also support the USGS mission and national water priorities and is 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 obligations. This includes the National Weather Service using information from more than 3,600 streamgages to predict floods; the Federal Emergency Management Agency identifying flood-prone areas; the Bureau of Reclamation operating dam and water conveyance systems; the National Park Service and Fish and Wildlife Service managing water resources and ecosystems; and the U.S. Army Corps of Engineers operating locks and dams.

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 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. In 2021, this work will continue with the goal of providing national coverage of sites along coastlines with capacity to temporarily install sensors and RDGs prior to major storms or tsunamis by 2022.

**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 network for tracking the quality of the Nation’s rivers and streams with consistent and comparable methods at all sites. In 2021, 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. This information can be used to identify sources of contaminants; understand how contaminant concentrations and loads are changing over time; monitor the effects of floods and other hydrologic events on water quality; and 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. 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 2021, the WOSP will maintain a nationwide network of approximately 690 groundwater monitoring sites called the Climate Response Network (CRN). These sites are used to understand the effects of drought and other climate variability on long-term trends in groundwater levels across the Nation. In addition, the USGS will continue to support an enterprise of approximately 100 groundwater-quality monitoring networks in strategically selected aquifers across the Nation to provide the data needed to understand the status of the Nation’s groundwater quality, and whether it is getting better or worse.

The National Water Information System (NWIS): 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. The NWIS is funded through the WOSP and the Water Resources Availability Program. Funds support the development and maintenance of reliable systems that deliver real-time and historic information to stakeholders. This is particularly critical during hazard events and the USGS ensures this system functions at peak efficiency and effectiveness. The current version of NWIS is inflexible, suffers from extensive technological obsolescence and is at increased risk of system failure because of aging infrastructure. As a part of NGWOS, the USGS is transitioning from existing legacy systems to a robust, scalable water information infrastructure to enable management of new data and sensor networks, support integration of water data from multiple agencies and sectors, and feed data and analytical products into the National Water Model and other hydrologic models. In 2021, the USGS will continue to enhance and modernize its water data management and delivery infrastructure. Further, efforts will continue to provide capabilities for managing real-time streamflow, water level and other data with a centralized platform meeting the Federal Cloud First Computing Strategy.