BUDGET JUSTIFICATIONS

The United States Department of the Interior

and Performance Information
Fiscal Year 2019

U.S. GEOLOGICAL SURVEY

NOTICE: These budget justifications are prepared for the Interior, Environment and Related Agencies Appropriations Subcommittees. Approval for release of the justifications prior to their printing in the public record of the Subcommittee hearings may be obtained through the Office of Budget of the Department of the Interior.

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Overview

The U.S. Geological Survey (USGS) was established in 1879 (43 U.S.C. 31) for "the classification of the public lands and examination of the geological structure, mineral resources, and products of the national domain." In 1962, Congress expanded the USGS Organic Act to include examinations outside the national domain.

Today, the USGS provides research and integrated assessments of natural resources; supports the stewardship of public lands and waters; and delivers natural hazard science to protect public safety, health, and American economic prosperity. The USGS provides science to inform stewardship of energy and mineral resources; to sustain healthy fish and wildlife populations; to monitor changes to land resources; to improve resilience to natural hazards and enhance community safety and well-being; to improve water resource decision making; and to provide accurate, high-resolution geospatial data. Scientific coordination and collaboration within Interior and across the government is central to the USGS mission. The diversity of USGS scientific expertise enables the bureau to carry out large-scale, multi-disciplinary investigations and provide scientific information to resource managers and planners, emergency response officials, and the public.

Budget Highlights

The 2019 current budget request for the USGS is $859.7 million. The budget provides funding for scientific monitoring, research, and mapping to support management strategies for land, water, and species. The budget funds energy and mineral assessments to identify the location of resources, and applies science to safeguard communities against natural hazards. The budget supports the Landsat 9 Ground System Development to meet a fiscal year 2021 launch, and invests in critical minerals assessments, utilizing tools such as light detection and ranging (lidar) elevation mapping, geologic mapping, and airborne geophysics to identify mineral resources that are of significant value to the United States, and can inform strategies to reduce critical mineral import dependence.

This budget ensures a range of scientific capabilities to:

- Monitor and ensure the availability and quality of the Nation's fresh water supply.
- Monitor and improve the ability to prepare for, respond to, mitigate the effects of, and become more resilient to natural hazards.
- Provide assessments of conventional and alternative domestic energy resources.
- Provide assessments of domestic sources of minerals that can be used for infrastructure development, new technologies, and national security.
- Understand the functions and health of ecosystems, research native and invasive species, and investigate wildlife diseases.
- Provide insight, analyses, and data which helps Interior agencies manage lands and resources.

Secretarial Priority Areas

There are six priority areas identified by the Secretary of the Interior:

1. Conserving our land and water.
2. Generating revenue and utilizing our natural resources.
3. Expanding outdoor recreation and access.
4. Fulfilling our trust and insular responsibilities.
5. Protecting our people and the border.
6. Modernizing our organization and infrastructure for the next 100 years.

A more complete and updated performance assessment, placed in the context of the FY 2018-2022 Strategic Plan, will appear in Interior's FY 2018/2019 Annual Performance Plan & Report (APP&R).

The DOI FY 2018-2022 Strategic Plan will outline Secretarial priorities and associated goals. The USGS plans a key role in contributing to a number of these Secretarial priorities and goals.

Priority Area: Conserving our land and water

DOI Goal #1: Utilize science in land, water, species and habitat management supporting decisions and activities

The USGS seeks to understand the impacts to the Nation's land, water and species challenges through scientific monitoring and research. Through advanced understanding and integrated modeling of processes that determine water availability, the USGS informs the balanced management of water resources for multiple purposes, including energy production, the sustainability of fish and other aquatic communities valued by society, and public enjoyment. USGS science serves to protect and conserve our Nation's fish and wildlife heritage by providing science for at-risk species and species of management concern.

DOI Goal #4: Utilize science in land use planning

The USGS is the lead civilian mapping agency for the Nation and supports the conduct of detailed surveys and the resulting distribution of high quality and highly accurate topographic, geologic, hydrographic, and other maps and data. Remote sensing satellites and aircraft monitor the Earth providing information that is broad, precise, and easily available. In addition to operating the Landsat satellites, the USGS provides a portal to the largest archive of remotely sensed land data in the world, supplying continuous access to current and historical land images worldwide. Sensed data provides information that enhances the understanding of ecosystems and the capabilities for predicting ecosystem change. The data promote an understanding of the role of the environment and wildlife, the requirements for disaster response, the effects of weather, and the availability of energy and mineral resources.

High-resolution geospatial information underpins geologic maps and other geospatial products that enable precise planning of civil engineering and transportation infrastructure, versatile urban planning, improved flood projection, timely and accurate emergency response, effective hazard identification and mitigation, and detailed environmental analyses. In addition, these initiatives inform energy and natural resources management, and groundwater investigations, and enable cutting-edge research in the geological sciences.

New strengths in computer and information science will be developed and enhanced to make it easier for USGS scientists to discover data and models, to share and publish results, and to discover connections between scientific information and knowledge. Enabling the effective exploitation of 'big data' to discover new ways to inform science-based decision-making is a primary driver for technology innovation. In the next decade, the USGS will increase both spatial and temporal resolution through research and development of products such as full four-dimensional geologic maps, showing how the complex geologic structure of the Earth has changed through time. Collectively, meeting this objective will create a seamless connection between all USGS activities to accelerate and make USGS science more efficient by fully integrating disciplinary expertise within a new and evolving science paradigm for a changing world.

Priority Area: Generating revenue and utilizing our natural resources

DOI Goal #1: Ensure energy and economic security for America

The USGS provides science that helps inform stewardship of American energy resources to meet our security and economic needs. As demands for energy resources grow, USGS research and assessments to understand the occurrence, quality, supply, and use of national and global resources become increasingly critical. The in-depth science provided by the USGS Energy Resources Program provides information and analyses to support strategic, evidence-based economic and geopolitical decisions. Industry and government utilize USGS data to inform decisions about the discovery and management of energy resources, including oil, gas, coal, geothermal, uranium, and gas hydrates.

DOI Goal #3: Ensure access to mineral resources

The USGS conducts research and assessment of minerals throughout the world and provides vital information on the availability of mineral resources, especially the critical and rare earth minerals needed for scientific, technological, or military applications. The United States is completely dependent upon foreign nations for 20 different mineral commodities, including several that are critical for national security. The Nation imports a majority of its supply for an additional 30 mineral commodities. Reliable sources of minerals for manufacturing of products such as cell phones, laptops, and cars, as well as products related to national defense, are essential to our national well-being. The USGS produces topographic and geological maps, geophysical and geochemical surveys, together with scientific research on mineral resources to produce resource assessments to understand the Nation's mineral endowment. As demands for mineral resources grow, research and assessments provided by the USGS Mineral Resources Program (http://minerals.usgs.gov) inform resource management and enable strategic, evidence-based economic and geopolitical decisions.

Priority Area: Expanding outdoor recreation and access

DOI Goal #1: Expand hunting, fishing, and other recreation on Interior lands

USGS science serves to support safe and sustainable opportunities for outdoor recreational activities. USGS data and research support the hunting and recreational fishing sectors that generate $144 billion in expenditures annually and 480,000 American jobs (2017 National Recreation Economy Report, Outdoor Industry Association). The USGS conducts socioeconomic analyses to help resource managers understand the impact of hunting, fishing, and outdoor recreation on local economies and job creation in communities adjacent to public lands. In 2019, the USGS will continue to work with a vast array of partners to provide science support to management agencies designed to sustain harvest of game, waterfowl, fish, and furbearing animals for the hunting, fishing, and wildlife-related sporting and recreation needs of the public. USGS scientists develop monitoring protocols to assess population size and range, identify patterns of change of those populations using historic and current data, study links between populations of different

species and relationships with other environmental changes, and then develop predictive models to evaluate outcomes of potential management actions using innovative sampling designs and statistical methods. In addition, the USGS collaborates with its Interior partners to provide information to hikers, paddlers, anglers, and other outdoor enthusiasts about the water conditions of streams, lakes, and rivers using streamgage data and mapping.

Priority Area: Fulfilling our trust and insular responsibilities

DOI Goal #1: Support tribal self-determination, self-governance, and sovereignty

The USGS provides information to Tribes as part of our basic mission of providing scientific information to all levels of government, and as part of the Federal Trust Responsibility to Tribes.

The USGS supports tribal self-determination and sovereignty by providing information, technical assistance, and training to Tribes, enabling them to address the complex natural resource issues they face throughout Native American lands. USGS scientists work closely with tribal leaders around the Country to address a variety of issues related to water rights, water supply, flood-warning predictions, and disease mitigation to protect the health of Native populations, and sustainability of habitats and healthy ecosystems.

USGS coordinated efforts with Tribes span a variety of monitoring and research activities across the Nation including an extensive network of streamflow gages and groundwater monitoring stations; training and technical assistance; data management and quality control; Geographic Information Systems (GIS); fish and wildlife assessment and monitoring; development of models and decision-making tools; and scientific research on how natural, climatic, land use, water use, and other human factors can affect the water cycle, water quantity, and quality. In addition, the USGS helps to address the needs of Tribes through the integration of tribal and indigenous ecological knowledge with more traditional science in management decisions and engagement in tribal outreach efforts, such as those for Tribes affected by recent hurricanes that demonstrate to Indian Country how USGS research can help to address tribal science needs.

DOI Goal #3: Strengthen economic and health capacities in the U.S. Territories, and fulfill US compact obligations to the freely associated States

The USGS coordinated a number of efforts within insular areas. These efforts cover a variety of monitoring and research activities, including an extensive network of streamflow gages and groundwater monitoring stations, training and technical assistance, data management and quality control, geographic information systems, fish and wildlife assessment and monitoring, development of models and decision-making tools, and scientific research supporting water reliability, coastal stability, and food supply. In addition, the USGS helped address the needs of insular area governments through the integration of local ecological knowledge with more traditional science in management decisions and engagement in local outreach efforts.

Priority Area: Protecting our people and the border

DOI Goal #4: Provide science to safeguard communities against natural hazards

USGS natural hazards science informs a broad range of disaster planning, situational awareness and response activities at local to global levels. USGS responsibilities in natural hazards include the issuing of warnings and advisories for earthquakes, volcanic eruptions, landslides, and coastal erosion; informing warnings issued by other agencies for floods, tsunamis, and wildfires; providing timely information to emergency managers and response officials, the media, and the public to inform and educate communities during and between crises to improve resilience. In addition to these responsibilities, the USGS supports these activities by continuing to improve the data systems that are critical to situational awareness;

implementing 24x7 operations for seismic and volcanic monitoring efforts; maintaining an extensive national network of streamgages measuring rainfall, streamflow, stream height or lake levels; developing tools for rapid evaluation of hazards; improving internal hazards communication; evaluating warning and response activities, involving the relevant communities; and fostering the next generation of hazard scientists and technicians.

The USGS applies a wide range of expertise to wildland fire science efforts that address the human and biological factors contributing to potential fire hazards. These activities utilize geospatial analysis and remote sensing, create decision support applications and methods, and integrate physical, ecological, and social factors to assess how changing conditions and land use influence the effects of wildland fire on ecosystem services and societal hazards.

In terms of wildland fire hazards, the USGS Earth Resources Observation and Science (EROS) Center has developed several new products for understanding and forecasting the probability of large wildland fires on all land in the conterminous United States.

The USGS provides information during times of drought and floods from water monitoring networks that generate hydrologic data that are the foundation of situational awareness and understanding of the Nation's water resources. USGS information and tools allow first responders, the public, water managers, planners, policy makers, and other decision makers to minimize loss of life and property because of water-related natural hazards, such as floods, droughts, and landslides.

Priority Area: Modernizing our organization and infrastructure for the next 100 years

DOI Goal #3: Prioritize Interior infrastructure needs and reduce deferred maintenance backlog

The USGS balances mission delivery with investments in operations and maintenance to sustain the portfolio in an appropriate condition befitting of our role as America's stewards. Appropriately maintained assets enable the USGS to inform and support habitat and resource management, outdoor recreation, water delivery, public safety, trust and treaty responsibilities, and the provision of critical economic inputs and job creation in local communities. There is a direct link between adequately constructed and maintained Federal real property, healthy habitats and populations, availability of safe and reliable public use opportunities, and robust local economies.

A significant factor affecting the sustainability of the USGS portfolio of constructed assets is aging infrastructure. Management of deferred maintenance is a USGS priority to ensure completion of needed repairs and prevent further deterioration and unsafe conditions. The USGS will address deferred maintenance/repair needs with priority given to those that support critical mission activities and manage risk as a means to improve the condition of assets. Furthermore, proactive maintenance, replacement of components and co-location of programs and staff in owned facilities will significantly reduce future costs.

In addition, the USGS must protect its critical information assets from cyber exploitation and attack to ensure that employees and the public can rely on the confidentiality, integrity, and availability of the USGS's data and information systems. The USGS is implementing advanced technologies that will increase visibility into its IMT environment, improve protections around its high-value information assets, and empower its workforce to better detect, respond, and recover from cyber-attacks and breaches. With a more secure computing environment in place, employees can more easily obtain the tools and data they need.

The USGS will continue to deploy and mature continuous diagnostics and mitigation capabilities that help to fortify networks and systems. These provide the USGS with tools to identify cybersecurity risks on an

ongoing basis, prioritize risks, and enable cybersecurity personnel to mitigate the most significant problems first. Achieving the performance objectives will enable the USGS to meet the requirements of Presidential Executive Order 13800, "Strengthening the Cybersecurity of Federal Networks and Critical Infrastructure." The USGS has adopted the National Institute of Standards and Technology Cybersecurity Framework and will work toward implementing and maturing the set of activities known to be effective in managing cybersecurity risks and that are necessary to achieve key cybersecurity.

The USGS is working collaboratively with its user community to understand operational needs in the field, resulting in expanding network capabilities to improve connectivity in remote areas to enable employees to be as productive as possible. The USGS will also seek to deliver services that support consolidating and standardizing IT services and systems, including consolidating and optimizing its data center and network operations and standardizing security, customer support, and administrative functions.

Fixed Costs

Fixed costs of $5.0 million are fully funded.

Administrative Savings

The Department annually spends nearly $3 billion to procure goods and services, over $1 billion on information technology, and over $300 million to administer acquisition and human resources services. Interior will work to achieve cost savings of $50 million through more aggressive use of shared services and use of multi-agency procurement vehicles, such as shared contracting with other bureaus and Federal agencies. These savings will take effort to achieve, however, identifying administrative efficiencies provides the best opportunity to meet broader fiscal objectives and maintain programmatic funding. While all bureaus and offices will contribute to overall savings, the USGS will achieve at least $8.3 million in administrative savings.

Department-wide Reorganization Plan

The Department of the Interior is taking bold steps to better position itself for the next 100 years. In response to President Trump's Executive Order on a Comprehensive Plan for Reorganizing the Executive Branch, Secretary Zinke laid out a vision for a reorganized Department of the Interior that aligns regional boundaries within Interior to provide better coordination across the Department to improve mission delivery and focus resources in the field. Across the Department, the 2019 budget includes a total of $17.5 million to start this effort.

The Department of the Interior intends to establish common regional boundaries for Interior's bureaus in FY 2018, and to further develop this approach in FY 2019. The goal is to improve overall operations, internal communication, customer service, and stakeholder engagement. Aligning geographic jurisdictions across Interior will enhance coordination of resource decisions and policies, and will simplify how citizens engage with the Department.

Organizing bureaus within common geographic areas will allow for more integrated and better-coordinated decision making across our bureaus.

Currently, Interior's bureaus have more than 40 distinct regions, each with their own geographic boundaries. This complicates coordination and hampers Interior's ability to get things done expeditiously. Having common regions will help streamline operations and in doing so, provide better service to the American people. Bureaus within a region will focus on common issues, taking a comprehensive approach

versus a bureau-centric approach. This culture shift will help us work better together to accomplish one vision.

The new regional boundaries currently under discussion, and subject to modification, are expected to have minimal budgetary impact. The BIA has initiated discussions with Indian Country and will continue with formal tribal consultations regarding any proposed adjustments to the regional field organizations serving the Bureau of Indian Affairs and Bureau of Indian Education.

2019 Budget Request *(dollars in thousands)*			
	2017 Actual	2018 Full Year CR	2019 Request
Current	**1,085,167**	**1,077,798**	**859,680**
Permanent	**1,081**	**696**	**696**
Operation and Maintenance of Quarters	*49*	*52*	*52*
Contributed Funds	*1,032*	*644*	*644*
Total Current and Permanent	**1,086,248**	**1,078,638**	**860,446**
Direct FTEs	*4,876*	*4,876*	*3,667*

2019 Current Budget Request *(dollars in thousands)*						
	2017 Actual	2018 Full Year CR	2019			
			Fixed Costs	Internal Transfers	Program Changes	Request
Ecosystems	**159,732**	**158,647**	**664**	**0**	**-63,180**	**96,131**
Land Resources	**[149,275]**	**[148,261]**	**434**	**148,261**	**-45,453**	**103,242**
Energy and Mineral Resources	**94,311**	**93,671**	**442**	**-200**	**-9,808**	**84,105**
Natural Hazards	**145,013**	**144,028**	**661**	**0**	**-27,387**	**117,302**
Water Resources	**214,754**	**213,296**	**1,188**	**200**	**-49,762**	**164,922**
Core Science Systems	**116,050**	**115,262**	**456**	**0**	**-23,440**	**92,278**
Science Support	**105,611**	**104,894**	**1,378**	**0**	**-17,022**	**89,250**
Facilities	**100,421**	**99,739**	**-243**	**0**	**12,954**	**112,450**
Surveys, Investigations and Research	**1,085,167**	**1,077,798**	**4,980**	**0**	**-223,098**	**859,680**

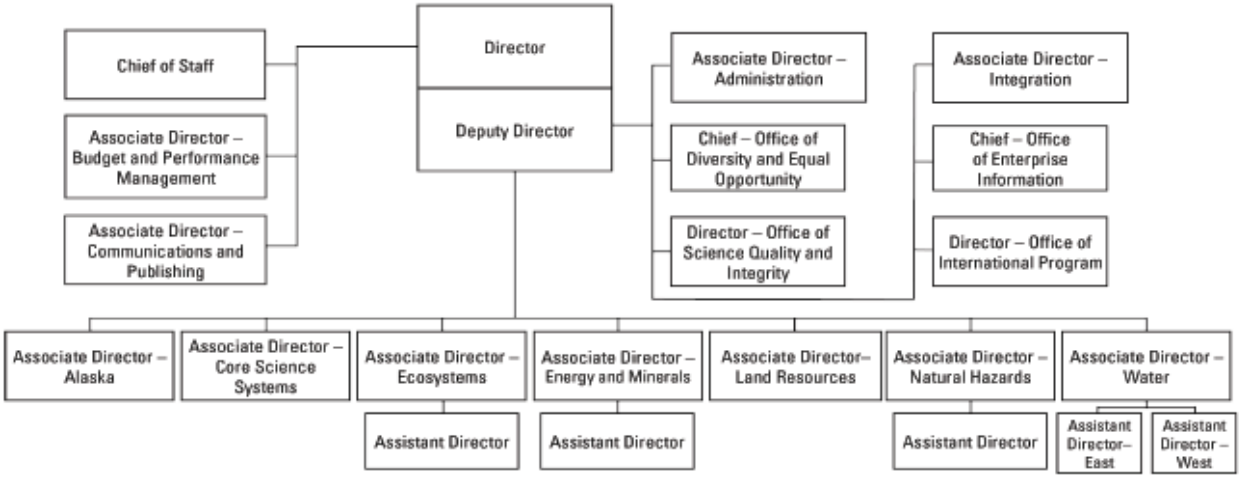
FTE			
	2017 Actual	2018 Full Year CR	2019 Request
Direct	**4,876**	**4,876**	**3,667**
Reimbursable	**2,993**	**2,993**	**2,993**
Working Capital Fund	**133**	**133**	**133**
Allocations	**36**	**36**	**36**
Contributed Funds	**6**	**6**	**6**
Total	**8,044**	**8,044**	**6,835**

Technical Adjustments

Organizational Realignment

The USGS proposed changes would improve accountability and management oversight of scientific programs. The new organizational structure will strengthen the USGS capability to deliver research and other scientific products to other Interior bureaus, other Federal agencies, and USGS collaborators outside of the Federal government. The proposed realignment will clarify roles and responsibilities, with line of sight reporting between field activities and the senior leaders accountable for implementing the USGS mission. This approach is in line with Secretary Zinke's goal to improve efficiency and utilize resources and expertise that is readily available.

Proposed Structure



The new structure maintains the current Associate Director positions with the following changes:

- Eliminate the Associate Director for Environmental Health
- Establish the Associate Director for Alaska (formerly the Alaska Regional Director), with oversight for the Alaska Integrated Science Center and primary responsibility for coordinating USGS activities in the region and engaging with Interior executives in Alaska.
- Rename the Associate Director for Budget, Planning, and Integration to Associate Director for Budget and Performance Management.
- Establish an Associated Director for Integration with responsibility for facilitating cross-mission approaches to topical, place-based, and science capacity issues.

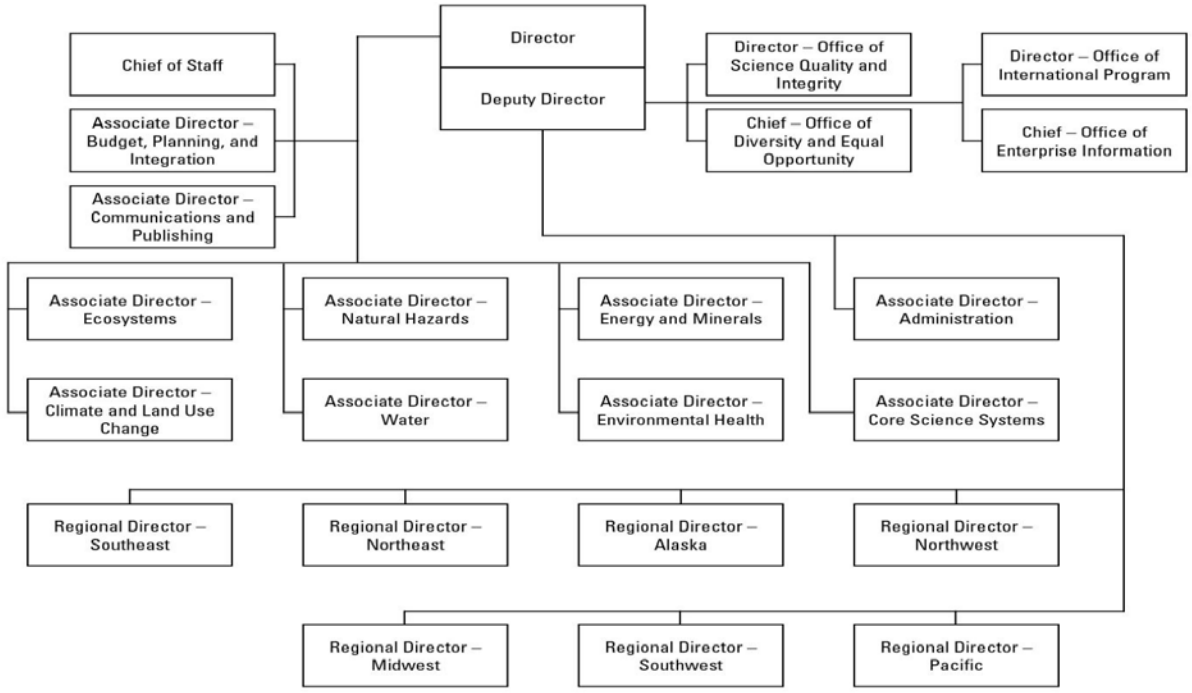
With the exception of the Alaska Integrated Science Center, the other 64 field-based science centers will be organized by mission area under the six mission-defined associate directors. The science centers are the key organizational unit for the USGS. Science center directors will have primary responsibility for local, regional, and state-based partnership development and stakeholder engagement and will serve as a conduit from the field to senior management.

To oversee line management of science centers, the new structure establishes five field-based assistant director positions (formerly regional directors) supporting the associate directors in the following mission areas: Energy and Minerals, Ecosystems, Natural Hazards, and Water, which will have one for the East and one for the West reflecting the larger number of water science centers.

Realigning regional directors into mission-based assistant directors will streamline the chain of command for the centers. These assistant directors will have the ability to align expertise and capacity to issues that require specific USGS capabilities, provide line management authority for the science centers, and serve as members of a newly established Integration Council that facilitates cross-mission approaches to topical, place-based, and science capacity issues that engage multiple missions. The newly established Associate Director for Integration, a conversion of one of the former regional director positions, will oversee the Integration Council.

The proposed reorganization does not alter the USGS budget structure. The organizational changes are limited to the reporting structure of the senior managers. The current regional director staff will report to the new assistant directors, and there will not be any need for relocation of employees. The reorganization will reduce the number of positions in the organization through attrition and voluntary placements, with associated savings in space costs. We do not anticipate the need for employee separations because of the proposed changes.

Existing Structure



The current USGS structure relies on a matrix-management approach with seven geographically defined regional directors and seven mission-defined associate directors. Currently, most USGS personnel are managed by the regional directors yet program funding and direction are managed through the associate directors.

Technical Adjustments

The USGS proposes two technical adjustments:

- Restructuring the Climate and Land Use budget activity into the Land Resources budget activity.
- Renaming of the Coastal and Marine Geology Program to the Coastal/Marine Hazards and Resources Program to convey the work of the program.

Climate and Land Use Change to Land Resources Mission Area Budget Restructure

The budget realigns the existing Climate and Land Use budget activity, focusing on a narrower set of scientific activities to meet priority stakeholder needs. In Climate and Land Use budget activity's place, the Land Resources budget activity will focus on classifying and examining land and associated resources/products of national interest; detecting and understanding changes in lands and associated resources/products; and delivering scientific information in forms/formats that are relevant to and capable of being used by land and natural resource planners, managers, and decision makers.

The following are summaries of each of the renamed/scoped programs and their relationship to one another:

- The **National Land Imaging** subactivity delivers the remote sensing observation capacity, data, and research required to understand how landscapes and associated natural resources are changing at grand scales. It collects, archives, and distributes a broad array of data from near-Earth and satellite-based remote sensing platforms.

- The **Land Change Science** subactivity conducts research to understand the forces that shape landscapes and their potential uses, to distinguish between land surface change resulting from natural forces and those that are associated with human activity and land use decisions, and to provide the scientific basis for land use decisions that affect the safety of communities, economic prosperity, and natural resources of the Nation. It delivers research products, information, and computer programs that help decision makers understand, interpret, and apply the knowledge and data gained from on-the-ground and remote sensing observation systems to land use planning, natural resource management, and adaptation planning decisions.

- The **National and Regional Climate Adaptation Science Centers** subactivity delivers on-the-ground observations and research to understand how changes in climate, land use, and associated changes in land cover are affecting the Nation's natural resources and associated populations of fish and wildlife species essential to the Nation's natural heritage. The centers provide information to develop tools and applications that help resource managers understand which observed changes are meaningful, what the observations suggest about the condition and sustainability of natural resources, and what can be done to support conservation priorities of the Nation.

The table shown below is a crosswalk of the old and new budget structure within CLU, using 2019 funding levels.

Fiscal Year 2019 *dollars in thousands*			PROPOSED		
			Land Resources		
			National Land Imaging Program	Land Change Science Program	National and Regional Climate Adaptation Science Centers
CURRENT	Climate & Land Use Change	National Climate Change & Wildlife Science Centers / DOI CSCs			$12,989
		Climate Research and Development		$5,886	
		Carbon Sequestration		$0	
		Land Remote Sensing	$75,514		
		Land Change Science		$8,853	
2019 Request Levels in New Structure			**$75,514**	**$14,739**	**$12,989**

The 2019 President's budget is presented in the proposed new structure. The budget includes internal transfers necessary to execute the restructure of the Climate and Land Use Mission area into the Land Resources Mission Area.

Natural Hazard – Coastal and Marine Geology Program to Coastal/Marine Hazards and Resources Name Change.

The USGS proposes to change the name of the Coastal and Marine Geology Program to the Coastal/Marine Hazards and Resources Program. There are no funding changes based on this name change. This change reflects the connection between the critically important hazards-related activities such as offshore earthquake and tsunami hazards as well as coastal changes hazards due to extreme storms. This also highlights the priority work conducted in the Program addressing to offshore resources, including work related to identifying the extended shelf of the United States and evaluating methane hydrates as a potential energy source.

Harmful Algal Blooms

The internal transfer moves the Harmful Algal Bloom work out of the Environmental Health Mission Area and into the Water Mission Area, National Water Quality Program to consolidate funding for this important work:

Transfer from Environmental Health (-$200,000 and 1 FTE)

Transfer to Water Resource Mission Area, National Water Quality Program for HABs ($200,000 and 1 FTE)

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Budget at a Glance

The budget at a glance table begins on the next page.

Budget at a Glance (Dollars in Thousands)	2017 Actual	2018 Full Year CR	2019			
			Fixed Costs	Internal Transfers	Program Changes	Request
Status and Trends	**20,473**	**20,334**	**92**	**0**	**-9,101**	**11,325**
Administrative Savings					*-279*	
Land and Water Management Research					*-4,333*	
Museum Collections					*-1,600*	
Species-Specific Research					*-2,889*	
Fisheries Program	**21,136**	**20,992**	**113**	**0**	**-11,404**	**9,701**
Administrative Savings					*-279*	
Contaminants Research					*-500*	
Great Lakes Fisheries Assessment					*-250*	
Land and Water Management Research					*-5,989*	
Species-Specific Fisheries Research					*-3,386*	
Unconventional Oil and Gas					*-1,000*	
Wildlife Program	**46,007**	**45,695**	**227**	**0**	**-12,482**	**33,440**
Administrative Savings					*-279*	
Amphibian Research and Monitoring					*-1,754*	
Arctic					*-1,600*	
Contaminants Research					*-500*	
Species-Specific Wildlife Research					*-6,599*	
White Nose Syndrome					*-250*	
Whooping Crane Propagation					*-1,500*	
Environments Program	**37,415**	**37,161**	**176**	**0**	**-12,768**	**24,569**
Administrative Savings					*-279*	
California Bay Delta					*-800*	
Chesapeake Bay					*-3,700*	
Ecosystems Services					*-1,000*	
Greater Everglades					*-5,850*	
Landscapes of Forest, Mountains, and Rivers					*-689*	
Southwest Desert					*-450*	
Invasive Species	**17,330**	**17,212**	**56**	**0**	**-172**	**17,096**

Budget at a Glance (Dollars in Thousands)	2017 Actual	2018 Full Year CR	2019			
			Fixed Costs	Internal Transfers	Program Changes	Request
Administrative Savings					*-172*	
Cooperative Research Units	**17,371**	**17,253**	**0**	**0**	**-17,253**	**0**
Total, Ecosystems	**159,732**	**158,647**	**664**	**0**	**-63,180**	**96,131**
National Land Imaging Program	**[85,794]**	**[85,211]**	**153**	**85,211**	**-9,850**	**75,514**
Administrative Savings					*-673*	
Remote Sensing Grants					*-1,207*	
Landsat 9 Ground Systems					*14,100*	
National Civil Applications Center					*-4,814*	
Research and Investigations					*-5,351*	
Satellite Operations					*-11,905*	
Land Change Science Program	**[38,146]**	**[37,887]**	**54**	**37,887**	**-23,202**	**14,739**
Carbon Sequestration					*-8,898*	
Climate Research and Development					*-9,818*	
Ecosystem Modelling and Decision Support					*-1,154*	
Landscape Science					*-2,339*	
Remote Sensing of Vegetation and Water					*-993*	
National and Regional Climate Adaptation Science Centers	**[25,335]**	**[25,163]**	**227**	**25,163**	**-12,401**	**12,989**
Administrative Savings					*-673*	
Arctic					*-500*	
Realign Climate Adaptation Science Centers					*-10,728*	
Tribal Climate Adaptation Science					*-500*	
Total, Land Resources	**[149,275]**	**[148,261]**	**434**	**148,261**	**-45,453**	**103,242**
Mineral Resources Program	**48,371**	**48,043**	**301**	**0**	**9,882**	**58,226**
Administrative Savings					*-716*	
Critical Minerals					*10,598*	
Energy Resources Program	**24,695**	**24,527**	**141**	**0**	**1,211**	**25,879**
Administrative Savings					*-387*	
Energy Research and Assessments					*1,598*	

Budget at a Glance (Dollars in Thousands)	2017 Actual	2018 Full Year CR	2019			
			Fixed Costs	Internal Transfers	Program Changes	Request
Contaminant Biology Program	**10,197**	**10,128**	**0**	**0**	**-10,128**	**0**
Toxic Substances Hydrology Program	**11,048**	**10,973**	**0**	**-200**	**-10,773**	**0**
Subtotal, Environmental Health	**21,245**	**21,101**	**0**	**-200**	**-20,901**	**0**
Total, Energy and Mineral Resources	**94,311**	**93,671**	**442**	**-200**	**-9,808**	**84,105**
Earthquake Hazards	**64,303**	**63,866**	**251**	**0**	**-13,118**	**50,999**
Administrative Savings					*-640*	
Earthquake Early Warning					*-10,200*	
Hazard and Risk Assessments in Low-to-Moderate Risk Areas					*-478*	
Regional Seismic Networks					*-1,800*	
Volcano Hazards	**28,121**	**27,930**	**153**	**0**	**-5,777**	**22,306**
Administrative Savings					*-279*	
Implementation of NVEWS					*-1,500*	
Maintenance in Commonwealth of the N. Mariana Islands and Yellowstone					*-500*	
Next Generation Lahar Detection					*-1,000*	
Repair and Upgrade of Analog Instruments on High-Threat Volcanoes					*-1,000*	
Volcano Hazards Assessments					*-1,498*	
Landslide Hazards	**3,538**	**3,514**	**24**	**0**	**-27**	**3,511**
Administrative Savings					*-27*	
Global Seismographic Network	**6,653**	**6,608**	**13**	**0**	**-1,684**	**4,937**
Administrative Savings					*-62*	
Seismic Station Upgrades					*-1,622*	
Geomagnetism	**1,888**	**1,875**	**0**	**0**	**-1,875**	**0**
Coastal/Marine Hazards and Resources Program	**40,510**	**40,235**	**220**	**0**	**-4,906**	**35,549**
Administrative Savings					*-462*	
Elevation Models and Coastal Resource Assessments					*-2,344*	
Marine Habitat and Resource Mapping and Ocean and Glacier Studies					*-1,600*	
Regional Coastal Management, Restoration, and Risk Reduction					*-500*	
Total, Natural Hazards	**145,013**	**144,028**	**661**	**0**	**-27,387**	**117,302**

Budget at a Glance (Dollars in Thousands)	2017 Actual	2018 Full Year CR	2019			
			Fixed Costs	Internal Transfers	Program Changes	Request
Water Availability and Use Science Program	**45,052**	**44,746**	**287**	**0**	**-14,682**	**30,351**
Administrative Savings					*-349*	
Mississippi River Alluvial Plain Aquifer Assessment					*-3,000*	
U.S.-Mexico Transboundary Aquifer Assessment					*-1,000*	
Focus Area Studies					*-1,600*	
Groundwater Models					*-869*	
Regional Groundwater Evaluations					*-789*	
Research and Development to Advance Water Science					*-4,325*	
Water Use – Cooperative Matching Funds					*-1,000*	
Water Use – Data and Research					*-1,500*	
Water Use – Unconventional Oil and Gas					*-250*	
Groundwater and Streamflow Information Program	**72,673**	**72,179**	**332**	**0**	**-7,596**	**64,915**
Administrative Savings					*-781*	
Water Tools					*-363*	
Cooperative Matching Funds – Tribal Waters					*-1,000*	
Groundwater Activities					*-3,752*	
U.S.-Canada Transboundary Streamgages					*-160*	
Research and Development to Advance Water Science					*-1,540*	
National Water Quality Program	**90,529**	**89,915**	**569**	**200**	**-21,028**	**69,656**
Administrative Savings					*-854*	
National Atmospheric Deposition Program					*-1,565*	
Enhanced Cooperative Activities and Urban Waters					*-717*	
National Park Service Cooperative Water Partnership					*-1,743*	
NAWQA Lower Mississippi Stream Quality Assessment					*-4,000*	
NAWQA Status and Trends Assessment					*-5,600*	
Research and Development to Advance Water Science					*-6,549*	
Water Resources Research Act Program	**6,500**	**6,456**	**0**	**0**	**-6,456**	**0**
Total, Water Resources	**214,754**	**213,296**	**1,188**	**200**	**-49,762**	**164,922**

Budget at a Glance (Dollars in Thousands)	2017 Actual	2018 Full Year CR	2019			
			Fixed Costs	Internal Transfers	Program Changes	Request
National Geospatial Program	**67,354**	**66,897**	**257**	**0**	**-16,276**	**50,878**
Administrative Savings					*-1,147*	
3DEP Data					*-7,329*	
3DEP Technical Support					*-2,757*	
Federal Geographic Data Committee					*-2,700*	
Geospatial Research					*-2,343*	
National Cooperative Geologic Mapping Program	**24,397**	**24,231**	**109**	**0**	**-1,950**	**22,390**
National Cooperative Geologic Mapping					*-1,950*	
Science Synthesis, Analysis and Research Program	**24,299**	**24,134**	**90**	**0**	**-5,214**	**19,010**
Biogeographic Science					*-2,357*	
USGS Libraries					*-2,857*	
Total, Core Science Systems	**116,050**	**115,262**	**456**	**0**	**-23,440**	**92,278**
Administration and Management	**81,981**	**81,424**	**1,316**	**0**	**-13,206**	**69,534**
Information Services	**23,630**	**23,470**	**62**	**0**	**-3,816**	**19,716**
Total, Science Support	**105,611**	**104,894**	**1,378**	**0**	**-17,022**	**89,250**
Rental Payments and Operations & Maintenance	**93,141**	**92,508**	**-243**	**0**	**12,954**	**105,219**
GSA Rent Adjustment and Support for Relocation of Menlo Park					*12,454*	
Support for Interior Reorganization					*500*	
Deferred Maintenance and Capital Improvement	**7,280**	**7,231**	**0**	**0**	**0**	**7,231**
Total, Facilities	**100,421**	**99,739**	**-243**	**0**	**12,954**	**112,450**
Total, Surveys, Investigations and Research	**1,085,167**	**1,077,798**	**4,980**	**0**	**-223,098**	**859,680**

Ecosystems

	2017	2018	2019				
	Actual	Full Year CR	Fixed Costs	Internal Transfer	Program Changes	Request	Change from 2018
Ecosystems	**159,732**	**158,647**	**664**	**-**	**(63,180)**	**96,131**	**(62,516)**
FTE	*892*	*892*	*-*	*-*	*(427)*	*465*	*(427)*
Status and Trends Program	**20,473**	**20,334**	**92**	**-**	**(9,101)**	**11,325**	**(9,009)**
FTE	*103*	*103*	*-*	*-*	*(60)*	*43*	*(60)*
Fisheries Program	**21,136**	**20,992**	**113**	**-**	**(11,404)**	**9,701**	**(11,291)**
FTE	*124*	*124*	*-*	*-*	*(74)*	*50*	*(74)*
Wildlife Program	**46,007**	**45,695**	**227**	**-**	**(12,482)**	**33,440**	**(12,255)**
FTE	*262*	*262*	*-*	*-*	*(76)*	*186*	*(76)*
Environments Program	**37,415**	**37,161**	**176**	**-**	**(12,768)**	**24,569**	**(12,592)**
FTE	*191*	*191*	*-*	*-*	*(82)*	*109*	*(82)*
Invasive Species Program	**17,330**	**17,212**	**56**	**-**	**(172)**	**17,096**	**(116)**
FTE	*77*	*77*	*-*	*-*	*-*	*77*	*-*
Cooperative Research Units	**17,371**	**17,253**	**-**	**-**	**(17,253)**	**-**	**(17,253)**
FTE	*135*	*135*	*-*	*-*	*(135)*	*-*	*(135)*

Through the Ecosystems Mission Area, the USGS provides scientific information and decision support to meet Interior's shared responsibility for land and species management, to fulfill treaty obligations with Tribes and foreign governments, to develop energy and mineral resources on Interior lands and the Outer Continental Shelf, and to supply water for irrigation and other human needs. USGS science protects and conserves the Nation's fish and wildlife heritage by bridging the gap between science and management for at-risk species and species of management concern. The USGS works with many partners to sustain the hunting, fishing, and wildlife-related recreation needs of the public by providing data, science research and monitoring that informs and supports the hunting and recreational fishing sectors that contribute $144 billion in expenditures and 480,000 American jobs (*2017 National Recreation Economy Report*, *Outdoor Industry Association*). The USGS identifies conservation measures designed to preclude the need for listing species as endangered or threatened; help listed species recover; prevent or control invasive species and wildlife disease outbreaks; and apply decision science so that management and policy actions are transparent and durable.

To address higher priorities, the USGS is not requesting funds for the Cooperative Research Units.

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Status and Trends

Dollars in Thousands	2017	2018	2019				
	Actual	Full Year CR	Fixed Costs	Internal Transfers	Program Changes	Request	Change from 2018
Status and Trends	**20,473**	**20,334**	**92**	**-**	**(9,101)**	**11,325**	**(9,009)**
Museum Collections					*(1,600)*		
Species-Specific Research					*(2,889)*		
Land and Water Management Research					*(4,333)*		
Administrative Savings					*(279)*		
FTE	**103**	**103**			**(60)**	**43**	**(60)**

The Status and Trends Program provides science, technology, and information that resource managers use to understand the current condition—or status—of plants, animals, and habitats under management responsibility of Interior bureaus and other Federal, State, and tribal partners. In addition, the Program collects, analyzes, and delivers data and information about past and potential future changes to species and habitats.

The 2019 budget request supports:

- Population assessments of Great Lakes forage fish used by States, Tribes, and provinces to manage a $7 billion commercial and recreational fishing industry.
- Population assessments of migratory birds used by National Flyway Councils to manage waterfowl hunting in the United States in cooperation with Canada and Mexico.
- Population assessments of North American bats to understand impacts of the invasive fungal disease white-nose syndrome on control of insects that threaten agriculture and human health.
- Maps of real-time and forecasted plant and animal activity used by resource managers to predict and manage invasive species, insect pests, wildlife disease, recreational opportunities, and habitats.
- Development of information and tools used by Federal and State agencies to assess, conserve, and enhance fish and wildlife habitat while facilitating energy development.

Justification of Program Changes

The request proposes the following to address higher priorities:

- Museum Collections (-$1,600,000 and -11 FTE)
- Species-Specific Research (-$2,889,000 and -20 FTE)
- Land and Water Management Research (-$4,333,000 and -29 FTE)

Additionally, the USGS will achieve $279,000 in administrative savings in this program.

Program Overview

This Program concentrates research efforts on two science priorities: timely and effective management of species, particularly those that cross-jurisdictional, migratory, or of management concern, and effective and efficient management of lands and waters, particularly habitats within protected areas that provide support to species of management concern.

The USGS provides data and information to support energy development across the West, including through the Wyoming Landscape Conservation Initiative, a long-term, science-based program focused on assessing, conserving, and enhancing fish and wildlife habitats while facilitating energy development through local collaboration and partnerships, and the Restoration Assessment and Monitoring Program, a USGS-led activity that strengthens restoration and rehabilitation outcomes executed by Interior and other agencies by providing science and guidance on effective strategies.

USGS population assessments of migratory birds are used by National Flyway Councils to manage waterfowl hunting in the United States in cooperation with Canada and Mexico. Bird hunting and bird watching activities are substantial contributors to the U.S. economy. The USGS Bird Banding Laboratory and North American Breeding Bird Survey provide support for the management of harvested migratory gamebird populations and produce science-based population data on more than 400 bird species in North America.

The North American Bat Monitoring Program is a multi-national, multi-partner program led by USGS, designed to better document and understand patterns, causes, and consequences of changes in bat populations at local to national scales.

The National Phenology Network produces and delivers maps of real-time and forecasted plant and animal activity used by resource managers to predict and manage invasive species, insect pests, wildlife disease, recreational opportunities, and critical habitats within National Parks and Wildlife Refuges. In 2019, the Network will develop and deliver real-time and short-term forecasts of the activity of vectors of disease, such as ticks and mosquitos, to support public safety.

Fisheries Program

Dollars in Thousands	2017	2018	2019				
	Actual	Full Year CR	Fixed Costs	Internal Transfer	Program Changes	Request	Change from 2018
Fisheries Program	**21,136**	**20,992**	**113**	**-**	**(11,404)**	**9,701**	**(11,291)**
Great Lakes Fisheries Assessment					*(250)*		
Species-Specific Fisheries Research					*(3,386)*		
Land and Water Management Research					*(5,989)*		
Unconventional Oil and Gas					*(1,000)*		
Contaminants Research					*(500)*		
Administrative Savings					*(279)*		
FTE	**124**	**124**	**-**	**-**	**(74)**	**50**	**(74)**

The program provides research, technological tools, and decision support to meet the science needs of the Nation's resource managers to conserve and protect aquatic species, communities, and habitats.

The 2019 budget request supports:

- Research and decision support tools to address the science needs of the Fish and Wildlife Service’s 7-year work plan to provide the best possible science for conservation for our Nation’s declining and imperiled aquatic species.

- Stock assessments of Great Lakes forage fish used by States, Tribes, and provinces to manage a $7 billion commercial and recreational fishing industry.

- Risk assessments and advanced tool development for discovery, surveillance, and control of fish diseases of cultured and wild fish managed by the Interior and other Federal, State, tribal, and international agencies.

Justification of Program Changes

The request proposes the following to address higher priorities:

- Great Lakes Fisheries Assessments (-$250,000 and -0 FTE)
- Species-Specific Fisheries Research (-$3,386,000 and -23 FTE)
- Land and Water Management Research (-$5,989 000 and -40 FTE)
- Unconventional Oil and Gas (-$1,000,000 and -7 FTE)
- Contaminants Research (-$500,000 and -4 FTE)

Additionally, the USGS will achieve $279,000 in administrative savings in this program.

Program Overview

The USGS Fisheries program provides research, technological tools, and decision support for resource managers in their efforts to conserve and protect aquatic species, communities, and habitats. Species management research encompasses threatened and endangered species, Interior trust species protected by law, sensitive species that are declining, rare, or uncommon that may be candidates for future listing consideration, and species of management concern identified by natural resource management agencies.

The USGS will support the Fish and Wildlife Service (FWS) for species identified in their 7-Year Listing Workplan to address key uncertainties in population status and habitat identification to inform listing decisions and pro-active and collaborative conservation between Interior and State Fish and Wildlife management agencies and other stakeholders and partners.

Under the 1954 Convention on Great Lakes Fisheries, the Department of the Interior is responsible for conducting a comprehensive research and monitoring program to support multi-jurisdictional recreational and commercial fisheries, tribal harvest, allocation decisions, and fish stocking activities. The USGS will continue to conduct research and develop new technologies to assess deep-water ecosystems, food webs, fish movement and behavior, fish population structure, and fish habitat to provide real-time information for management of this rapidly changing and internationally important fishery.

The USGS will continue to assess mass mortalities of economically and ecologically important fish species such as salmon, sturgeon, trout, and whitefish from disease outbreaks in freshwater systems and Interior hatcheries across the Nation. This work will enhance biosurveillance of fish diseases by improving information and data delivery on monitoring and species occurrences through field research, online databases and information systems; advance our understanding of the complex interactions that determine disease outbreaks including temperature and streamflow; and deliver decision-support science. The USGS has a long history of conducting on-the-ground disease surveillance, investigating fish die-offs, and developing new diagnostic tests and mitigation tools used by numerous partners across the United States.

The FWS uses these to minimize disease in hatchery-raised fish released to the wild and Bureau of Reclamation uses these to understand the impacts of water management and environmental conditions on fish.

In the Pacific Northwest, the USGS is investigating Infectious Hematopoietic Necrosis Virus (IHNV), which causes acute disease in juvenile Pacific salmonid species and recently completed a comprehensive study to determine the spatial and temporal patterns of IHNV in the Pacific Northwest. The USGS is addressing mass mortalities from disease of returning salmon stocks and resident native species like sturgeon in the Columbia River. By understanding these patterns and processes, USGS science is being used by managers to take actions to improve the health of threatened or endangered fish populations.

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Wildlife Program

Dollars in Thousands	2017	2018	2019				
	Actual	Full Year CR	Fixed Costs	Internal Transfer	Program Changes	Request	Change from 2018
Wildlife Program	**46,007**	**45,695**	**227**	**-**	**(12,482)**	**33,440**	**(12,255)**
Whooping Crane Propagation					*(1,500)*		
Species-Specific Wildlife Research					*(6,599)*		
Amphibian Research and Monitoring					*(1,754)*		
Arctic					*(1,600)*		
Contaminants Research					*(500)*		
White Nose Syndrome					*(250)*		
Administrative Savings					*(279)*		
FTE	**262**	**262**	**-**	**-**	**(76)**	**186**	**(76)**

The Wildlife program provides research, management tools, and decision support for resource managers in their efforts to conserve and protect wildlife species and their habitats.

The 2019 budget request supports:

- Surveys and investigations on waterfowl ecology and populations to help maintain a sustainable waterfowl harvest. Wildlife agencies use this work to establish hunting regulations through the National Flyway Councils, supporting the $3.0 billion waterfowl hunting industry.
- Development of scientific information and tools for use in the design and siting of energy, transportation, and other infrastructure to reduce conflict with wildlife and streamline development.
- Research and decision support tools to address the science needs of the Fish and Wildlife Service's 7-year work plan in order to provide the best possible science for conservation.
- Surveillance, diagnostic support, and source tracking of wildlife diseases such as avian influenza and development of tools for early detection, risk assessment and management of diseases such as chronic wasting disease in large game species such as deer and elk.

Justification of Program Changes

The request proposes the following to address higher priorities:

- Whooping Crane Propagation (-$1,500,000 and -5 FTE)
- Species-Specific Wildlife Research (-$6,599,000 and -44 FTE)
- Amphibian Research and Monitoring (-$1,754,000 and -12 FTE)
- Arctic (-$1,600,000 and -11 FTE)

- Contaminants Research (-$500,000 and -3 FTE)
- White Nose Syndrome (-$250,000 and -1 FTE)

The USGS plans to achieve $279,000 in administrative savings within this program.

Program Overview

The Wildlife Program maintains a particular focus on Interior trust responsibilities and law. USGS science spans all aspects of wildlife biology needed by Interior and other Federal, State, and tribal managers to make informed, cost-effective, and balanced decisions of economic, social, ecological, and cultural importance. The Wildlife program provides research, management tools, and decision support for resource managers in their efforts to conserve and protect wildlife species and their habitats. USGS scientists conduct studies on life history, population ecology, and conservation and restoration strategies for at-risk species, Federal and State listed species, migratory species, interjurisdictional species, and the habitat requirements of those resources. These investigations lead to more effective and viable conservation actions that reduce the need for formal listing and support the goal of down-listing or delisting. Research includes development and application of advanced technologies such as remote sensing and molecular genetics to assess population status and health.

The USGS conducts research on imperiled species and species of conservation concern in order to provide the best possible science for conservation for our Nation's wildlife and terrestrial species. The USGS researches numerous bird species, including game and non-game species. State agencies rely on USGS population studies to determine sustainable harvest levels, and FWS and other Federal bureaus make use of our science in their management obligations under the Migratory Birds Treaty Act.

Interior has management responsibilities for manatees, sea otters, walrus, and polar bears. The USGS maintains robust research portfolios on all four species, including long-term datasets of population levels, animal movements, and habitat interactions. USGS science has been pivotal in recent Endangered Species Act determinations, such as the FWS's decisions not to list walrus and to downlist manatees from Endangered to Threatened.

The USGS developed a new automated assessment approach, called the disturbance automated reference toolset to help resource managers assesses patterns in ecological recovery from energy development in the Southwest. This approach incorporates satellite imagery, digital soil mapping, predictive ecological modeling, and field assessments to evaluate the level of vegetation growth.

The USGS continues work to research wildlife diseases such as avian Influenza and chronic wasting disease.

Environments Program

Dollars in Thousands	2017	2018	2019				
	Actual	Full Year CR	Fixed Costs	Internal Transfer	Program Changes	Request	Change from 2018
Environments Program	**37,415**	**37,161**	**176**	**-**	**(12,768)**	**24,569**	**(12,592)**
Ecosystems Services					*(1,000)*		
Chesapeake Bay					*(3,700)*		
Everglades					*(5,850)*		
Southwest Desert					*(450)*		
California Bay-Delta					*(800)*		
Landscapes (Forest, Mountains, Rivers)					*(689)*		
Administrative Savings					*(279)*		
FTE	**191**	**191**	**-**	**-**	**(82)**	**109**	**(82)**

The USGS Environments Program helps land managers within Interior bureaus and other Federal, State, and tribal partners understand the relationships between resource management actions (or no action) and fish and wildlife trust resources.

The 2019 budget request supports:

- Science to inform decisions about planning, managing, and using coastal areas for purposes as varied as resource management, economic development, and hazard mitigation.
- Research and decision support tools to manage Interior lands to reduce the risks of fire, invasive species, wildlife disease, and harmful algal blooms.
- Decision support tools and information on the most cost-effective and successful land and water conservation and restoration practices to support Interior lands and trust responsibilities.
- Science and tools to identify habitat required to maintain target populations of federally listed species, candidate species, migratory species, and other species of management concern.
- Cutting-edge information and tools to help land managers make decisions about energy development on public lands and responsibly manage public lands for abundant trust resources.

Justification of Program Changes

The request proposes the following to address higher priorities:

- Ecosystem Services (-$1,000,000 and -6 FTE)
- Chesapeake Bay (-$3,700,000 and -25 FTE)
- Everglades (-$5,850,000 and -39 FTE)

- Southwest Desert (-$450,000 and -3 FTE)
- California Bay-Delta (-$800,000 and -5 FTE)
- Landscapes (Forests, Mountains, and Rivers) (-$689,000 and -4 FTE)

The USGS plans to achieve $279,000 in administrative savings within the program.

Program Overview

This program supports efforts to: manage energy and mineral development on public lands; manage lands to provide abundant species for fishing, hunting, and recreation; implement pre-listing land and water management efforts to preclude species from becoming listed under the Endangered Species Act; and getting threatened and endangered species down listed or delisted. It also help Interior land managers predict wildfire risk and behavior by understanding fuel loads and treatments, assess the risk for landslides, air and water quality impacts post-fire, and determine the most cost-effective and/or least impactful land and water management and restoration alternatives.

Mortality due to vehicle collisions can be a major contributor to survivorship in some wildlife populations and is an economic and safety issue for the public. The USGS has been working to develop tools and data products that improve the ability to estimate habitat quality, connectivity, and identifying patterns in animal movement. With increasing visitor use of parks and expanding road networks to accommodate population growth, the USGS is helping managers more accurately identify areas where roads present a barrier to animal movement and the features of crossing structures that particular species will likely use.

Protecting endangered species while managing economically important species is an ongoing natural resource management challenge. In the Colorado River, the rainbow trout sport fishery is desired within the Glen Canyon National Recreation Area but not downriver in the Grand Canyon National Park where it negatively affects the endangered humpback chub. The USGS developed a biological/economic model to identify optimal strategies and economic and biological tradeoffs when controlling rainbow trout to achieve adult humpback chub population goals in the Grand Canyon. This ongoing research will provide managers the information they need to manage endangered native species and economically important nonnative species using economically efficient approaches. The USGS biological/economic framework is also applicable to different natural resource management challenges in complex social-ecological systems.

Research and decision support tools (e.g., models, statistics, maps) development is focused on land management to reduce the risk of fire, drought, invasive species, disease, and other threats. For example, research informing the management of fuel loads and prediction of post-fire health, safety, and economic risks. In addition, research to inform the management and restoration of lands and waters to minimize conditions favoring the spread or establishment of invasive species and wildlife disease, and test management practices to reduce harmful algal blooms.

Invasive Species Program

Dollars in Thousands	2017	2018	2019				
	Actual	Full Year CR	Fixed Costs	Internal Transfer	Program Changes	Request	Change from 2018
Invasive Species	**17,330**	**17,212**	**56**	**-**	**(172)**	**17,096**	**(116)**
Administrative Savings					*(172)*		
FTE	**77**	**77**	**-**	**-**	**-**	**77**	**-**

The Invasive Species Program provides essential research, management tools, and decision support to meet the science needs of resource managers to reduce or eliminate the threat of invasive species and wildlife disease. USGS programs studying biological threats focus on research, monitoring, and technology development for the containment or eradication of invasive species across the Nation, with recent work encompassing Asian carp, Burmese python, brown tree snakes, and tegu.

The 2019 budget request supports:

- Delivering data to the Federal and State managers and the public on distribution of aquatic invasive species through a Web-based platform that serves as an early warning and alert system for new invasions with tools to identify potential invaders after large storm events.

- Technical expertise and capacity to rapidly respond to new invasions, including testing chemical controls to facilitate rapid response to new zebra and quagga mussel infestations and identifying reptile species to aid State partners responding to new infestations.

- Testing and refining new molecular and remote sensing technologies including environmental DNA (eDNA), drones, and infrared remote sensing to identify invasive species early in an invasion when chances of eradication success are highest.

- Supporting early detection and rapid response for invasive reptiles such as Burmese pythons and Argentine black and white tegus in Florida, boa constrictors in the Virgin Islands, and brown treesnakes on Guam, including the Brown Treesnake Rapid Response Team.

- Species-specific controls for invasive plants and animals to minimize application costs and ecological effects of treatments including targeted chemicals for Asian carp and zebra and quagga mussels, pheromones (chemical substances) for sea lamprey, and microbes to control mosquitoes, common reed, and cheatgrass.

- Providing data and technical expertise to reduce the economic and ecologic impacts of salt cedar, cheatgrass, buffelgrass, and other invasive plants throughout the West.

- Improving the power of early detection tools, developing containment and control methodologies such as carbon dioxide barriers, targeted chemical controls, and integrated management strategies as part of the intergovernmental team preventing the spread of Asian carp into the Great Lakes and reducing their effects elsewhere in the Nation.

Justification of Program Changes

The USGS plans to achieve $172,000 in administrative savings within the program.

Program Overview

The USGS Invasive Species Program develops tools, technologies, and decision support systems to detect, monitor, assess risk, and control aquatic and terrestrial invasive species including invasive wildlife diseases for the Nation and Department of the Interior bureaus. The Invasive Species Program provides essential research, management tools, and decision support to meet the science needs of the Nation's resource managers in their efforts to reduce or eliminate the threat of invasive species and wildlife disease. USGS programs studying biological threats focus on research, monitoring, and technology development for the containment or eradication of invasive species across the Nation, with recent work encompassing Asian carp, Burmese Python, Brown tree snakes, and tegu.

USGS scientists developed and refined molecular tools and approaches for Asian carp detection such as loop-mediated isothermal amplification, digital and quantitative polymerase chain reaction, and high-throughput sequencing. USGS scientists have developed and continue to test containment and control tools and technologies and investigate options for combined implementation of tools using an integrated adaptive management approach for Asian carp.

Burmese pythons have become widespread in south Florida, including large portions of the Everglades. Pythons affect many native species, including American alligators, through competition and predation. Primary goals of USGS research is to improve the understanding of python impacts to native ecosystems, and develop tools to track and remove reptile invaders, including telemetry, isotopic analysis, and eDNA. The USGS is working to prevent invasive Argentine tegu lizards from expanding into Everglades National Park by developing and deploying high-efficiency traps that have resulted in the removal of hundreds of these large omnivorous lizards from just outside the park.

The USGS conducts multi-scale, integrated assessments to map infestations and accurately monitor the spread of invasive plants in the West to predict areas most vulnerable to invasive species, assess the effects of management practices and natural disturbances on invasive species, evaluate how invasive plants alter the frequency and intensity of wild fires; and improve methods to restore public rangelands affected by invasion of terrestrial plants.

The USGS conducts research and develops tools and technologies to control invasive species that cause economic and ecologic harm in the Great Lakes, including sea lamprey, zebra and quagga mussels, and invasive reeds. These technologies are being transferred to other regions of the United States to combat similar invasions, such as zebra and quagga mussels in the Pacific Northwest.

Tracking the establishment and spread of existing and new invasive species is critical to reducing their incurred costs. The USGS helps to optimize traditional monitoring methods and develops new tools, particularly molecular techniques, to assist in the early detection. USGS research focuses on developing and enhancing capabilities to forecast and predict invasive species establishment and spread. Early detection helps resource managers identify and report new invasive species while they are still in very low abundance and containment and eradication costs are minimized. USGS research improves existing invasive species control methods and develops and tests new chemical, physical, molecular, and biological methods of control, including gene silencing, microbial symbionts, and other innovative technologies. A focus of USGS research is to integrate control strategies where applicable to empower land and water managers to respond rapidly to a wide variety of new invasions across the United States.

Land Resources

Dollars in Thousands	2017	2018	2019				
	Actual	Full Year CR	Fixed Costs	Internal Transfer	Program Changes	Request	Change from 2018
Land Resources	**[149,275]**	**[148,261]**	**434**	**148,261**	**(45,453)**	**103,242**	**(45,019)**
FTE	*412*	*412*	-	-	*(163)*	*249*	*(163)*
National Land Imaging	**[85,794]**	**[85,211]**	**153**	**85,211**	**(9,850)**	**75,514**	**(9,697)**
FTE	*148*	*148*	-	-	*(52)*	*96*	*(52)*
Land Change Science	**[38,146]**	**[37,887]**	**54**	**37,887**	**(23,202)**	**14,739**	**(23,148)**
FTE	*201*	*201*	-	-	*(93)*	*108*	*(93)*
National and Regional Climate Adaptation Science Centers	**[25,335]**	**[25,163]**	**227**	**25,163**	**(12,401)**	**12,989**	**(12,174)**
FTE	*63*	*63*	-	-	*(18)*	*45*	*(18)*

The Land Resources programs deliver scientific data, techniques, analyses, and tools that advance the Nation's understanding of landscapes, the forces that shape them, and interactions of plants, animals, and people that live within them to understand risks to affiliated national interests. The programs' scientists and engineers are world leaders in the research, monitoring, and remote sensing necessary to understand and detect changes that affect land resources and processes that support economic growth and societal well-being. USGS data and products provide a scientific foundation for decisions concerning the management of and investments in natural and built landscapes, and how they might be adapted to secure the Nation's interests.

Technical Change

The 2019 USGS budget continues a restructuring proposed in the 2018 President's budget. The restructure underscores an alignment of remotely-sensed image data products with field-based research to deliver scientific research and products needed to classify and examine land resources; associated products and services of national and regional interest; and information on the changes and their impacts occurring in each of these focus areas over time.

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National Land Imaging Program

Dollars in Thousands	2017	2018	2019				
	Actual	Full Year CR	Fixed Costs	Internal Transfer	Program Changes	Request	Change from 2018
National Land Imaging	**[85,794]**	**[85,211]**	**153**	**85,211**	**(9,850)**	**75,514**	**(9,697)**
Transfer from Land Remote Sensing				*85,211*			
Research and Investigations					*(5,351)*		
National Civil Applications Center					*(4,814)*		
Remote Sensing State Grants[1]					*(1,207)*		
Satellite Operations					*(11,905)*		
Landsat 9 Ground System					*14,100*		
Administrative Savings					*(673)*		
Satellite Operations – *non-add*	**[71,237]**	**[70,753]**	**-**	**[70,753]**	**[2,195]**	**[72,948]**	**[(2,195)]**
FTE	**148**	**148**	**-**	**-**	**(52)**	**96**	**(52)**

The National Land Imaging (NLI) program delivers remote sensing observation capacity, data, and research to inform land and resource managers around the Country while improving understanding of how landscapes and associated natural resources are changing at global and regional scales.

The 2019 request supports:

- Continued development of Landsat 9 ground and flight systems in collaboration with the National Aeronautics and Space Administration (NASA) toward a launch in fiscal year 2021.
- Continued operation of Landsat 7 and Landsat 8 satellites, typically collecting over 1,000 scenes per day (each scene covers over 12,000 square miles) to monitor water use, moisture content in soil and vegetation, and provide valuable insight on terrestrial surface conditions.
- Continue to implement the Land Change Monitoring, Assessment, and Projection (LCMAP) suite of utilities that would allow users to examine past land surface conditions, reconstruct trends, identify land change as it occurs, develop land cover products with greater automation, and project future conditions.
- Continue investigation and adaptation of unmanned aircraft technology to support many science needs (e.g., surface water dynamics, groundwater surveys, coastal erosion, fault line surveys, microclimate studies, wildlife surveys, coal mine reclamation, harmful algal blooms) in areas difficult to access, at lower human risk and at lower cost than traditional methods.

[1]Formerly called the AmericaView Grant program

Justification of Program Changes

Landsat 9 Ground System Development (+$14,100,000 and 0 FTE): The 2019 budget requests builds on the 2018 President's budget request, which includes $26.7 million for Landsat 9 ground systems development. To keep pace with the planned launch, the USGS would use $32.0 million in satellite operations. This funds development of multiple mission operation elements, procurement of hardware and software for the ground system, and completes ramp-up of the flight and ground operations teams. This keeps the USGS on track with NASA for key milestones.

The request proposes the following to address higher priorities:

- Satellite Operations (-$11,905,000 and -4 FTE)
- Research and Investigations (-$5,310,000 and -17 FTE)
- National Civil Applications Center (-$4,847,000 and -31 FTE)
- Remote Sensing State Grants[2] (-$1,215,000 and 0 FTE)

The USGS plans to achieve $673,000 in administrative savings within the program.

Program Overview

The NLI program delivers remote sensing observation capacity, data, and research to inform land and resource managers around the Country while improving understanding of how landscapes and associated natural resources are changing at global and regional scales. The USGS directly and in coordination with operators of other satellites and Earth-imaging platforms, collects, archives, processes and distributes a broad array of data from near-Earth and satellite-based remote sensing platforms. The NLI program also manages the USGS partnership with the NASA for the Sustainable Land Imaging program, ensuring that both agencies work together to maintain the Nation's land remote sensing capabilities.

The USGS operates Landsat 7 and Landsat 8 satellites, typically collecting over 1,000 scenes per day (each scene covers over 12,000 square miles). Landsat is the only operational civil satellite with both thermal and short wave infrared sensors, used extensively in water and agricultural management. These types of sensors allow users to monitor water use, discriminate moisture content of soils and vegetation, and estimate heat temperatures in urban areas. Landsat 9 is the follow-on mission to Landsat 8, and direct replacement for Landsat 7, ensuring the continuation of the four-decade collection of Landsat multi-spectral imagery across the Earth's land surfaces and supporting near-weekly Landsat revisit for hundreds of land cover applications supporting tens of thousands of research and operational users across the Nation.

The USGS's Earth Resources Observation and Science (EROS) Center near Sioux Falls, SD, performs the satellite operations and image data collection, archiving, processing, and distribution. In its National Satellite Land Remote Sensing Data Archive, EROS houses nearly seven million Landsat satellite scenes acquired globally since 1972. In its Long Term Archive for aerial photos and geospatial data, EROS houses over six million high-definition aerial mapping photos of U.S. sites, some dating to 1937.

[2] formerly AmericaView Grant program

The NLI program coordinates application of Unmanned Aircraft Systems activities, providing scientists ways to look longer, closer, and more frequently at some of the Earth's most remote locations, previously too expensive or dangerous to monitor closely, such as the interior of volcanos or the depths of coalmines.

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Land Change Science Program

Dollars in Thousands	2017	2018	2019				
	Actual	Full Year CR	Fixed Costs	Internal Transfer	Program Changes	Request	Change from 2018
Land Change Science Program	**[38,146]**	**[37,887]**	**54**	**37,887**	**(23,202)**	**14,739**	**(23,148)**
Transfer from Carbon Sequestration				*8,898*			
Transfer from Climate R&D				*19,164*			
Transfer from Land Change Science				*9,825*			
Carbon Sequestration					*(8,898)*		
Landscape Science					*(2,339)*		
Climate R&D					*(9,818)*		
Ecosystem Modelling & Decision Support					*(1,154)*		
Remote Sensing of Vegetation and Water					*(993)*		
FTE	**201**	**201**			**(93)**	**108**	**(93)**

The Land Change Science program (LCS) delivers research, investigations, models, and applications that provide the scientific bases for land use decisions affecting the safety of communities, economic prosperity, and the natural resources of the Nation.

The 2019 request supports:

- Expanding compilation of continental-scale synthesis of natural patterns of drought and impacts on terrestrial and aquatic communities and natural resources to include the entire Holocene period (last 11,700 years). Results will improve capabilities to anticipate future changes in water availability and the impacts of long-term seasonal changes on society, agriculture, and ecosystems.

- Building upon new methods published in 2018 to consistently measure the ice mass balance (the volume of water contained in glaciers) in benchmark glaciers of Alaska and the Pacific Northwest, continue development of techniques to integrate radar remote sensing data with field observations to improve mass balance estimates across entire glaciers. This will improve assessments of the potential impacts of glacier change on water availability to downstream communities and habitats.

- Updating the National Land Cover Database (NLCD) to track land cover change from 1992 through 2016. Currently, the database identifies changes through 2011. This will provide resource managers recent information to support resource management plans and assessments.

Justification of Program Changes

The request proposes the following to address higher priorities:

- Carbon Sequestration (-$8,898,000 and -37 FTE)

- Landscape Science (-$2,339,000 and -4 FTE)

- Climate Research and Development (-$9,818,000 and -44 FTE)
- Ecosystem Modelling and Decision Support (-$1,154,000 and -4 FTE)
- Remote Sensing of Vegetation and Water Linkages (-$993,000 and -4 FTE)

Program Overview

The program's science improves understanding of the forces that shape landscapes and their potential uses and provides data to help distinguish between land surface change resulting from natural forces and those associated with land management. This research provides data to understand how natural disturbances (such as droughts, fire, and sea level change) and land use changes (such as urbanization, agriculture, and water management) affect the composition, distribution, and functioning of land and natural resources. Research products and technical methods produced by the program helps decision makers apply the knowledge and data gained from on-the-ground and remote sensing observation systems to land use planning, natural resource management, and adaptation planning decisions.

The USGS will continue analyzing and interpreting continental-scale synthesis of natural patterns of drought and impacts on terrestrial and aquatic communities and natural resources. Based on evaluation of existing datasets from earlier time intervals, key periods of change will be identified for more analyses. Results will improve capabilities to anticipate future changes in water availability across the Nation and the impacts of long-term seasonal changes on society, agriculture, and ecosystems.

The program studies land use and land cover change at multiple scales, documenting the geographic variability of change and defining the environmental, social, technological, and political drivers of change, as well as assessing the impacts of these changes. This includes studying long-term changes in land cover associated with climate variability, fire disturbance, and land management activities. The USGS uses this information to develop spatially explicit models of the impacts of these changes on ecosystem extent and function, and the services they provide.

One product of LCS research is the NLCD, which serves as the definitive Landsat-based, high-resolution, land cover database for the Nation. It provides spatial reference and descriptive data for characteristics of the land surface such as the location and extent of urban, agriculture, and forest systems, percent impervious surface, and percent tree-canopy cover. The NLCD supports a wide variety of Federal, State, local, tribal, and nongovernmental applications that seek to assess ecosystem status and health, understand the patterns of biodiversity, predict economic effects of land use decisions and climate fluctuations, and develop land management policy.

In fiscal year 2019, the USGS plans to incorporate methodologies developed as part of the LCMAP project to improve the accuracy of the NLCD. It will also enable the NLCD to update land cover datasets every two years, as opposed to the current five-year cycle. The LCS will continue developing automated methods and tools supporting near real-time, satellite-based, drought monitoring. Assessed characteristics would include soil moisture, evapotranspiration rates, vegetation drought response, and other metrics of drought impacts on natural and agricultural systems, thus helping water managers effectively allocate scarce water resources.

The program also maintains the Hazard Exposure Reporting and Analytics (HERA) dynamic Web application, created to provide a platform that makes research on community exposure to coastal-flooding hazards influenced by sea-level rise accessible to planners, decision makers, and the public in a manner that is both easy to use and intuitive. HERA aims to help individuals and organizations to design better mitigation and adaptation strategies for coastal hazards.

Land-change simulation modelling of projected future development serves as an exploratory tool aimed at helping local governments understand the hazard-exposure implications of community growth and to include this knowledge in risk-reduction planning.

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National and Regional Climate Adaptation Science Centers

Dollars in Thousands	2017	2018	2019				
	Actual	Full Year CR	Fixed Costs	Internal Transfer	Program Changes	Request	Change from 2018
National and Regional Climate Adaptation Science Centers	**[25,335]**	**[25,163]**	**227**	**25,163**	**(12,401)**	**12,989**	**(12,174)**
Arctic					*(500)*		
Climate Adaptation for Tribes					*(500)*		
Realign Climate Adaptation Science Centers					*(10,728)*		
Administrative Savings					*(673)*		
FTE	**63**	**63**	**-**	**-**	**(18)**	**45**	**(18)**

The National and Regional Climate Adaptation Science Centers (NRCASCs) deliver the science to help fish, wildlife, water, land, and people anticipate, plan for, and adapt to a changing environment. The 2019 request would consolidate centers, refocusing work on the highest priority needs of Interior bureaus and partners.

The 2019 request supports:

- Science to understand the implications of land and climate change on drought, flooding, wildfire, and other extreme events; coastal resources; invasive species; high priority species, communities, and ecosystems; and maintaining sustainable harvests of fish and wildlife.
- Exchanging information between scientists and managers to support successful adaptation.
- Synthesizing data and developing tools to support decision makers to ensure that information meets the unique needs of managers.

Justification of Program Changes

The request proposes the following to address higher priorities:

- Arctic (-$500,000 and -4 FTE)
- Climate Adaptation Science for Tribes (-$500,000 and -4 FTE)
- Realign Climate Adaptation Science Centers (-$10,728,000 and -10 FTE)

The USGS plans to achieve $673,000 in administrative savings within the program.

Program Overview

The Centers provide information, tools, and applications to help resource managers meet current and emerging challenges that threaten the sustainability of natural resources. They focus on a better understanding of the implications of changing climate on invasive species, high priority species,

communities, and ecosystems; increase understanding of the uncertainties associated with models; and advance the design of adaptation strategies. They likewise serve as an interface between Federal researchers, land managers, and front line stewards of natural and cultural resources.

The scientific work done within NRCASCs is responsive to the following guiding principles:

- Meets the needs of resource managers.
- Prioritizes evaluation, translation, and synthesis of climate-impact research findings.
- Promotes rigorous and integrated research to advance fundamental understanding of climate impacts to fish and wildlife resources.
- Develops approaches to ensure broad dissemination of results to the public and foster professional scrutiny, critique, and learning.
- Promotes institutional efficiencies through partnerships to avoid duplication of effort and leveraging opportunities in climate-impact research.

Strategic science planning at the Centers begins with input from fish and wildlife management partners. Each regional science center has a Stakeholder Advisory Committee with representatives from various Department of the Interior bureaus, other State and Federal agencies, and tribal governments.

Energy and Mineral Resources

Dollars in Thousands	2017	2018	2019				
	Actual	Full Year CR	Fixed Costs	Internal Transfer	Program Changes	Request	Change from 2018
Energy and Mineral Resources	**94,311**	**93,671**	**442**	**(200)**	**(9,808)**	**84,105**	**(9,566)**
FTE	*548*	*548*	*-*	*-*	*(108)*	*440*	*(108)*
Mineral Resources Program	**48,371**	**48,043**	**301**	**-**	**9,882**	**58,226**	**10,183**
FTE	*301*	*301*	*-*	*-*	*4*	*305*	*4*
Energy Resources Program	**24,695**	**24,527**	**141**	**-**	**1,211**	**25,879**	**1,352**
FTE	*128*	*128*	*-*	*-*	*7*	*135*	*7*
Environmental Health Programs	**21,245**	**21,101**	**-**	**(200)**	**(20,901)**	**-**	**(21,101)**
FTE	*119*	*119*	*-*	*-*	*(119)*	*-*	*(119)*

The Energy and Mineral Resources Mission Area conducts scientific research, completes energy and mineral resource assessments, and compiles information and statistics on the worldwide supply and flow of minerals and materials essential to our economy and national security.

Energy and mineral resources are critical components of the Nation's economy. The United States is currently 100 percent dependent on foreign nations for 20 different mineral commodities, including several that are critical for national security. The Nation depends on energy to power homes and businesses, as well as minerals to manufacture products such as cell phones, laptops, and cars and renewable energy technologies. As demands for energy and mineral resources grow, USGS research and assessments become increasingly critical for understanding the occurrence, quality, supply, and use of national and global resources. The in-depth science provided by the USGS Energy and Mineral Resources Mission Area informs strategic, evidence-based economic and geopolitical decisions and facilitates responsible natural resource development.

To address higher priorities, the USGS is not requesting funds for Environmental Health programs. The budget includes an internal transfer from Environmental Health to Water Resources, National Water Quality Program of $200,000 and one FTE supporting research on harmful algal blooms and harmful algal toxin issues in water bodies throughout the Nation.

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Energy Resources Program

Dollars in Thousands	2017	2018	2019				
	Actual	Full Year CR	Fixed Costs	Internal Transfer	Program Changes	Request	Change from 2018
Energy Resources Program	**24,695**	**24,527**	**141**	**-**	**1,211**	**25,879**	**1,352**
Energy Research and Assessments					*1,598*		
Administrative Savings					*(387)*		
FTE	**128**	**128**	**-**	**-**	**7**	**135**	**7**

The USGS Energy Resources Program (ERP) is the sole provider of publicly available estimates of geological energy resources for the United States (exclusive of the U.S. Outer Continental Shelf), and provides publicly available estimates related to global oil and gas resources. The geologic energy resources that the ERP studies are: oil (including shale and heavy oil), natural gas, coal, coalbed methane, gas hydrates, geothermal resources, and uranium. ERP science informs decision making related to domestic and foreign energy resources, as well as the management of energy resources on Federal lands.

The 2019 request supports:

- Release additional USGS assessments of undiscovered, technically recoverable oil and gas resources in U.S. and non-U.S. basins. Continue the underlying geological, geophysical, and geochemical research that underpins the assessments.
- Continue to lead an interagency effort (with BLM and BOEM) in support of Secretarial Order 3352 to update assessments of Alaska North Slope oil and gas resource potential.
- Continue research into geothermal resources aimed at improving the viability of Enhanced Geothermal Systems and studying environmental impacts of geothermal energy development on Federal lands.
- Support USGS gas hydrate studies with the USGS Coastal/Marine Hazards and Resources Program, and contribute to DOE- and industry-sponsored cooperative gas hydrate projects.

Justification of Program Changes

Energy Research and Assessments (+$1,598,000 and +7 FTE): The goals of this work are to complete and publish an assessment methodology; conduct a national assessment of recoverable oil and associated CO_2 storage that is expected in future CO_2-enhanced oil recovery operations; and publish the assessment results. In addition, this will allow for a limited amount of research on improving the geologic and technical foundation of CO_2 storage in various geologic basins. Improved understanding of the applicability of CO_2-enhanced oil recovery will contribute to more efficient hydrocarbon development, helping fulfill the Administration's goal of energy dominance.

The USGS plans to achieve $387,000 in administrative savings within the program.

Program Overview

This program provides the publicly available data and tools to inform energy policy discussions and to support science-based decisions that facilitate an all-of-the-above approach to energy development and responsible use of resources. It also invests in innovation, from research to enable and improve assessments of current energy resources to understanding and assessing the potential for transformative new energy resources.

The ERP assesses oil and gas resource potential through in-depth studies of geology and resources in various petroleum provinces throughout the United States. Studies of the geologic, geophysical, and geochemical framework of these areas allows for better understanding of the resource potential and environmental impacts of oil and gas development.

USGS assessments of oil and gas resources are highly relevant to energy policy, especially as recovery processes such as directional drilling and hydraulic fracturing have become widespread in the United States. ERP resource assessments are widely used by a variety of stakeholders including local, State and Federal governments, land resource managers, and the public. ERP products are utilized by the U.S. Energy Information Administration (EIA) as the basis for computing reserve estimates for various basins in the United States and globally.

In 2017, in light of recent significant industry discoveries and in response to Secretarial Executive Order 3352, the USGS initiated of a multi-bureau effort (with BLM and BOEM) to assess the North Slope of Alaska resource potential. The USGS continues collaborations with the Geological Survey of Canada to improve the understanding of the geologic framework from eastern Arctic Alaska through the Mackenzie Delta and into the southern passive margin of the Canadian Arctic Islands (including petroleum systems elements).

In 2019, the program will support petroleum research and assessments of:

- Alaska North Slope 1002 Area
- San Juan Basin of New Mexico and Colorado
- Utica Shale in the Appalachian Basin
- Denver Basin of Colorado
- Wyoming Thrust Belt of Utah and Wyoming
- Southwest Wyoming Province
- Mesaverde Formation in the Uinta Basin of Utah
- Eastern Great Basin of Nevada and Utah.

Because there is currently no global unconventional oil and gas resource assessment, the USGS has made this a priority and is continuing to publish assessments of conventional and unconventional oil and gas resources from regions around the world. The completion of global resource assessments helps underpin the Nation's understanding of domestic and foreign energy supplies as the economy, national security and standard of living of the United States depends on adequate and reliable supplies of energy.

In 2019, the ERP will release an updated assessment of global petroleum resources. Global assessments will include the East and West Barents Sea Basins, the West Siberia Basin of Russia, the West Greenland-East Canada Basin, the McKenzie Delta of Canada, and Arctic Canadian Basins.

The USGS conducts early-stage research on the geologic processes forming energy resources and the geologic setting of these resources to enable and improve assessments of current national and global coal, oil, and gas resources. Accurate and scientifically based assessments of coal, oil, and gas resources of the Nation and world are dependent upon this geologic information.

The work of the USGS in geologic process and resource characterization also provides a scientific basis to evaluate the potential contributions to future energy supplies from currently used energy resources and from emerging resources such as gas hydrates, and for understanding the economic viability and potential environmental factors associated with resource development and use. For example, geochemical research helps to explain how oil and gas are generated, how they migrate out of source rocks, and how they accumulate and are preserved in reservoir rocks. Predictive models developed from this research aid in predicting the type, timing, and migration patterns of hydrocarbon generated. As an example, USGS research on the Nanushuk and Torok formations in Alaska, completed in 2017, forms the basis for the hydrocarbon resource assessments of the Alaska North Slope.

Understanding the potential for further diversifying our energy portfolio by harnessing our Nation's renewable and alternative energy potential is important for informed decision making that takes into account the resulting effects on our economy and environment. In 2019, the ERP will support studies to develop, test, and deploy miniature unmanned aerial systems to perform future thermal infrared (or "heat mapping") studies to monitor changes associated with a potential expansion in geothermal production.

USGS research in alternative energy sources also includes uranium resource evaluations that are collaborative with other programs. Domestic sources of uranium may be abundant but have not been comprehensively assessed since the mid-1990s.

Gas hydrate research is an USGS investment in understanding future energy supplies. In 2019, the ERP will:

- Provide personnel and resources to conduct field and laboratory analyses of material recovered by conventional and pressure core systems, and partner in the synthesis of data from logging, direct sampling, and geophysical and geologic characterization studies, in support of an Alaska gas hydrate production test well project.

- Conduct a new Alaska North Slope gas hydrate assessment.

- Continue to contribute to developing the operational plan in support of the International Ocean Discovery Program sponsored Expedition 386, which consists of a program of five drilling locations in the northern Gulf of Mexico, scheduled for the spring of 2020, whereby the physical and engineering properties of gas hydrates will be further studied to better evaluate scalability and commerciality.

For 2019, the USGS proposes to continue studies into the application of economics to resource assessments to understand the economic dynamics of shale gas and oil plays in order to model resource costs and evaluate future potential domestic supplies, thus helping to inform resource managers and other decision makers of potential development pressures, especially on public lands. USGS will augment its operational quality management systems through continued development of a program-wide Laboratory Information Management System (LIMS) for incorporating data management best practices and capabilities to collect,

store, manage, process, document, validate, and archive laboratory information assets from ERP laboratories.

The USGS will continue to maintain and serve data previously provided to the National Coal Resources Data System (NCRDS) from State Cooperators and other ERP-funded efforts.

In 2019, USGS projects will update data management plans as needed to support of Federal data management policies and departmental and bureau guidance. These efforts collectively will help the ERP and Energy Science Centers to meet Federal information mandates and align with USGS strategic science goals for interoperability and interdisciplinary research to support science-based approaches for critical decisions addressing societal issues.

The USGS Science and Decisions Center (SDC) conducts research and applications to increase the use and value of science in decision making. The SDC's multidisciplinary efforts focus on improved decision making throughout a variety of natural resource science disciplines. SDC economists and physical, biological, and social scientists work with partners in Interior and other government agencies, academia, and nongovernmental organizations to develop innovative methods, analytical tools, and institutional structures to integrate science more effectively with natural resource management.

The SDC also provides the analytical structure and tools to support efficient and effective management of resources. The SDC advances systematic decision-making approaches including assessment of management outcomes and lessons learned in order to help decision makers and improve natural resource management outcomes.

Mineral Resources Program

Dollars in Thousands	2017	2018	2019				
	Actual	Full Year CR	Fixed Costs	Internal Transfer	Program Changes	Request	Change from 2018
Mineral Resources Program	**48,371**	**48,043**	**301**	**-**	**9,882**	**58,226**	**10,183**
Critical Minerals					*10,598*		
Administrative Savings					*(716)*		
FTE	**301**	**301**	**-**	**-**	**4**	**305**	**4**

The Mineral Resources Program (MRP) is the sole Federal source of scientific information and research on nonfuel mineral potential, production, consumption, and interaction with the environment. The MRP supports data collection and research on a wide variety of nonfuel mineral resources that are critical to the economic stability and national security of the United States.

The 2019 request supports:

- Collection, analysis, and dissemination of minerals information and materials flow studies.
- Work on new sources of critical minerals and on the lifecycles of critical minerals.
- Research to understand the genesis and distribution of critical mineral resources throughout the Nation by collecting, preserving and disseminating geological, geochemical, and geophysical data and initiating qualitative and quantitative mineral assessments.
- A prioritized nationwide program of topographic, geologic and geophysical mapping to enhance understanding of the Nation's mineral resource potential in order to better manage the supply of critical minerals.

Justification of Program Changes

Critical Minerals (+$10,598,000 and +4 FTE): In support of Executive Order 13817 and Secretarial Order 3359, the USGS is developing a plan, the Three Dimensional mapping and Economic Empowerment Program, to improve the topographic, geological, and geophysical mapping of the United States. Initial efforts will focus on conducting airborne geophysical surveys in a limited number of targeted areas where existing detailed topographic/elevation coverage is available and the mineral potential is predicted to be high, based on existing data.

Priority targeted areas include portions of Alaska, the mid-continent region, and the Western United States These areas likely contain significant mineral resources based on comparisons with areas of similar geology elsewhere in the world. These resources are not visible at the Earth's surface, so they must be identified through modern geological and geophysical mapping techniques that explore what is underground.

The effort will largely fund work through contracts with the private sector, States, or universities, with the USGS providing critical planning, oversight and data analysis. The effort will extend existing topographic and elevation coverage by utilizing private-sector contractors for data collection. Geological mapping will

be conducted internally by the USGS and externally through partnerships with State Geological Surveys and universities, with funding for the external partnerships sent through existing USGS National Cooperative Geologic Mapping programs, leveraging State matching funds to further program goals. Data collection for airborne aeromagnetic surveys will be conducted by private-sector contractors; the USGS will ensure data quality and standardization as well as providing data interpretation and analysis. All data generated by the effort will be available to the public electronically and provide direct benefits to the Nation. These data may be used inform resource management decisions that could reduce mineral import dependence and to evaluate targeted areas for mineral potential. These data are also highly beneficial for infrastructure, transportation, and land-use planning; hazard assessments for landslides, volcanoes, and floods; water resources management; emergency response, and more.

The USGS plans to achieve $716,000 in administrative savings within the program.

Program Overview

The USGS characterizes and identifies critical mineral resources important to our Nation's economy and way of life. The program uses geologic, geochemical, geophysical, and remote sensing surveys to characterize the mineral potential of the United States. The program supports data collection and research on a wide variety of nonfuel mineral resources that are critical to economic stability and national security.

In 2000, data showed that the United States was 100 percent reliant on foreign sources for 13 minerals and imported a majority of its supply for an additional 20 minerals. By 2016, USGS work indicated 100 percent foreign reliance increased to 20 minerals, with a 50 percent or greater foreign dependency for an additional 30 minerals. Research by the USGS helps to define and forecast these dependencies and to inform Federal decision-makers about how to address them. Furthermore, a scientific understanding of how minerals interact with the environment informs the management of our public lands and resources and is used for protecting and improving public health and safety.

The MRP examines changes in supply risk and the impact of potential supply disruptions for critical minerals. The USGS National Minerals Information Center (NMIC) has taken a lead role in further development and implementation of a critical minerals initiative under the White House Office of Science and Technology Policy led National Science and Technology Council, in collaboration with Federal partners and industry stakeholders. The group developed a "criticality tool" based on a number of factors, which can be used to identify emerging supply risks and evaluate the impact of commodity supply restrictions.

In 2017 the MRP produced a report, "GIS-based identification of areas that have resource potential for critical minerals in six selected groups of deposit types in Alaska," which contains a set of mineral 'prospectivity' maps that depict areas of high potential for critical minerals including chromium, cobalt, gallium, germanium, platinum group elements (PGEs), rare earth elements (REEs), titanium, tungsten, and uranium as well as other valuable minerals. These maps were produced through a cost-effective synthesis relying on re-analysis of previously collected samples for elements not included in the original sample analyses together with a GIS-based evaluation of sample locations in relation to bedrock geology.

USGS
science for a changing world

2016 U.S. Net Import Reliance for Selected Mineral Materials[1]

Commodity	Percent	Major import sources (2012–15)[2]
ARSENIC	100	China, Japan
ASBESTOS	100	Brazil
CESIUM	100	Canada
FLUORSPAR	100	Mexico, China, South Africa, Mongolia
GALLIUM	100	China, Germany, United Kingdom, Ukraine
GRAPHITE (natural)	100	China, Mexico, Canada, Brazil
INDIUM	100	Canada, China, France, Belgium
MANGANESE	100	South Africa, Gabon, Australia, Georgia
MICA, sheet (natural)	100	China, Brazil, Belgium, Austria
NIOBIUM (columbium)	100	Brazil, Canada
QUARTZ CRYSTAL (industrial)	100	China, Japan, Romania, United Kingdom
RARE EARTHS[3]	100	China, Estonia, France, Japan
RUBIDIUM	100	Canada
SCANDIUM	100	China
STRONTIUM	100	Mexico, Germany, China
TANTALUM	100	China, Kazakhstan, Germany, Thailand
THALLIUM	100	Germany, Russia
THORIUM	100	India, France, United Kingdom
VANADIUM	100	Czech Republic, Canada, Republic of Korea, Austria
YTTRIUM	100	China, Estonia, Japan, Germany
GEMSTONES	99	Israel, India, Belgium, South Africa
BISMUTH	95	China, Belgium, Peru, United Kingdom
TITANIUM MINERAL CONCENTRATES	91	South Africa, Australia, Canada, Mozambique
POTASH	90	Canada, Russia, Chile, Israel
GERMANIUM	85	China, Belgium, Russia, Canada
STONE (dimension)	84	China, Brazil, Italy, Turkey
ANTIMONY	83	China, Thailand, Bolivia, Belgium
ZINC	82	Canada, Mexico, Peru, Australia
RHENIUM	81	Chile, Poland, Germany
GARNET (industrial)	79	Australia, India, South Africa, China
BARITE	78	China, India, Morocco, Mexico
FUSED ALUMINUM OXIDE (crude)	>75	China, Canada, Venezuela
BAUXITE	>75	Jamaica, Brazil, Guinea, Guyana
TELLURIUM	>75	Canada, China, Belgium, Philippines
TIN	75	Peru, Indonesia, Malaysia, Bolivia
COBALT	74	China, Norway, Finland, Japan
DIAMOND (dust grit, and powder)	73	China, Ireland, Romania, Russia
PLATINUM	73	South Africa, Germany, United Kingdom, Italy
IRON OXIDE PIGMENTS (natural)	>70	Cyprus, France, Austria, Spain
IRON OXIDE PIGMENTS (synthetic)	>70	China, Germany, Canada, Brazil
PEAT	69	Canada
SILVER	67	Mexico, Canada, Peru, Poland
CHROMIUM	58	South Africa, Kazakhstan, Russia
MAGNESIUM COMPOUNDS	53	China, Brazil, Canada, Australia
ALUMINUM	52	Canada, Russia, United Arab Emirates, China
IODINE	>50	Chile, Japan
LITHIUM	>50	Chile, Argentina, China
SILICON CARBIDE (crude)	>50	China, South Africa, Netherlands, Romania
ZIRCONIUM MINERAL CONCENTRATES	>50	South Africa, Australia, Senegal
ZIRCONIUM (unwrought)	>50	China, Japan, Germany
BROMINE	<50	Israel, China, Jordan
MICA, scrap and flake (natural)	48	Canada, China, India, Finland
PALLADIUM	48	South Africa, Russia, Italy, United Kingdom
TITANIUM (sponge)	41	Japan, Kazakhstan, China
SILICON	38	Russia, China, Canada, Brazil, South Africa
COPPER	34	Chile, Canada, Mexico
LEAD	30	Canada, Mexico, Republic of Korea, Peru
VERMICULITE	30	Brazil, South Africa, China, Zimbabwe
MAGNESIUM METAL	<30	Israel, Canada, China, Mexico
NITROGEN (fixed)—AMMONIA	28	Trinidad and Tobago, Canada, Russia, Ukraine
TUNGSTEN	>25	China, Canada, Bolivia, Germany
NICKEL	25	Canada, Australia, Norway, Russia

[1]Not all mineral commodities covered in this publication are listed here. Those not shown include mineral commodities for which the United States is a net exporter (alumina; boron; clays; diatomite; helium; iron and steel scrap; iron ore; kyanite; molybdenum; sand and gravel, industrial; selenium; soda ash; titanium dioxide pigment; wollastonite; and zeolites) or less than 25% import reliant (abrasives, metallic; beryllium; cadmium; cement; diamond, industrial stones; feldspar; gypsum; iron and steel; iron and steel slag; lime; perlite; phosphate rock; pumice; sand and gravel, construction; salt; stone, crushed; sulfur; and talc). For some mineral commodities (gold, hafnium, and mercury), not enough information is available to calculate the exact percentage of import reliance.

[2]In descending order of import share.

[3]Data include lanthanides.

A visual representation of U.S. reliance on foreign sources for many significant mineral commodities

Source: USGS Mineral Commodity Summaries (2017)

USGS geologists previously recognized the geologic similarity of the Southeastern United States to southeastern China where the vast majority of today's "heavy" rare earth elements (the most valuable of the rare earth elements) supply is produced. USGS geoscientists will continue to conduct field- and laboratory-based research and literature review on critical minerals, especially in Alaska, the midcontinent and the Southeastern United States, and will collaborate with NMIC economists and commodity experts to determine which mineral commodities are most critical to our national economy and security, so that future assessments can focus on these commodities.

The MRP supports research on how and where mineral deposits form and develops methods to detect potential mineral resources. This research has produced innovations in mineral resource science, ranging from collaborating with other Federal agencies to incorporate the latest space-based and airborne Earth observation instruments and the latest data science to the discovery of a new mineral.

USGS geologic, geophysical, and geochemical research enables and improves the assessment of undiscovered mineral resources, most of which are not easily identified at the Earth's surface because they are hidden by non-mineral bearing rocks, soils, or dense vegetation. Geophysical tools and techniques allow geologic units and structures beneath the Earth's surface to be mapped and provide data that can be used to develop three-dimensional models of a particular area to understand how mineral resources are distributed. Innovative new geochemical tools and methods also are being developed by MRP to reduce uncertainty in mineral resource assessments.

USGS assessments support decision-makers' interests in ensuring a secure supply of mineral resources by providing reliable, accurate information about the location, quantity, and quality of mineral resources. Assessments at a variety of scales provide valuable information to a range of users, including Federal, State, and local land-use managers.

In addition, USGS supports development of tools and techniques designed to understand what happens when mineral deposits are weathered or mined. Mineral environmental assessments use knowledge of mineral deposits to anticipate environmental challenges associated with abandoned mines and the effects of developing new mineral deposits, providing specific information on the potential release of contaminants into the environment.

The USGS collaborated with the BLM in developing a geospatial database (USMIN) that captures mine features from topographic maps.

The USGS continued research into the interactions of mineral resources with the environment, both natural and because of resource extraction, to understand emerging challenges and opportunities for future mining and new uses of previously mined materials. One on-going study focuses on geochemical modelling of the potential use of steel slag as a mechanism to remove phosphate from water.

Geological mapping continues in Alaska's Yukon-Tanana terrane. In addition to contributing to understanding the bedrock geology, this mapping will help determine the source of known placer gold deposits in the region and aid in determining the area's potential to host critical minerals deposits.

The program's Minerals Information function, through the NMIC, supports collection, analysis, and dissemination of data that document production and consumption for about 100 mineral commodities, both domestically and internationally, for 180 countries. The data provide decision makers with information to ensure that the Nation has an adequate and dependable supply of minerals and mineral materials to meet its defense and economic needs at acceptable costs. The public and private sectors use this information to understand the use and ultimate disposition of materials in the economy and to forecast supply and demand. These data are used to formulate plans to deal with shortages and interruptions in minerals supplies, and to

develop strategies for maintenance of a competitive position in the global economy. The NMIC will continue to provide hundreds of reports such as the Minerals Commodity Summaries, the Minerals Yearbook, the Mineral Industry Surveys, Metal Industry Indicators, and the Nonmetallic Mineral Products Industry Indexes. These and other MRP information products, along with sound analysis from minerals and materials analysis specialists and program scientists, allow for decision makers and stakeholders to understand the changes and importance of mineral resource production, consumption, and use. The NMIC will continue to provide high quality information and analysis that informs Federal critical minerals policy and is of paramount importance to U.S. national security and trade interests.

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Natural Hazards

Dollars in Thousands	2017	2018	2019				
	Actual	Full Year CR	Fixed Costs	Internal Transfer	Program Changes	Request	Change from 2018
Natural Hazards	**145,01**	**144,02**	**661**	**-**	**(27,387)**	**117,302**	**(26,726)**
FTE	*642*	*642*	-	-	*(54)*	*588*	*(54)*
Earthquake Hazards Program	**64,303**	**63,866**	**251**	**-**	**(13,118)**	**50,999**	**(12,867)**
FTE	*240*	*240*	-	-	*(18)*	*222*	*(18)*
Volcano Hazards Program	**28,121**	**27,930**	**153**	**-**	**(5,777)**	**22,306**	**(5,624)**
FTE	*142*	*142*	-	-	*(7)*	*135*	*(7)*
Landslide Hazards Program	**3,538**	**3,514**	**24**	**-**	**(27)**	**3,511**	**(3)**
FTE	*24*	*24*	-	-	-	*24*	-
Global Seismographic Network	**6,653**	**6,608**	**13**	**-**	**(1,684)**	**4,937**	**(1,671)**
FTE	*12*	*12*	-	-	*(2)*	*10*	*(2)*
Geomagnetism Program	**1,888**	**1,875**	**-**	**-**	**(1,875)**	**-**	**(1,875)**
FTE	*11*	*11*	-	-	*(11)*	-	*(11)*
Coastal/Marine Hazards and Resources Program	**40,510**	**40,235**	**220**	**-**	**(4,906)**	**35,549**	**(4,686)**
FTE	*213*	*213*	-	-	*(16)*	*197*	*(16)*

The USGS provides scientific information to emergency responders, policy makers, and the public to reduce losses from a wide range of natural hazards, including earthquakes, floods, hurricanes, landslides, tsunamis, volcanic eruptions, and wildfires. Working with its partners, cooperators, and customers, the USGS delivers actionable assessments of these hazards and helps to develop effective strategies for achieving more-resilient communities. The USGS is the Federal agency responsible for monitoring and notification of earthquakes, volcanic activity, and landslides and coastal erosion in the United States. For many other hazards, the USGS directly supports the warning responsibility of the National Oceanic and Atmospheric Administration.

To achieve its primary mission, and to fulfill its responsibilities for loss and risk reduction, the USGS Natural Hazards Mission Area develops, delivers, and applies several components of hazard science: observations and targeted research underpin assessments, forecasts, warnings, and crisis and disaster response. The research, data, products, and detailed information that the USGS provides enables Federal, State, tribal, local, and private-sector end-users to better understand, anticipate and reduce their risks associated with natural, technological, and environmental hazards, and enables science-based decisions that effectively enhance resilience and reduce impacts from those threats.

To address higher priorities, the USGS is not requesting funds for the Geomagnetism program.

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Earthquake Hazards Program

Dollars in Thousands	2017	2018	2019				
	Actual	Full Year CR	Fixed Costs	Internal Transfer	Program Changes	Request	Change from 2018
Earthquake Hazards Program	**64,303**	**63,866**	**251**	**-**	**(13,118)**	**50,999**	**(12,867)**
Hazard and Risk Assessments in Low-to-Moderate Risk Areas					*(478)*		
Regional Seismic Networks					*(1,800)*		
Earthquake Early Warning					*(10,200)*		
Administrative Savings					*(640)*		
FTE	**240**	**240**	**-**	**-**	**(18)**	**222**	**(18)**

The Earthquake Hazards program provides the scientific information, situational awareness, and knowledge necessary to reduce deaths, injuries, and economic losses from earthquakes and earthquake-induced tsunamis, landslides and soil liquefaction.

The 2019 budget supports:

- Monitoring the Nation's earthquakes via the Advanced National Seismic System (ANSS) and through support of networks operated by university partners.
- Providing 24x7 reporting on domestic and global earthquakes.
- Delivering rapid earthquake impact and situational awareness products to support emergency response; and develop improved methods for continued improvement in the quality and timeliness of real-time earthquake information.
- Delivering real-time earthquake data to NOAA, supporting tsunami monitoring in the Pacific Rim and disaster alerting in Alaska, Hawaii, Washington, California, and U.S. Territories in the Western Pacific and Caribbean.
- Improving the USGS National Seismic Hazard Model describing the likelihood and potential impacts of earthquakes nationwide, and serves as the basis of seismic provisions in building codes, and maintain associated databases and tools that are widely used by engineers for site-specific engineering design and seismic risk analysis.
- Conducting research on the causes, characteristics, and effects of earthquakes, including investigations of earthquakes related to wastewater disposal and other industrial activities.
- Communicating earthquake information to the public and to key stakeholders, including Federal and State emergency response agencies, disaster relief organizations, operators of utilities and lifelines, and communities at risk.

Justification of Program Changes

The request proposes the following to address higher priorities:

- Hazard and Risk Assessments in Low to Moderate Risk Areas (-$478,000 and -3 FTE)
- Regional Seismic Networks (-$1,800,000/0 FTE)
- Earthquake Early Warning (-$10,200,000 and -15 FTE)

The USGS plans to achieve $640,000 of administrative savings within the program.

Program Overview

The USGS Earthquake Hazards Program (EHP) is the applied Earth science component of the four-Agency National Earthquake Hazards Reduction Program, reauthorized by the Earthquake Hazards Reduction Authorization Act of 2004.[3] To effect loss reduction, the EHP supports a highly coordinated set of monitoring, hazards assessment, applied research, and risk translation and communication activities in at-risk regions nationwide. Through the National Earthquake Information Center, the USGS is the only U.S. agency that routinely and continuously reports on current domestic and worldwide earthquake activity. Through the Advanced National Seismic System (ANSS), the USGS and its State and university partners monitor and report on earthquakes nationwide. Through the National Seismic Hazard Maps, the EHP provides the basis for seismic provisions in the Nation's building codes, which affect one trillion dollars' worth of new construction annually in the United States.

The ANSS includes a national backbone seismic network, the National Earthquake Information Center (NEIC), partner-operated networks, and the National Engineering Strong Motion Project for monitoring earthquake shaking in structures. The NEIC provides information on potentially damaging earthquakes to the National Command Center; the White House; the Departments of Defense, Homeland Security (including FEMA), Transportation, Energy, and Interior; State emergency services; numerous public and private infrastructure management centers (e.g., railroads and pipelines); the media; and the public.

The USGS monitors the Nation's earthquakes via the ANSS and, through support of several ANSS networks operated by university partners and provides 24x7 reporting on domestic and global earthquakes. The program delivers rapid earthquake impact and situational awareness products to support emergency response; and develop improved methods for continued improvement in the quality and timeliness of real-time earthquake information. Rapid earthquake notifications are delivered electronically to subscribers and a suite of earthquake information products, such as *ShakeMaps*, *Did You Feel It*? and rapid *PAGER* estimates of financial and human impacts, are available on the USGS Web site (earthquakes.usgs.gov).

The USGS contributes to earthquake risk-mitigation strategies by developing seismic hazard models and maps that describe the likelihood and potential effects of earthquakes nationwide, especially in the urban areas of highest risk. The USGS National Seismic Hazard Model, and maps derived thereof, is used in the development of building codes for the United States. The model integrates a wide range of geological and geophysical information to estimate the severity of ground shaking that each given location is expected to experience in the coming decades.

[3] P.L. 108–360

The USGS works closely with earthquake researchers, engineers, and State and local government representatives across the Nation to ensure that the model and maps represent the most current and accurate information available. The USGS also conducts and supports a range of targeted, applied research that leads to improved hazard estimates; this includes geological and geophysical investigations to improve knowledge of hazardous faults, and analysis of data to improve estimates of earthquake ground motions.

The USGS hazard model underlies the International Building Code (IBC), the code that has been adopted throughout most of the United States as the standard for building design. The USGS updates the National Seismic Hazard Model and maps on a six-year cycle that is aligned with the processes that lead to updates to the IBC. The model was last updated in 2014; the USGS is producing a draft update in 2018 for review by applicable engineering groups, and will deliver a full update of the model in 2020.

Because the scale of the National Seismic Hazard Model precludes taking into account local variations in the size and duration of seismic shaking caused by small-scale geologic structures and soil conditions, the USGS partners with State and local experts to produce more detailed urban seismic hazard maps for selected high- to moderate-risk areas. These products make it possible for local officials to make precise and informed zoning and building code decisions.

The USGS conducts and supports a broad suite of field, laboratory, and theoretical research on the causes, characteristics, and effects of earthquakes. This targeted, applied research has direct application in increasing the accuracy and precision of the agency's earthquake hazards assessments, earthquake forecasts, earthquake monitoring products, and earthquake mitigation practices, including:

- **Subduction Zone Science –** The most powerful of the world's earthquakes, tsunamis, landslides, and volcanic eruptions occur in subduction zones, where tectonic plates collide and one is thrust beneath another. In the United States, a subduction zone off southern Alaska spawned the magnitude 9.2 earthquake that damaged Anchorage in 1964. The Cascadia subduction zone threatens coastal areas of Washington, Oregon, and northern California, and U.S. territories in the Caribbean are also at risk from subduction zone earthquakes. The USGS hazard programs, including the EHP, are investigating the processes leading to subduction earthquakes, likely magnitudes of potential earthquakes and their impacts, and providing science to inform policies and actions by Federal, State, and local partners to increase our Nation's resilience to these hazards.

- **Induced Seismicity** –Although the risk of inducing felt seismic events through hydraulic fracturing operations is low, there is concern that potentially hazardous earthquakes can be induced through disposal of wastewater through underground injection control disposal-wells. The USGS is working with academic and industry partners to collect and analyze additional data, developing methods to forecast which types of injections in which geologic setting are most likely to induce or trigger earthquakes, and to perform comprehensive studies at carefully-selected field sites. The USGS is providing this improved knowledge to decision makers, regulators, and industry experts attempting to minimize seismic risks, and has adapted its procedures for assessing seismic hazards to account for potentially induced earthquakes.

- **Forecasting Hazards from Earthquake Sequences** – Earthquakes occur in sequences, typically a large event followed by many aftershocks, some of them large and potentially damaging. A large earthquake may also trigger the occurrence of later earthquakes on nearby faults. Furthermore, earthquakes related to volcanic, geothermal, or industrial activity may occur in swarms, prolonged series of earthquakes with up to several largest events. The USGS is engaged in research to quantify changes in earthquake likelihoods with time, and to develop and deploy a nationwide capability to release aftershock advisories during major earthquake sequences.

- **Supporting External Research Partnerships** – External collaboration advances targeted research and addresses specific needs of the USGS using the experience and knowledge of world experts. The EHP provides competitive, peer-reviewed, external research support through competitive grants and cooperative agreements that enlist the talents and expertise of the academic community, State government, and the private sector.

The Earthquake Hazards program produces a large and growing quantity of data and information on earthquakes and related hazards. For this science information to be used to mitigate risk and limit losses, the USGS takes a proactive role with various user communities in the application and interpretation of program results. Active engagement with users provides opportunities for dialogue on modifications to existing products and advice on new products that make USGS work and results more relevant and applicable. Opportunities for engaging users take place at both national and regional levels.

The Program strives to create and refine a variety of earthquake information products that accurately and effectively communicate earthquake science to key audiences, including decision makers. The EHP supports the USGS Scientific Application for Risk Reduction (SAFRR) project to improve sharing of earthquake safety information with the public, conducting research with social scientists with expertise in risk communication.

Volcano Hazards Program

Dollars in Thousands	2017	2018	2019				
	Actual	Full Year CR	Fixed Costs	Internal Transfer	Program Changes	Request	Change from 2018
Volcano Hazards Program	**28,121**	**27,930**	**153**	**-**	**(5,777)**	**22,306**	**(5,624)**
Hazards Assessments					*(1,498)*		
Repair & Upgrade Analog Instruments on High Threat Volcanoes					*(1,000)*		
Next Generation Lahar Detection					*(1,000)*		
Implementation of NVEWS					*(1,500)*		
Monitoring Maintenance in Commonwealth of the Northern Mariana Islands and Yellowstone					*(500)*		
Administrative Savings					*(279)*		
FTE	**142**	**142**	**-**	**-**	**(7)**	**135**	**(7)**

The Volcano Hazards program is built upon a structure of five volcano observatories that organize the Nation's volcanoes into distinct areas of responsibility. The volcano observatories are managed with recognition of the importance of local knowledge and close ties with local officials and emergency managers, but it relies on interoperability among the observatories, including use of common tools and standards.

The 2019 request supports:

- Regularly scheduled network maintenance from all observatories, as needed.
- Field investigations of Very-High-Threat volcanoes and generation of volcanic hazard assessments for these volcanoes.
- Field and laboratory based studies of volcanic processes that will inform volcano monitoring strategies and the generation of updated volcanic hazard assessments.
- Hardening the Alaska Volcano Observatory Operations Room with a new emergency generator to maintain situational awareness and monitoring capability even during power failures caused by human or natural causes.
- Opportunistically converting six to eight analog seismometers and analog telemetry nodes at Alaska monitoring stations to digital seismometers with digital data telemetry to make progress on compliance of monitoring networks with NTIA restrictions on radio frequency utilization.
- Continuing to leverage partnership resources toward acquiring high-resolution lidar data over Very-High-Threat and High-Threat volcanoes.

Justification of Program Changes

The request proposes the following to address higher priorities:

- Hazard Assessments (-$1,498,000 and -3 FTE)
- Repair and Upgrade Analog Instruments on High-Threat Volcanoes (-$1,000,000/0 FTE)
- Next Generation Lahar Detection (-$1,000,000/0 FTE)
- Implementation of NVEWS (-$1,500,000 and -2 FTE)
- Monitoring Maintenance in the Commonwealth of the Northern Mariana Islands and Yellowstone (-$500,000 and -2 FTE)

The USGS plans to achieve $279,000 of administrative savings within the program.

Program Overview

The USGS operates ground-based volcano monitoring networks on 85 of the Nation's Very High-Threat to Moderate-Threat Volcanoes. The suite of ground-based instruments for most of these volcanoes consists of seismometers within 20 kilometers of the volcano summit, continuous GPS instruments, tilt meters, Web cameras, microbarographs, and in a few cases, MultiGas sensors or UV camera systems for near real-time measurement of volcanic gas emissions. Airborne and satellite-based remote sensing instruments augment these in-ground instruments.

The USGS conducts applied research to advance understanding of how volcanoes work, what causes them to erupt, and how to interpret signals that may be precursors to eruption. Better understanding of the complex physical processes that drive volcanic eruptions forms the scientific basis for improved eruption forecasts and warnings, quantitative hazard assessments, and situational awareness. This applied research includes a variety of key topics including:

- Characterizing erupted products from recent and pre-historical eruptions and their distribution on the landscape.
- Deducing the eruptive histories, recurrence intervals, and hazards from past eruptions.
- Analyzing the gases and waters on volcanoes that provide clues of subsurface activity.
- Measuring and interpreting the earthquakes and ground movements at monitored volcanoes to characterize background activity during restive periods and during unrest and escalation to eruption to characterize eruption precursors.
- Surveying the volcanoes from satellite-based remote sensing to detect subtle changes.
- Modeling the physical and chemical processes that occur prior to and during eruptions.
- Developing new mathematical tools to forecast eruptions based on growing databases and physical principles.
- Tracking the changes effected by volcanic eruptions.

All lines of applied research fundamentally support and inform the program of the nature of precursor signals we may observe on volcanoes because of magma ascent. The applied research allows for accurate assessment of volcano threat levels, improved analysis, and interpretation of observed data, and cost-effective design of modern monitoring networks. Results from applied research are integrated in an iterative approach to VHP's long-term volcano monitoring efforts to maintain effective, cost efficient, and state-of-the-art volcano monitoring capability.

In 2017, the Alaska Volcano Observatory (AVO) initiated response to the Bogoslof Island eruption, from December 2016 – present. This eruption presented many challenges owing to it occurring with an unusually high pace of explosive activity during the winter at an unmonitored volcano that just barely extends above sea level. The observatory developed means to detect activity and provide rapid notification to the Federal Aviation Administration of the possibility of volcanic ash threatening civilian and military aircraft in the region. Integrating diverse streams of data, such as from a worldwide lightning detection network, monitoring instruments on volcanoes 46 and 72 kilometers distant from Bogoslof, and satellite data into an alarm system, the observatory was able to not only to detect the onset of activity within minutes, but in some cases, was able to provide warning that an eruption appeared imminent. As a result, the Bogoslof response has been successful in not only providing public warnings and notifications of activity, but has also advanced our analytical capabilities scientifically and organizationally.

The AVO will continue studies of Alaskan volcanoes and hazards with focus on High-Threat and Very-High-Threat volcanoes such as Augustine, Makushin, and Akutan. In 2019, AVO will continue to maintain volcano monitoring networks and opportunistically convert analog telemetry nodes to digital seismometers with digital telemetry. AVO also plans to benefit from 2018 planning to establish VSAT backups at one or more remote data hubs.

The Cascades Volcano Observatory (CVO) will complete geologic mapping activities at Glacier Peak volcano in Washington. The CVO will develop new hazard assessment products for Cascade volcanoes with a particular focus on next-generation hazards assessments. This will include more use of Geographic Information Systems and digital products in the assessments. The CVO will also continue to participate in scientific studies to refine geologic and geophysical assessments of the structure and stability of the 1980 Mount St. Helens debris avalanche that dammed the outlet of Spirit Lake. Failure of the dam could threaten up to 50,000 citizens downstream. The CVO will maintain existing monitoring networks and prepare to install new stations at Glacier Peak volcano once permits are granted. CVO staff will also work with U.S. Forest Service and U.S. Army Corps of Engineers to improve monitoring systems at Spirit Lake. In 2019, the CVO will work with stakeholders to update interagency coordination plans for Mount Rainier, Mount Baker, and Glacier Peak. The CVO will also participate in interagency tabletop exercises based on eruption scenarios at Mount Baker and Mount St. Helens.

The USGS California Volcano Observatory (CalVO) will conduct Bayesian modeling of explosive volcanic systems using multi-parametric data. Modeling can be used to robustly constrain important characteristics of explosive volcanic eruptions (and associated uncertainties), such as magmatic reservoir volumes. This modeling captures constraints from multitudes of disparate data types currently being collected, guides future data collection efforts, and has the potential to improve future eruption forecasting. CalVO will also research, characterize, and model the links between snowmelt and shallow swarm seismicity south of Long Valley Caldera in California. This project will anticipate and interpret future swarms in this area. Results of this study will directly benefit both scientific and societal communities, helping to provide insight into hydrologic processes, earthquake nucleation, and clearer identification of swarms that may be directly linked to volcanic activity. In 2019, CalVO will close the monitoring gap at High-Threat Clear Lake Volcanic Field, by installing four new digitally telemetered seismograph stations to improve the monitoring network. Improvements to the network will allow CalVO scientists to better detect and locate smaller earthquakes and find and locate sources of seismic tremor indicative of magma movement in the subsurface.

The Hawaiian Volcano Observatory (HVO) will initiate a project to update and revise the volcano hazard map for the entire Island of Hawaii covering Mauna Loa, Kilauea, Hualalai, and Mauna Kea. In 2019, HVO emphases will be to stabilize Kilauea gas monitoring program, replace failing components in aging seismometers and GPS installations, and investigate new ways to monitor volcanic activity more efficiently with remote methods (e.g., infrasound, satellite). In 2019, the HVO will continue to work with agency partners and potentially affected communities to prepare for a future eruption of Maun Loa, or a new threat from Kilauea, continue internal planning for eruption response to support needs of the emergency management community. A Hawaii interagency eruption response plan will be completed.

In 2019, Yellowstone Volcano Observatory will continue thermal and geochemical monitoring of the Yellowstone hydrothermal system and monitoring of geodynamics. The USGS monitors groundwater geochemistry at Western United States and Alaskan volcanoes as part of its overall monitoring effort. At Yellowstone Volcanic Field, there is a real-time stream and hydrothermal pool temperature-monitoring network to detect rapid increases in groundwater temperatures in order to mitigate against hazardous hydrothermal explosions in a national park with large attendance during the summer season.

The USGS also monitors the Mammoth Lakes area of Long Valley Caldera where there were three carbon dioxide asphyxiation fatalities in April of 2006.

The program provides situational awareness and warnings, and forecasts of hazardous volcanic activity to communities at risk. To achieve success in this critically important role, the VHP delivers its warnings and forecasts to the public via the Internet, social media, teleconferences, community meetings and other effective means such that all sections of potentially impacted populations are informed.

Landslide Hazards Program

Dollars in Thousands	2017	2018	2019				
	Actual	Full Year CR	Fixed Costs	Internal Transfer	Program Changes	Request	Change from 2018
Landslide Hazards Program	**3,538**	**3,514**	**24**	**-**	**(27)**	**3,511**	**(3)**
Administrative Savings					*(27)*		
FTE	**24**	**24**	**-**	**-**	**-**	**24**	**-**

The USGS assists Federal, State, and local agencies through landslide site evaluations and provides strategies for reducing ongoing and future impacts from landslides. The Landslide Hazards program deploys near-real-time monitoring systems at active landslide sites to gather continuous movement, rainfall, and hydrologic data needed to understand the mechanisms of landslide occurrence and mobility and forecast future behavior. Such data and understanding form the scientific underpinnings for early warning of conditions that may trigger landslides.

The 2019 request supports:

- Field, laboratory, and modeling studies of landslide initiation and mobility processes in cooperation with Federal, State, academic, and private sector partners to develop, test, and advance tools and methods for landslide monitoring, hazard assessment, and forecasting.
- Providing post-wildfire debris-flow hazard assessments for major wildfires to Burned Area Emergency Response Teams, State Geological Surveys, Federal, State, and local emergency management and the public.
- Collecting observations, conducting studies, and testing methods and models to expand the NOAA-USGS partnership for post-wildfire debris-flow early warning beyond the prototype area in southern California to other parts of the Western United States.

Justification of Program Changes

The USGS plans to achieve $27,000 of administrative savings within the program.

Program Overview

The LHP conducts research targeted to improve understanding of landslide processes that informs the development and enhancement of tools for hazard assessment and early warning. Activities include surface and subsurface investigation of past and ongoing landslide activity, operation of natural laboratories to monitor landslide processes, and development of tools and methods for landslide hazard assessment. Sustained efforts in landslide monitoring have led to significant advances in understanding slope stability and landslide processes. Capability built by these efforts in cooperation with the USGS Volcano Hazards Program (VHP) provided the expertise and experience needed to deploy and operate the near-real-time hazard assessment system used to support the search, rescue, and recovery operation at the SR530 landslide near Oso, WA.

In 2017, the LHP released a report describing a new approach to simulate the full spectrum of hydrological and sediment transport processes that describe post-wildfire debris flow generation, transport, and deposition. This work is the culmination of field and modeling efforts conducted in cooperation with partners from academic and State sectors, and provides the foundation for the next generation of post-wildfire debris-flow hazard assessments. The LHP also published studies describing the observed recent increase in large rock avalanches in Glacier Bay National Park and Preserve and a method to estimate rainfall intensities needed to initiate post-wildfire debris flows. This work helps overcome the need for an extensive data collection of rainfall and debris-flow observations to support expansion of the NOAA-USGS debris-flow early warning system.

The knowledge and improved understanding gained through applied research is used to develop and improve tools and methods for landslide hazard assessment and early warning. The LHP provides susceptibility maps, hazard assessments, and situational awareness to a broad range of Federal and State agencies ranging from the U.S. Forest Service (USFS) to emergency managers of local communities. These jurisdictions use USGS products to mitigate the effects of landslides and debris flows through land use planning, response planning, and warning systems. The LHP produces debris-flow hazard assessments operationally for major wildfires in the Western United States. For other landslide types and in other settings, landslide hazard assessments are typically produced as demonstration projects or in response to a request from Federal or State partners. For example, the LHP partnered with the National Park Service to produce a rockfall risk assessment for Yosemite National Park. The risk assessment, released in 2014, was used to relocate or repurpose park infrastructure to reduce the threat of rockfall impact to park visitors and staff.

Global Seismographic Network

Dollars in Thousands	2017	2018	2019				
	Actual	Full Year CR	Fixed Costs	Internal Transfer	Program Changes	Request	Change from 2018
Global Seismographic Network	**6,653**	**6,608**	**13**	**-**	**(1,684)**	**4,937**	**(1,671)**
Seismic Station Upgrades					*(1,622)*		
Administrative Savings					*(62)*		
FTE	**12**	**12**	**-**	**-**	**(2)**	**10**	**(2)**

The Global Seismographic Network (GSN) consists of more than 150 globally distributed stations. It provides the high-quality seismic data needed for earthquake alerts and situational awareness products, tsunami warnings, national security (through nuclear test treaty monitoring and research), seismic hazard assessments and earthquake loss reduction, as well as research on earthquake sources and the structure and dynamics of the Earth.

The 2019 request supports:

- Operating the network to provide seismic data needed for earthquake alerts and situational awareness products, tsunami warnings, national security, hazard assessments, and research.
- Developing the Data Quality Analyzer software to expand its use in monitoring and improving the data quality from the existing instrumentation.

Justification of Program Changes

The request proposes the following to address higher priorities:

- Seismic Station Upgrades (-$1,622,000 and -2 FTE)

The USGS plans to achieve $62,000 of administrative savings within the program.

Program Overview

Because of its real-time data delivery, the GSN is a critical element of USGS hazard alerting activities, as well as supporting activities of other Federal agencies, including the NOAA tsunami warning; National Science Foundation basic research; and the Department of Energy (DOE) and the Department of Defense (DOD) nuclear test treaty monitoring and research. GSN stations transmit real-time data continuously to the USGS National Earthquake Information Center to determine the locations, depths, magnitudes, and other parameters of earthquakes worldwide, in conjunction with data from other networks. GSN data allows for the rapid determination of the location and orientation of the fault that caused the earthquake, and provides an estimate of the length of the fault that ruptured during the earthquake, which are essential for modeling earthquake effects. An additional important aspect of GSN activities is evaluating, developing, and advancing new technologies for seismic instrumentation, sensor installation, and seismic data acquisition and management.

The USGS will continue to operate the 100-station, USGS portion of the GSN at a high level of data recovery, real-time telemetry performance, and high cost efficiency. There will also be further development of the Data Quality Analyzer system to ensure the data quality of the GSN is maintained.

Coastal/Marine Hazards and Resources Program

Dollars in Thousands	2017	2018	2019				
	Actual	Full Year CR	Fixed Costs	Internal Transfer	Program Changes	Request	Change from 2018
Coastal/Marine Hazards and Resources Program	**40,510**	**40,235**	**220**	**-**	**(4,906)**	**35,549**	**(4,686)**
Regional Coastal Management, Restoration, and Risk Reduction					*(500)*		
Marine and Habitat Resource Mapping and Ocean and Glacier Studies					*(1600)*		
Elevation Model Development and Coastal Resource Assessments					*(2,344)*		
Administrative Savings	-	-	-	-	*(462)*		
FTE	**213**	**213**	**-**	**-**	**(16)**	**197**	**(16)**

The Coastal/Marine Hazards and Resources Program (CMHRP) provides surveys, knowledge and tools to characterize the hazard and resource potential of the Nation's offshore and coastal areas. CMHRP data, research, and technical expertise provides managers with the information and tools to anticipate and reduce the risk of natural hazards and coastal change, and to assess and manage marine and coastal resources to meet current needs and to respond to changing demands.

The 2019 request supports:

- Marine geological and geophysical investigations to provide Federal, State, and local users with improved assessments of hazard sources (earthquakes, tsunami, submarine landslides) and their potential impacts on offshore operations, coastal communities and infrastructure.

- Field and laboratory studies with other Federal and academic partners to characterize marine methane systems and associated sea-bed processes to enhance understanding of their substantial energy resource potential, the risk they represent to offshore operations and their role in the global carbon system and marine ecological productivity.

- Analyses and expertise to delineate the U.S. Extended Continental Shelf consistent with international law and apply unique USGS expertise to understand the occurrence and potential of deep-sea mineral resources.

- Regional real-time forecasts of erosion and inundation due to coastal storms, including hurricanes; and long-term forecasts of the likelihood of future coastal change and inundation due to storms, erosion, and sea-level rise.

- Data and knowledge for priority locations on physical setting and processes that informs local, State, and Federal coastal management, planning, and public safety efforts to design and assess strategies for regional restoration, risk reduction, and coastal management.

Justification of Program Changes

The request proposes the following to address higher priorities:

- Regional Coastal Management, Restoration, and Risk Reduction (-$500,000 and -3 FTE)
- Marine Habitat and Resource Mapping and Ocean and Glacier Studies (-$1,600,000 and -6 FTE)
- Elevation Models and Coastal Resource Assessments (-$2,344,000 and -7 FTE)

The USGS plans to achieve $462,000 of administrative savings within the program.

Program Overview

USGS data, research, and technical expertise provides managers with the information and tools to anticipate and reduce the risk of natural hazards and coastal change, and to assess and manage marine and coastal resources to meet current needs and to respond to changing demands. The USGS addresses a wide range of issues in locations from the shallow waters of estuaries to the deep sea. The program responds to immediate local and regional priorities across these environments, while also delivering comprehensive, long-term coastal and marine science-based products.

The USGS provides Federal, State, and local users with improved assessments of hazard sources (earthquakes, tsunami, submarine landslides) and their potential impacts on offshore operations, coastal communities and infrastructure with an increasing focus on support of bureau-wide investigations of subduction zone processes and hazards.

The CMHRP works with other Federal and academic partners to characterize marine methane systems and associated seabed processes to enhance understanding of their substantial energy resource potential, the risk they represent to offshore operations and their role in the global carbon system and marine ecological productivity.

In addition, the USGS will contribute analyses and expertise to delineate the U.S. Extended Continental Shelf consistent with international law, expanding U.S. sovereignty over resources on and beneath the sea floor. Resources will also be directed to efforts to provide unique USGS expertise on the occurrence and potential of deep-sea mineral resources.

The USGS provides real-time forecasts of erosion and inundation due to coastal storms, including hurricanes. The USGS is the recognized Federal provider of research, information and tools to anticipate and respond to physical change along our Nation’s coast and to understand the consequences of change on communities, infrastructure, and resources. For the majority of contiguous U.S. ocean beaches and barrier islands, CMHRP provides real-time forecasts of erosion and inundation and long-term forecasts of the likelihood of future coastal change due to storms, erosion and sea-level rise.

Ocean hazard events like tsunamis, triggered by earthquakes and landslides, storm surges associated with hurricanes and extreme storms, oil and gas spills, floods and associated delivery of watershed contaminants, affect the health and safety of our Nation's ocean and coastal communities, infrastructure and ecosystems. USGS scientists study the causes, distribution, and hazard potential of coastal and submarine hazard events including earthquakes and submarine landslides, as well as associated tsunami potential. Additionally, USGS studies focus on geologic mapping, sampling, and understanding energy and mineral resources including studies of geologic settings and processes to inform offshore renewable energy development.

The program conducts studies in the deepwater sector (water depth greater than 300 feet) of the U.S. Outer Continental Shelf in the Atlantic Ocean to locate seeps that emit methane gas at the seafloor. The program works to image the sediment structures that channel gas flow beneath these seeps, to determine where and how this natural gas originates, and to characterize the unique ecosystems and corals found near the seeps and in nearby canyons. In locations where the most recently available seismic data are more than three decades old, CMHRP will plan and conduct high- and intermediate-resolution seismic surveys to address critical data gaps related to marine geohazards and the distribution of gas hydrate and other resources.

As part of an interagency collaboration led by the Department of State, the CMHRP conducts analysis of Atlantic margin seismic data and other information to provide the scientific basis for delineating the seaward extent of U.S. sovereign rights to manage, conserve, or exploit the extended continental shelf beyond the 200 nautical mile limit of the Exclusive Economic Zone.

The CMHRP brings together multidisciplinary expertise focused on developing tools and models to improve understanding of how healthy ecosystems function, as well as how they respond to environmental change and human impacts including regional ecosystem restoration. Research studies address the condition, health, and societal value of coral reef, coastal wetland, benthic habitat, and groundwater resources.

The CMHRP develops, maintains, and delivers a wide range of resources to access and apply program scientific data, expertise, technology, tools, and other resources. The CMHRP provides coastal and marine emergency and resource managers with data, models, and tools for use in planning and managing activities in the ocean and along the coast. The CMHRP is an innovator in mapping and laboratory analyses, whose expertise is sought by other governmental agencies, educational institutions, and private companies. In turn, the USGS seeks collaborative research and development to continually improve and enhance the data collection tools, analytical techniques, and technologies utilized in our coastal and marine studies.

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Water Resources

Dollars in Thousands	2017	2018	2019				
	Actual	Full Year CR	Fixed Costs	Internal Transfer	Program Changes	Request	Change from 2018
Water Resources	**214,754**	**213,296**	**1,188**	**200**	**(49,762)**	**164,922**	**(48,374)**
FTE	*1,287*	*1,287*	-	-	*(241)*	*1,046*	*(241)*
Water Availability and Use Science Program	**45,052**	**44,746**	**287**	**-**	**(14,682)**	**30,351**	**(14,395)**
FTE	*320*	*320*	-	-	*(71)*	*249*	*(71)*
Groundwater and Streamflow Information Program	**72,673**	**72,179**	**332**	**-**	**(7,596)**	**64,915**	**(7,264)**
FTE	*331*	*331*	-	-	*(31)*	*300*	*(31)*
National Water Quality Program	**90,529**	**89,915**	**569**	**200**	**(21,028)**	**69,656**	**(20,259)**
FTE	*635*	*635*	-	-	*(138)*	*497*	*(138)*
Water Resources Research Act Program	**6,500**	**6,456**	**-**	**-**	**(6,456)**	**-**	**(6,456)**
FTE	*1*	*1*	-	-	*(1)*	-	*(1)*
Cooperative Matching Funds[4]	**[59,927]**	**[59,927]**	**-**	**-**	**[-2,717]**	**[57,210]**	**[-2,717]**

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. USGS information and tools allow first responders, the public, water managers and planners, policy makers, and other decision makers to:

- Minimize loss of life and property because of water-related natural hazards.
- Manage freshwater, both above and below the land surface, for domestic, public, agricultural, commercial, industrial, recreational, and ecological uses.
- Protect and enhance water for human health, aquatic health, and environmental quality.
- Contribute to wise use, development, and conservation of water resources.

The Water Resources Mission Area carries out its programs through the USGS Water Science Centers covering all 50 States and Puerto Rico.

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

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

Cooperative Matching Funds

The cooperative matching funds 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 2019 request includes $57,210,000 across the three sub-activities of the mission area.

Water Availability and Use Science Program

	2017	2018	2019				
	Actual	Full Year CR	Fixed Costs	Internal Transfer	Program Changes	Request	Change from 2018
Water Availability and Use Science Program	**45,052**	**44,746**	**287**	**-**	**(14,682)**	**30,351**	**(14,395)**
Research and Development to Advance Water Science[5]					*(4,325)*		
Groundwater Models					*(869)*		
Mississippi Alluvial Plain Aquifer Assessment					*(3,000)*		
U.S.-Mexico Transboundary Aquifer Assessment					*(1,000)*		
Regional Groundwater Evaluations					*(789)*		
Water Use – Cooperative Matching Funds					*(1,000)*		
Water Use – Data and Research					*(1,500)*		
Water Use – Unconventional Oil and Gas					*(250)*		
Focus Area Studies					*(1,600)*		
Administrative Savings					*(349)*		
Cooperative Matching Funds[6]	**[12,397]**	**[12,397]**	**-**	**-**	**[-1,000]**	**[11,397]**	**[-1,000]**
FTE	*320*	*320*	*-*	*-*	*(71)*	*249*	*(71)*

The Water Availability and Use Science Program (WAUSP) supports research and projects that advance the goal of improving our understanding water budget components at the national and regional level.

The 2019 request supports:

- Collaborating with State partners to improve collection and reporting of water use data.
- Developing new techniques and methods to estimate water use and invest in new technologies to measure water use.
- Supporting the enhancement of tools to understand groundwater and surface-water interactions, sediment transport processes, and support evaluations of conjunctive management of these resources.
- Engaging and collaborate with stakeholders to ensure data and products meet the needs of local, regional, and national resource managers.

[5] Formerly the National Research Program

[6] Cooperative Matching Funds are used to support research, data collection, and assessment activities across the Water Availability and Use Science Program, and therefore shown as a non-add component within the Program.

- Researching the effect of drought on water availability for human and ecological uses.
- Enhancing regional water availability studies to provide information and tools for future management decisions.
- Conducting research on water-budget components; synthesize, predict and report information at regional and national scales, enhance water modeling and prediction capability, and compile and report water information in ways that are useful to States.

Justification of Program Changes

The request proposes the following to address higher priorities:

- Research and Development to Advance Water Science (-$4,325,000 and -28 FTE)
- Groundwater Models (-$869,000 and -7 FTE)
- Regional Groundwater Evaluations (-$789,000 and -4 FTE)
- Mississippi Alluvial Plain Aquifer Assessment (-$3,000,000 and -18 FTE)
- U.S.-Mexico Transboundary Aquifer Assessment (-$1,000,000 and -4 FTE)
- Focus Area Studies (-$1,600,000 and -8 FTE)
- Water Use – Cooperative Matching Funds (-$1,000,000/0 FTE)
- Water Use – Data and Research (-$1,500,000 and -1 FTE)
- Water Use – Unconventional Oil and Gas (-$250,000 and -1 FTE)

The USGS plans to achieve $349,000 of administrative savings within the program.

Program Overview

The WAUSP supports research and projects that advance the goal of improving our understanding water budget components at the national and regional level, as well as through the National Water Census (NWC). With the NWC, the USGS works with partners and stakeholders to improve our understanding of water budget components in the face of increasing demand and competition for limited regional water resources to ensure adequate water availability for both human and ecological needs now and into the future.

The USGS has begun development of a National Hydrologic Model (NHM) to support a coordinated, comprehensive, and consistent hydrologic modeling at multiple scales for the conterminous United States. The NHM provides baseline estimates of total water availability, changes in the timing and source of streamflow, and measures of the uncertainty of these estimates. In 2017, USGS researchers developed baseline datasets for all components of the water budget with estimates of error; added a stream temperature module to the NHM capabilities allowing for simulation of stream temperature; developed a tool to improve NHM model accessibility for local applications; improved representation of surface storage (water stored in ponds, lakes, and reservoirs) within the NHM; improved representation of snowmelt processes; and began work to improve streamflow routing algorithms in collaboration with the National Center for Atmospheric Research (NCAR). In 2018 and 2019, USGS researchers will continue collaboration with partners and stakeholders like the National Weather Service (NWS) and NCAR to improve national

prediction capabilities of surface water-groundwater interaction, stream water temperature, erosion and sediment transport, and water-quality.

The USGS has begun work to construct a national model of the shallow groundwater system that covers the contiguous United States; this model will help advance national water availability prediction capabilities. In 2017, the USGS developed baseline estimates of evapotranspiration, runoff to streams, and recharge to shallow groundwater. Maps at a 1-km resolution across the contiguous United States were published in 2017. Notably, the recharge map is the first "wall-to-wall" estimate of long-term average recharge values based on water balance calculations of this water budget component. In 2018 and 2019, the USGS will work with partners and stakeholders to provide input into future directions of the National Groundwater Model. This collaboration is critical to ensuring that groundwater is accounted for accurately in water budgets, as well as Earth system prediction models of water availability.

With issues like drought, groundwater depletion, shifting weather patterns, and demand for groundwater expected to continue to rise, understanding brackish groundwater supplies can help determine whether they can supplement or replace taxed freshwater sources in water-stressed areas. Specifically, as the Bureau of Reclamation works to promote sustainable water treatment for brackish aquifers, information on the chemical composition of the water and well yields is important to understanding the needs of water treatment. In 2017, the USGS released the first national assessment of brackish groundwater resources in more than 50 years. The study found that the amount of brackish groundwater underlying the Country is more than 35 times the amount of fresh groundwater, as well as 800 times the amount of brackish groundwater, currently used each year. By incorporating new data from more than 380,000 sites, the 2017 assessment provides comprehensive national dataset on the quantity and quality of brackish groundwater. This information provides a foundation to inform decision and policy makers about the potential for expanding brackish groundwater development. In 2018, the USGS will work closely with the Bureau of Reclamation to develop a Web service that will allow resource managers and other users to discover and download the brackish water data for their area of interest. In 2019, additional enhancements to this Web service, such as geochemical modeling capabilities, have been identified for development.

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Groundwater and Streamflow Information Program

	2017	2018	2019				
	Actual	Full Year CR	Fixed Costs	Internal Transfer	Program Changes	Request	Change from 2018
Groundwater and Streamflow Information Program	**72,673**	**72,179**	**332**	**-**	**(7,596)**	**64,915**	**(7,264)**
Cooperative Matching Funds – Tribal Waters					*(1,000)*		
Water Tools					*(363)*		
Research and Development to Advance Water Science[7]					*(1,540)*		
U.S.-Canada Transboundary Streamgages					*(160)*		
Groundwater Activities					*(3,752)*		
Administrative Savings					*(781)*		
Cooperative Matching Funds[8]	**[30,299]**	**[30,299]**	**-**	**-**	**[-1,000]**	**[29,299]**	**[-1,000]**
FTE	*331*	*331*	-	-	*(31)*	*300*	*(31)*

The Groundwater and Streamflow Information Program (GWSIP) encompasses the Water Resources Mission Area's objectives to collect, manage, and disseminate consistently high-quality and reliable hydrologic information in real-time and over the long-term, which are both critical for managing our Nation's water resources and anticipating and responding to water hazards that can result in loss of life and property.

The 2019 request supports:

- Maintaining a national streamgage network of more than 8,200 real-time streamgages.
- Continuing the collection and dissemination of high quality hydrologic information in real time and over the long term.
- Engaging and collaborating with our stakeholders to ensure data and products meet the needs of local, regional, and national resource managers.
- Developing next generation data collection tools and techniques, including improved data collection and dissemination during hazards (floods, droughts, hurricanes).
- Supporting improvement of flood forecast predictions, drought management, and development of national water prediction capabilities.

[7] Formerly the National Research Program

[8] Cooperative Matching Funds are used to support research, data collection, and assessment activities across the Groundwater and Streamflow Information Program, and therefore shown as a non-add component within the Program.

Justification of Program Changes

The request proposes the following to address higher priorities:

- Cooperative Matching Funds – Tribal Waters (-$1,000,000 and -6 FTE)
- Water Tools (-$363,000 and -2 FTE)
- Research and Development to Advance Water Science (-$1,540,000 and -10 FTE)
- U.S. Canada Transboundary Streamgages (-$160,000 and -0 FTE)
- Groundwater Activities (-$3,752,000 and -13 FTE)

The USGS plans to achieve $781,000 of administrative savings within the program.

Program Overview

The Groundwater and Streamflow Information Program (GWSIP) encompasses the Water Resources Mission Area's objectives to collect, manage, and disseminate consistently high-quality and reliable hydrologic information in real-time and over the long-term, which are both critical for managing our Nation's water resources and anticipating and responding to water hazards that can result in loss of life and property. The program serves as the national source of timely, quality-assured, and relevant data for short- and long-term water decisions by local, State, tribal, regional, and national stakeholders.

The USGS 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 used for decisions such as water supply planning; aquifer storage and recovery; infrastructure design; floodplain and ecosystem management; energy development; and resolution of water disputes. Access to water information is increasingly more critical as climate patterns, land use, and population change, increase the challenges of managing competing water priorities.

Serving as the largest water data holder in the world, the USGS works in partnership with more than 1,000 Federal, regional, State, tribal, and local agencies to maintain and manage the National Streamflow Network. The network comprises more than 8,200 streamgages across the Nation and provides a continuous source of streamflow information. Information provided through the network forms the scientific basis for decision-making related to protection of life and property from water-related hazards, such as floods; cost-effective management of freshwater that is safe and available for drinking, irrigation, energy, industry, recreation, and ecosystem health; and national, State, tribal, and local economic well-being. The latest streamflow information is available as alerts to users by email or text message and as real-time stream conditions change, updated at intervals of one hour or less.

The USGS places the utmost importance on high quality, accessible, and consistent streamflow measurements over the full range of streamflow conditions to reduce uncertainty and to position the United States for a future that may hold unanticipated challenges, such as related to bigger and (or) more frequent floods, more sustained droughts, and changes in snowpack regimes. In addition, the USGS prioritizes the robustness of more than 8,200 streamgages in order to cover a broad range of watersheds and streamflow conditions across the Nation. A robust network is vital to support the hydrologic research needed to

characterize local and regional streamflow, especially at ungaged locations. Given that it is not economically feasible to measure all rivers and streams at all the important locations, a robust network enables the USGS to provide streamflow estimates at ungaged locations. For example, Federal and State transportation agencies annually estimate flood-frequencies for designing and upgrading thousands of culverts and bridges at ungaged locations across the Nation.

One of the highest goals of the USGS is to maintain long-term stability of a critical, high-priority streamgages 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 due to population growth and changes in land use, water use, and climate.
- Water-quality assessments on sources, transport, and fate of contaminants in major rivers and estuaries.

To meet these strategic long-term Federal priorities and responsibilities, the USGS has identified a network of 4,760 “Federal Priority Streamgages” (FPS), roughly half of the total streamgage network. In 2017, approximately 3,460 of these streamgages were operational, including 1,176 fully funded by the USGS and the other 2,284 streamgages were jointly funded by the USGS and partners.

The remaining streamgages in the Network are also integral to the USGS mission and national water priorities related to hazard mitigation and water availability for human and ecosystem health. These approximate 4,800 streamgages were supported by Cooperative Matching Funds, in concert with cooperators and other USGS partners.

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.
- Flood plain mapping and planning.
- Tide monitoring and prediction.
- Recreational safety and enjoyment.

- Indian Water Rights settlements.

Other Federal agencies continued to rely on streamflow information to meet their respective obligations. This includes:

- The National Weather Service flood prediction using information from over 2,500 streamgages at River Forecast Points.
- The Federal Emergency Management Agency (FEMA) for identifying flood prone areas.
- The U.S. Army Corps of Engineers (USACE) for operation of locks and dams.
- The Bureau of Reclamation for dam and water conveyance systems operations.
- The National Park Service (NPS) and the U.S. Fish and Wildlife Service (FWS) for managing water resources and ecosystems.

In addition to streamgages, the USGS continues to expand the use of storm tide sensors that measure tidal fluctuations and height of the tide relative to land surface. These sensors are part of a relatively new USGS mobile network of rapidly deployable, experimental instruments that are used to observe and document hurricane-induced storm-surge, waves, and tides as they make landfall and interact with coastal features.

In 2017, the USGS tested a new rapidly deployable streamgage (RDG). These new RDGs are less expensive, easier to install, and accommodate a variety of new sensors.

The USGS continues to enhance flood inundation mapping capabilities in order to provide emergency managers and the public with ready access to flood inundation information. The USGS, in concert with the NOAA, USACE, and local and State agencies, continue to enhance standardized geospatial flood inundation models and maps indexed to real-time streamgages that show floodwater extent and depth on the land surface. These flood forecasting tools are used for flood response and mitigation, and enable emergency management officials at local, State, tribal, and Federal levels to assess flood threats and to see, along with the general public, on a street-by-street basis, the expected extent of a flood hours, or even days, before it occurs.

The GWSIP supports the development, implementation, and maintenance of reliable systems for real-time and historic information delivery to all stakeholders that include data processing, quality assurance, storage, and readily available access. At the center of USGS water data products lies the National Water Information System (NWIS), which provides current conditions related to streamflow, flood and high flow, drought, and groundwater levels, in addition to water-quality and water-use data. The USGS ensures this system functions at peak efficiency and effectiveness, especially during hazard events. Hurricanes Harvey, Irma, and Maria resulted in record levels of requests for real-time stream and reservoir water level measurements and August 2017 was the busiest month on record, serving over 128 million requests for water information, due to Hurricane Harvey.

National Water Quality Program

	2017	2018	2019				
	Actual	Full Year CR	Fixed Costs	Internal Transfer	Program Changes	Request	Change from 2018
National Water Quality Program	**90,529**	**89,915**	**569**	**200**	**(21,028)**	**69,656**	**(20,259)**
Transfer from Environmental Health				*200*			
NAWQA Status and Trends Assessments					*(5,600)*		
NAWQA Lower Mississippi Stream Quality Assessment					*(4,000)*		
Enhanced Cooperative Activities and Urban Waters					*(717)*		
National Park Service Water-Quality Partnership					*(1,743)*		
Research and Development to Advance Water Science[9]					*(6,549)*		
National Atmospheric Deposition Program					*(1,565)*		
Administrative Savings					*(854)*		
Cooperative Matching Funds[10]	**[17,231]**	**[17,231]**	**-**	**-**	**[-717]**	**[16,514]**	**[-717]**
FTE	*635*	*635*	-	-	*(138)*	*497*	*(138)*

The National Water Quality Program (NWQP) encompasses the USGS water-quality monitoring, assessment, and research activities.

The 2019 request supports**:**

- Long-term, nationally consistent monitoring of sediment, nutrients, and pesticides at 104 stream monitoring sites that include large coastal and inland rivers and small (generally less than 100 mi^2) agricultural and minimally disturbed reference watersheds.
- Continued upgrades to the NWIS water-quality system.
- Continued long-term monitoring and modeling studies of nutrients, pesticides, sediment and other important water-quality constituents to provide information for water managers, policy makers and the public about current water-quality conditions, how they are changing through time, and the major factors that influence observed conditions and trends.

[9] Formerly the National Research Program.
[10] Cooperative Matching Funds are used to support research, data collection, and assessment activities across the National Water Quality Program, and therefore shown as a non-add component within the Program.

- Continued regional-scale modeling of current and projected surface-water and groundwater quality in selected major river basins and important principal aquifers.

- Continued efforts to develop state-of-the-science sensor technology to monitor and forecast changes on a near real-time basis for key water-quality constituents or their surrogates—such as salinity, sediment, algal toxins (HABs), and other contaminants—that can impair water quality and adversely affect the health of humans and aquatic ecosystems.

- Conducting research on water quality processes to enhance the Nation's water modeling and prediction capability.

Justification of Program Changes

The request proposes the following to address higher priorities:

- NAWQA Project Status and Trends Assessments (-$5,600,000 and -39 FTE)

- NAWQA Project Lower Mississippi Stream Quality Assessment (-$4,000,000 and -28 FTE)

- Enhanced Cooperative Activities and Urban Waters (-$717,000 and -6 FTE)

- National Park Service Water-Quality Partnership (-$1,743,000 and -12 FTE)

- Research and Development to Advance Water Science (-$6,549,000 and -44 FTE)

- National Atmospheric Deposition Program (-$1,565,000 and -10 FTE)

The budget includes an internal transfer from Environmental Health to Water Resource, National Water Quality Program of $200,000 and one FTE supporting research on harmful algal blooms and harmful algal toxin issues in water bodies throughout the Nation.

The USGS plans to achieve $854,000 of administrative savings within the program.

Program Overview

The NWQP encompasses the Water Resources Mission Area's water-quality monitoring, assessment, and research activities.

Primary goals of the NWQP are to:

- Assess the current quality of the Nation's freshwater resources and how it is changing over time.

- Explain how human activities and natural factors (e.g., land use, water use, and meteorological variability) affect the quality of surface water and groundwater.

- Determine the relative effects of important sources of water-quality impairment, including contaminants, excess nutrients and sediment, and altered streamflow in aquatic ecosystems.

- Predict the effects of human activities, meteorological variability, and management strategies on future water-quality and ecosystem conditions.

Water-quality challenges are increasing in number and complexity, and solutions are becoming more challenging and costly. The U.S. population in 2017 is over 325 million people, representing an increase of 24 million people in the last decade. This increasing population—accompanied by increased development and use of fertilizers and pesticides for food production—increases pressure on existing resources for supply water of suitable quality for irrigation, drinking water, energy development, and healthy ecosystems. NWQP investments in monitoring, assessments, modeling, and research provide the data and scientific information needed to address current and future water-quality challenges.

Long-term monitoring of water quality is used to track how changes in land use, climate, and water-quality management actions are affecting streams and rivers and associated commercial and recreational fisheries in estuaries across the Nation.

Many water bodies throughout the Nation experience chronic harmful algal bloom (HAB) issues, and toxic blooms have occurred in every State in the Nation. USGS HAB science is focused on developing analytical laboratory and field methods to detect and quantify blooms and associated toxins and taste-and-odor compounds, understanding causal factors, environmental fate and transport, ecological processes, effects of environmental exposure, and developing early warning systems for potentially harmful blooms. In 2019, the NWQP will continue this HAB research.

The USGS National Water Quality Laboratory (NWQL) is a state-of-the-art, nationally accredited laboratory providing high quality, reproducible data from the chemical analysis of water, sediment, and tissue samples, and the taxonomic identification of aquatic insects and other invertebrate organisms.

The NWQL is a leader in the research and development of new analytical methods to improve detection of contaminants at trace and ultra-trace levels, and in the detection of new and emerging contaminants. In 2019, the NWQL will continue to analyze about 40,000 water-quality samples collected annually by USGS national programs and science centers, and other Federal, State, and local customers, and work collaboratively on developing priorities for future analytical needs.

The primary models used by the USGS to develop national and regional assessments of water-quality conditions from monitoring data for the Nation’s streams and rivers are the Spatially Referenced Regressions On Watershed attributes (SPARROW) (model for sediment, nutrients, and dissolved solids), and the Watershed Regressions for Pesticides (WARP) model. Results of a new pesticide method that analyzes for 225 pesticides, including 47 parent compounds not included in previous analytical methods for stream samples collected between 2013 and 2017, will be incorporated into revised WARP models starting in 2019.

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Core Science Systems

Dollars in Thousands	2017	2018	2019				
	Actual	Full Year CR	Fixed Costs	Internal Transfer	Program Changes	Request	Change from 2018
Core Science Systems	**116,050**	**115,262**	**456**	**-**	**(23,440)**	**92,278**	**(22,984)**
FTE	*470*	*470*	-	-	*(58)*	*412*	*(58)*
National Geospatial Program	**67,354**	**66,897**	**257**	**-**	**(16,276)**	**50,878**	**(16,019)**
FTE	*271*	*271*	-	-	*(26)*	*245*	*(26)*
National Cooperative Geologic Mapping Program	**24,397**	**24,231**	**109**	**-**	**(1,950)**	**22,390**	**(1,841)**
FTE	*108*	*108*	-	-	*(5)*	*103*	*(5)*
Science Synthesis, Analysis, and Research Program	**24,299**	**24,134**	**90**	**-**	**(5,214)**	**19,010**	**(5,124)**
FTE	*91*	*91*	-	-	*(27)*	*64*	*(27)*

Core Science Systems (CSS) leads the USGS's mission as the civilian mapping agency for the Nation—a legacy since the establishment of the USGS in 1879. CSS conducts detailed surveys and distributes the resulting high quality and highly accurate topographic, geologic, hydrographic, and biogeographic maps and data. Mapping accuracy enabled by cutting-edge technologies allows precise planning for critical mineral assessments; energy development; transportation and pipeline infrastructure projects; urban planning and development; flood prediction at regional, local, and neighborhood scales; emergency response; and hazard mitigation.

CSS builds on the core strengths of the USGS in characterizing and understanding complex Earth systems. CSS products provide foundational geospatial data for the Nation; underpin the work of all USGS mission areas; and are essential enablers for meeting Administration priorities in addressing America's growing energy, critical mineral resource, water, and infrastructure improvement needs.

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National Geospatial Program

Dollars in Thousands	2017	2018	2019				
	Actual	Full Year CR	Fixed Costs	Internal Transfer	Program Changes	Request	Change from 2018
National Geospatial Program	**67,354**	**66,897**	**257**	**-**	**(16,276)**	**50,878**	**(16,019)**
3DEP Data					*(7,329)*		
3DEP Technical Support					*(2,757)*		
Geospatial Research					*(2,343)*		
Federal Geographic Data Committee					*(2,700)*		
Administrative Savings					*(1,147)*		
FTE	**271**	**271**	**-**	**-**	**(26)**	**245**	**(26)**

The National Geospatial Program (NGP) organizes, updates, and publishes the geospatial baseline of the Nation's topography, natural landscape, and built environment through The National Map—a compilation of the foundational data layers for the entire Nation, maintained in the public domain. The NGP supports the Interior's responsibilities for national geospatial coordination, and carries out the USGS's government-wide leadership responsibilities for elevation, hydrography and watershed boundaries, and geographic names. As one of the cornerstones of the USGS, The National Map has many uses ranging from recreation to scientific analysis to emergency response. The National Map is easily accessible for display on the Web, as products and services, and as downloadable data. The American people rely on the NGP's publicly available enhanced data and mapping to remain informed and to stay healthy and safe.

The 2019 request supports:

- Continuing work towards National coverage collection completion for lidar by 2033 to support a broad range of uses including infrastructure construction and management, energy development, flood risk management, topographic map production, and more.

- Continuing to shift map production toward dynamic on-demand mapping, updating topographic databases quarterly rather than annually. Dynamic mapping greatly improves access to updated mapping data and allows for production of various map scales.

- Continuing to build partnerships and strengthen governance, via the 3D Elevation Program (3DEP) Executive Forum of participating Federal agencies, to increase 3DEP investments, coordinate Federal elevation data acquisition, and improve best practices.

- Continuing to provide foundational data for emergency operations that support public safety and response to major natural disasters.

Justification of Program Changes

The request proposes the following to address higher priorities:

- 3DEP Data (-$7,329,000 and 0 FTE)

- 3DEP Technical Support (-$2,757,000 and -11 FTE)
- Geospatial Research (-$2,343,000 and -8 FTE)
- Federal Geographic Data Committee Functions (-$2,700,000 and -7 FTE)

The USGS plans to achieve $1,147,000 of administrative savings within the program.

Program Overview

The NGP organizes, updates, and publishes the geospatial baseline of the Nation's topography, natural landscape and built environment through The National Map—a compilation of the foundational data layers for the entire Nation, maintained in the public domain.

The NGP supports Interior's responsibilities for national geospatial coordination, and carries out the USGS's government-wide leadership responsibilities for elevation, hydrography and watershed boundaries, and geographic names.

As one of the cornerstones of the USGS, The National Map has many uses ranging from recreation to scientific analysis to emergency response. The National Map is easily accessible for display on the Web, as products and services, and as downloadable data. The American people rely on the NGP's publicly available enhanced data and mapping to remain informed and to stay healthy and safe.

The 3DEP acquires high-resolution, three-dimensional elevation data for the Nation, including high-resolution IfSAR elevation data for the State of Alaska. Geospatial liaisons from across the United States help to coordinate requirements with Federal, State, local, and tribal governments and private industry to acquire data. The program's annual Broad Agency Announcement process effectively leverages USGS dollars with matching partner funds, to speed national elevation data coverage completion in support of energy and critical minerals assessments, natural resources conservation, public safety, and job creation.

Federal, State, tribal, and local partners use the National Hydrography Dataset Plus High Resolution (NHDPlus HR) to perform water quantity and quality mapping; reference hydrologic features and observations for more accurate flood risk management; and report on surface water conditions.

Nationwide topographic maps and geospatial data produced by the USGS, remain a pivotal part of many business processes and applications across the Country, particularly for hunting and outdoor recreation; wildfire management and suppression; aerial navigation and safety; and natural hazards mitigation and recovery.

The US Topo map product is a georeferenced digital map produced from National Map data. The American public can use US Topo maps like the traditional 7.5-minute quadrangle paper topographic maps for which the USGS is well known. However, in contrast to paper-based maps, US Topo maps provide modern technological advantages that support faster, wider public distribution and basic, onscreen geospatial analysis.

The USGS ensures the production and delivery of the digital geospatial foundation for the Nation. This includes the US Topo program providing free and open general reference topographic maps to the public, as well as aggregation and maintenance of the data layers and Web services of The National Map. The USGS maintains the authoritative Federal database for geographic names, the Geographic Names Information System, on behalf of all Federal partners and provides program leadership in coordination of emergency response activities focused on delivery of geospatial information, products, and services.

In 2018 and 2019, the USGS plans to:

- Complete the shift from a three-year production cycle of US Topos for the lower 48 States to a quarterly refresh of dynamic Web map services broadening availability of new, updated data across the Nation, rather than only one third of the Nation per year.

- Produce 1,400 Alaska US Topos, which is 69 percent of total Alaska US Topo coverage by the end of fiscal year 2018.

- Continue to provide geospatial products and services to users via Web-based map services, geoprocessing services, visualization services, staged map products and data products through an efficient enterprise platform that incorporates on premises and cloud-based hosting and delivery platforms meeting current industry specifications.

- Continue to support emergency operations for major disasters such as hurricanes, tornados, flood response, and public safety by leveraging existing partnerships with the Defense Logistics Agency.

- Continue implementing a cloud-based system capable of topographic map production and distribution and continue quarterly updates to national foundational mapping databases in dynamic Web services, substantially improving user access to current information.

- Continue to provide Secretariat support for the Board on Geographic Names and its Domestic names Committee and Advisory Committee on Antarctic Names.

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National Cooperative Geologic Mapping Program

Dollars in Thousands	2017	2018	2019				
	Actual	Full Year CR	Fixed Costs	Internal Transfer	Program Changes	Request	Change from 2018
National Cooperative Geologic Mapping Program	**24,397**	**24,231**	**109**	**-**	**(1,950)**	**22,390**	**(1,841)**
National Cooperative Geologic Mapping Program Functions					*(1,950)*		
FTE	**108**	**108**	**-**	**-**	**(5)**	**103**	**(5)**

The National Cooperative Geologic Mapping Program (NCGMP) along with its Federal, State, and university partners surveys and researches the Nation's geological resources. The NCGMP also collaborates with State Geological Surveys to conduct scientific investigations and, produce digital geologic maps, models, and visualizations, which help to mitigate natural hazards, assess hydrogeology, assess groundwater availability, and conduct energy and mineral assessments at county and regional scales.

The 2019 request supports:

- Working with State partners to begin implementation of strategic actions outlined in the new Decadal Strategic Plan for the Program.
- Continuing to enhance the performance and relevance of NCGMP program components (FEDMAP, STATEMAP, EDMAP) to maximize efficiency in program function, funding allocation, prioritization of need, and program accountability.
- Beginning the transition to a modern geologic map data schema developed by the USGS and State Geological Surveys.
- Working with partners and universities to improve youth outreach and develop more opportunities to train geologic mappers in all facets of the science, including emerging mapping technologies.
- Advancing an effort to design, build, and interpret a seamless three-dimensional geologic framework model for the Nation based on new and prior geologic mapping at regional to local scales.
- Partnering with the Geological Surveys of other nations on the construction of national geologic framework models.
- Adding digital geologic maps to The National Map Viewer maintained by the National Geospatial Program.
- Providing an additional 40,000 square miles of geologic map coverage to the American public through the NCGMP's National Geologic Map Database.

Justification of Program Changes

The request proposes the following to address higher priorities:

- National Cooperative Geologic Mapping Program Function (-$1,950,000 and -5 FTE)

Program Overview

The National Cooperative Geologic Mapping Program (NCGMP) characterizes, interprets, and distributes the geologic framework model (i.e., a three-dimensional visualization of surface and subsurface rock, soil, and sediment layers) of the Nation through geologic mapping and derivative research (i.e., reducing the map information to an understandable, generalized, or more narrowly-scoped format for non-geologist decision makers), in support of the responsible use of land, water, energy, and mineral resources. These products also help to mitigate the impact of geologic hazards on society and facilitate economic growth and national security through informed natural resource management. The USGS's vision is to create an integrated, three-dimensional, digital geologic framework of the United States and its territories to address the Nation's rapidly changing natural resource needs.

A hallmark of the NCGMP, the National Geologic Map Database, is a major collaborative effort with the Association of American State Geologists. This national database provides rapid access for the public, scientists, and decision makers to well-documented and standardized Federal and State geoscience information that can be used to support research, understanding, and decisions on a number of societal needs. Through annual workshops, the NCGMP's National Geologic Map Database leads national-level information exchanges and the development of more efficient methods for digital mapping, cartography, geographic information system analysis, and information management.

The FEDMAP component provides direction and funds for 25 regional geologic mapping and synthesis projects that cross-jurisdictional boundaries. Annually, the NCGMP Program Council, consisting of representatives from State Geological Surveys, USGS researchers, and USGS Science Center Directors evaluate new and ongoing geologic mapping work plans to maximize efficiency in program function, funding allocation, prioritization of need, and program accountability. Through FEDMAP projects, the current program has accelerated research into geologic specialties, including subsurface geophysical methodology and modeling, three-dimensional geologic modeling, radiogenic isotope and cosmogenic geochronology, petrology and geochemistry, hydrogeology, and paleo-environmental study while still maintaining core geologic mapping expertise.

The STATEMAP component funds the geologic mapping studies conducted by approximately 45 State Geological Surveys through a competitive cooperative agreement program that matches every Federal dollar with a State dollar. This program effectively leverages limited Federal funds with State partners and continues to be effective at balancing the diverse needs of the Nation and individual States. The State-matched grants to State Geological Surveys focus on producing new geologic maps that address societally relevant issues identified by the States including: water, mineral, and energy resources; earthquake, flood, karst, volcanic, and landslide hazards; soil conditions; coastal erosion and flooding; and urban and infrastructure development.

The EDMAP component provides direction and funds for competitive grants to universities and colleges for undergraduate and graduate students to conduct geologic mapping across the Nation. The objective of the program is to mentor the next generation of geoscientists in the science of modern geologic mapping and its application to field and laboratory based geologic problems. EDMAP projects typically involve one season of fieldwork and require a one-to-one match of Federal dollars from the university.

Science Synthesis, Analysis, and Research Program

Dollars in Thousands	2017	2018	2019				
	Actual	Full Year CR	Fixed Costs	Internal Transfer	Program Changes	Request	Change from 2018
Science Synthesis, Analysis, and Research Program	**24,299**	**24,134**	**90**	**-**	**(5,214)**	**19,010**	**(5,124)**
Biogeographic Science					*(2,357)*		
USGS Libraries					*(2,857)*		
FTE	**91**	**91**	**-**	**-**	**(27)**	**64**	**(27)**

The Science Synthesis, Analysis, and Research program provides analysis and synthesis of scientific data and information, and long-term preservation of scientific data and library collections. This program strives to accelerate research and decision making through data science, information delivery, advanced computing, biodiversity analytics, and preserved geoscientific assets.

The 2019 request supports:

- Enhancing the USGS's high performance computing capabilities to support USGS and Interior computational and management challenges, enable more timely data transfer and analysis and provide more capable delivery of completed research results to address priority environmental, natural resource and economic challenges.

- Integrating additional data and capabilities to the USGS's National Biogeographic Map to provide improved analytical tools for the examination of selected species, habitats, protections, and habitat conditions.

- Continuing to increase access, discovery, understanding and reuse of USGS science data and information by providing tools and expertise to release, preserve, and deliver science data.

- Continuing to support preserving and promoting reuse of valuable geoscientific documents, samples, and data to inform geologic studies.

- Continuing to work with researchers to promote preservation of geoscientific artifacts and data by promoting best practices, shared repositories, and standardized data sharing techniques to expose and enable investigation of existing collections and associated data.

- Continuing to improve discovery and access to valuable fossils, rock cores, and associated data to industry, academic, and government researchers to promote geoscientific investigation of natural resources (e.g., oil, gas, and minerals) and development.

Justification of Program Changes

The request proposes the following to address higher priorities:

- Biogeographic Science (-$2,357,000 and -7 FTE)

- USGS Library (-$2,857,000 and -20 FTE)

Program Overview

The program includes the Core Science Analytics, Synthesis, and Library Program (CSAS&L); the National Geological and Geophysical Data Preservation Program (NGGDPP); the Core Research Center; and the J.W. Powell Center for Analysis and Synthesis (Powell Center). These activities provide an integrated suite of essential data, services, and applications to empower USGS and its collaborators to effectively manage, steward and analyze key scientific data and materials.

The USGS provides integrated and synthesized biogeographic data and information on protected lands and waters, species and habitats, and the dynamics that affect those trust resources over time. Through data science, high-performance computing and technologies, and open scientific data requirements, the USGS develops new methods and tools that help inform and engage citizens, launch and empower business, and help governments manage and conserve America's public land assets.

The Data Integration and Synthesis component provides bureau-wide leadership in establishing and implementing science data-management practices; expertise in data lifecycle best practices; and access to standards, workflows, training, and enterprise tools to help ensure that the USGS and its bureau partners properly maintain, describe, preserve, and make accessible Federal data to the American public. Preserving and sharing USGS science data increases the reproducibility of science and creates efficiencies in the reuse of science data. It also provides support for developing an Advanced Research Computing Framework, which the USGS maintains to execute complex computational models required to quickly and efficiently process high-resolution elevation datasets, integrating elevation and hydrography data, and three-dimensional geologic datasets.

Across the Nation, vast collections of valuable geologic materials and data, collected over many decades, are managed by State Geological Surveys, the USGS, and other Interior bureaus. However, many of these assets are unknown beyond the scientists who collected them. The USGS provides technical and financial assistance to State geological surveys and Interior bureaus to support preservation, exposure, and reuse of valuable physical geoscience samples (e.g., drilling cores and rock and sediment samples) and data (e.g., borehole logs, GIS databases, maps, field notebooks, etc.). Preserving endangered and unique geological and geophysical collections reduces duplicative collection costs and unearths resources that may have been previously unknown. The results of this effort are described in the National Digital Catalog, a centralized database accessible to the public.

The Core Research Center provides for the preservation of rock cores for use by scientists and educators from government, industry, and academia. Because of this storage capability, billions of dollars are saved by not redrilling and replicating collections. The drilling cost to replicate the core collection alone is conservatively estimated to be in excess of $80 billion.[11] The CRC is one of the largest and most heavily used public core repositories in the United States. The CRC also houses, in volume, the second largest Federal fossil collection in the United States.

[11] Source: U.S. Department of Energy, March, 2016

Science Support

Dollars in Thousands	2017	2018	2019				
	Actual	Full Year CR	Fixed Costs	Internal Transfer	Program Changes	Request	Change from 2018 Full Year CR
Science Support	**105,611**	**104,894**	**1,378**	**-**	**(17,022)**	**89,250**	**(15,644)**
FTE	*547*	*547*	-	-	*(158)*	*389*	*(158)*
Administration and Management	**81,981**	**81,424**	**1,316**	**-**	**(13,206)**	**69,534**	**(11,890)**
FTE	*481*	*481*	-	-	*(150)*	*331*	*(150)*
Information Services	**23,630**	**23,470**	**62**	**-**	**(3,816)**	**19,716**	**(3,754)**
FTE	*66*	*66*	-	-	*(8)*	*58*	*(8)*

The Science Support Activity provides the core functions that make it possible to conduct USGS science. These business and information services and systems include acquisitions and grants, finance, internal controls, communications, budget and performance, monitoring and evaluation of science quality and integrity, information assurance, information management and technology services, and human capital. Science Support also includes the executive leadership and management that provide guidance, direction, and oversight for all USGS science activities.

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Administration and Management

Dollars in Thousands	2017	2018	2019				
	Actual	Full Year CR	Fixed Costs	Internal Transfer	Program Changes	Request	Change from 2018
Administration and Management	**81,981**	**81,424**	**1,316**	**-**	**(13,206)**	**69,534**	**(11,890)**
Administration and Management					*(13,206)*		
FTE	**481**	**481**	**-**	**-**	**(150)**	**331**	**(150)**

The offices and personnel in this subactivity in the proposed organization structure are the Office of the Director; Senior Executive Leadership; Budget and Performance Management; Communications and Publishing; Science Quality and Integrity; International Programs; Diversity and Equal Opportunity; and Administration.

Justification of Program Change

The request proposes the following to address higher priorities:

- Administration and Management (-$13,206,000 and -150 FTE)

Program Overview

The subactivity provides bureau-wide leadership and direction; establishes organizational vision, mission, goals and scientific priorities; develops and enforces standards for scientific rigor and integrity; plans, obtains and manages necessary resources, including people, budget authority, facilities and equipment; provides resource management systems; implements statutory and regulatory requirements and monitors and enforces compliance; and communicates the USGS mission and science to Congress and the public.

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Information Services

Dollars in Thousands	2017	2018	2019				
	Actual	Full Year CR	Fixed Costs	Internal Transfer	Program Changes	Request	Change from 2018
Information Services	**23,630**	**23,470**	**62**	**-**	**(3,816)**	**19,716**	**(3,754)**
Information Services					*(3,816)*		
FTE	**66**	**66**	**-**	**-**	**(8)**	**58**	**(8)**

The subactivity provides the Information Management and Technology (IMT) foundation for the USGS science mission by implementing advances in IMT and using them to facilitate research, data gathering, analysis and modeling, scientific collaboration, knowledge management and work processes.

Justification of Program Change

The request proposes the following to address higher priorities:

- Information Services (-$3,816,000 and -8 FTE)

Program Overview

Information Services funds numerous IMT activities such as the USGS information assurance program, infrastructure and computing services, applications and customer support, information and investment management program. In addition to IMT services, this subactivity also supports the Interior IMT bureau activities through the Department of the Interior Working Capital Fund Central and Direct bills. Although Information Services has been confronted with mission challenges resulting from cybersecurity incidents and the implementation of the Federal Information and Technology Acquisition Reform Act (FITARA), the subactivity continues to provide bureau-wide IMT services necessary to support a successful and respected science organization.

The Information Services (IS) subactivity provides the IMT foundation for the USGS science mission by implementing advances in IMT and using them to facilitate research, data gathering, analysis and modeling scientific collaboration, knowledge management and work processes.

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Facilities

Dollars in Thousands	2017	2018	2019				
	Actual	Full Year CR	Fixed Costs	Internal Transfer	Program Changes	Request	Change from 2018
Facilities	**100,421**	**99,739**	**(243)**	**-**	**12,954**	**112,450**	**12,711**
FTE	*78*	*78*	-	-	-	*78*	-
Rental Payments and Operations & Maintenance	**93,141**	**92,508**	**(243)**	**-**	**12,954**	**105,219**	**12,711**
FTE	*78*	*78*	-	-	-	*78*	-
Deferred Maintenance and Capital Improvement	**7,280**	**7,231**	**-**	**-**	**-**	**7,231**	**-**
FTE	-	-	-	-	-	-	-

The USGS Facilities Activity provides safe, functional workspace to accomplish the bureau's scientific mission with an emphasis on the mission driving facility needs. Funds support, rent; basic facility operations; security; facility maintenance in compliance with Federal, State, and local standards; and provide a safe, sustainable working environment for USGS employees, visiting partners, and customers.

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Rental Payments and Operations and Maintenance

Dollars in Thousands	2017	2018	2019				
	Actual	Full Year CR	Fixed Costs	Internal Transfer	Program Changes	Request	Change from 2018
Rental Payments and Operations & Maintenance	**93,141**	**92,508**	**(243)**	**$0**	**$12,954**	**$105,219**	**$12,711**
GSA Rent Adjustment and Support for Relocation of Menlo Park	-	-	-	-	*12,454*	-	*12,454*
Support for Interior Reorganization	-	-	-	-	*500*	-	*500*
FTE	**78**	**78**	**-**	**-**	**-**	**78**	**-**

The Rental Payments (RP) and Operations and Maintenance (O&M) Subactivity provides the USGS with funding needed to meet annual recurring obligations for renting space and operating and maintaining owned real property.

Justification of Program Change

Rental Payments and Operations and Maintenance (+$12,454,000): This provides for the GSA rent escalation of roughly 150 percent at the Menlo Park, CA, campus. The USGS is relocating all staff, public safety-monitoring equipment, and analytical laboratories from the high-cost GSA-owned Menlo Park campus to a NASA Ames-owned campus located at Moffett Field in Mountain View, CA. This move furthers Interior's goal of modernizing our infrastructure, reducing facilities footprint and cost, and collocating with other Federal agencies. It enhances—through synergies and leveraging—the Earth science capabilities of both USGS and NASA.

Support for Interior Reorganization (+$500,000): The budget includes $500,000 to shift resources to the field to improve service and efficiency and continue to migrate to common regional boundaries.

Program Overview

Rental payments are paid to GSA, other Federal sources, private lessors, and cooperators for space occupied by the USGS. The USGS has unique facility requirements for supporting science functions and relies heavily on GSA to meet those needs, including modern laboratory space. The USGS occupies approximately 4 million square feet of rentable space in about 166 GSA buildings nationwide, making the USGS one of the largest users of GSA space within Interior. Only 21 percent of USGS space is owned; the remaining 79 percent of the USGS space is provided through GSA, direct leases with the private sector, and cooperative and interagency agreements with State and local governments, universities, and other Federal agencies.

The Operations and Maintenance cost component provides funding for basic facility operations, security and facility maintenance, and providing a safe working environment for USGS employees, visiting partners, and customers. Maintenance involves the upkeep of USGS owned facilities, structures, and capitalized equipment, necessary to maintain the useful life of the asset. To protect our important resources, ongoing investments in annual and cyclic maintenance, repair, revitalization, and disposal of assets must be considered as a part of a long-term operations and maintenance program. Operations of USGS owned

facilities include costs such as utilities, janitorial and pest services, waste management, and salaries for staff responsible for the day-to-day operations of the facility.

The full cost of USGS rent, operations, and maintenance are only partially covered by this subactivity. Science programs cover the balance. In 2017, the science programs funded $5.1 million of rent and O&M. The USGS estimates that science programs will fund $4.8 million in rent and O&M in 2018 and in 2019.

Deferred Maintenance and Capital Improvements

Dollars in Thousands	2017	2018	2019				
	Actual	Full Year CR	Fixed Costs	Internal Transfer	Program Changes	Request	Change from 2018
Deferred Maintenance and Capital Improvement	7,280	7,231	-	-	-	7,231	-
FTE	-	-	-	-	-	-	-

Deferred maintenance needs are addressed through the USGS Deferred Maintenance and Capital Improvement (DMCI) program, which provides funding to address the highest priority USGS facility and equipment requirements. The 2019 DMCI funds provide the USGS necessary funding to address its facilities maintenance needs. The DMCI funding will provide for 11 deferred maintenance projects at six different sites that contribute significantly to the bureau's Deferred Maintenance backlog. The types of facilities needs that will be addressed include projects that correct deficiencies in laboratory space, address health and safety issues, improve climate control systems, and ensure compliance with the ADA.

Justification of Program Changes

There are no changes proposed for this program.

Program Overview

Facilities projects reflect comprehensive evaluations conducted by independent architectural and engineering firms. These installation-wide assessments help establish core data on the condition of USGS constructed assets. Additionally, knowing the estimated cost of deferred maintenance and the replacement value of constructed assets allows the USGS to use the industry standard Facility Condition Index as a method of measuring facility condition and condition changes. The condition assessment process also identifies, reports, and tracks asbestos, environmental, and disposal liabilities of USGS. Through the asset management planning process, the USGS identifies real property assets that are candidates for disposition. Any asset that is no longer critical to the mission, in poor condition, or no longer cost effective to maintain is a candidate for possible disposal.

Seismic Instrumentation – The use of DMCI funds will focus on the replacement of existing equipment that has exceeded its expected life and that cannot be expected to operate continuously without increasing frequency of failures.

Cableways – Cableways have been used for many decades by the USGS for the measurement of streamflow and collection of water-quality samples. The DMCI program supports the USGS streamgage network by restoring vital cableways to safe operation, and removing abandoned cableways that present a potential hazard to employees and to the public.

The 2019 DMCI funds provide the USGS necessary funding to address its facilities maintenance needs. Examples of the types of projects that will be funded through this request include:

- Correcting a water supply system to wet laboratories for aquatic research at the Western Fisheries Research Center.

- Modifying restrooms at the Northern Prairie Wildlife Research Center to be ADA compliant.
- Adding biosecurity protection capabilities at the Upper Midwest Environmental Sciences Center.
- Replacing Underground Fuel Storage Tank for the Tight Isolation Building at the National Wildlife Health Center.
- Replacing the Roof on the C-3 Pollution Abatement Building at the Columbia Environmental Research Center.

Condition Assessments – Condition assessments are used to identify deferred maintenance needs, life and safety issues, and ADA accessibility issues. Condition assessments provide detailed deficiency information to facilities managers who then prioritize the needed repairs. The more costly deficiencies are often addressed through DMCI projects.

Working Capital Fund

The Working Capital Fund (WCF) was made available for expenses necessary for furnishing materials, supplies, equipment, work, and services in support of USGS programs, and as authorized by law, to agencies of the Federal Government and others.

The WCF consists of:

- The WCF Investment Component provides a mechanism to assist USGS managers in planning for and acquiring goods and services that are too costly to acquire in a single fiscal year or that, due to the nature of services provided, must operate in a multi- as opposed to a single-year basis of funding. Investments are supported by documented investment plans that include estimated acquisition/replacement costs, a schedule of deposits, and approval of the plans, deposits, and expenditures by designated USGS officials.

- The WCF Fee-for-Service Component provides a continuous cycle of client services for fees established in a rate-setting process. Fees are predicated upon both direct and indirect costs associated with providing the services, including amortization of equipment required to provide the services.

- The GSA buildings delegation component is used to manage funds received under the delegated authority for the J.W. Powell Building and Advanced Systems Center in Reston, VA, as provided by 40 U.S.C. 121 (d) and (e) (formerly subsections 205 (d) and (e) of the Federal Property and Administrative Services Act of 1949, as amended, and 40 U.S.C. 486 (d) and (e), respectively). Delegated functions include building operations, maintenance, cleaning, overseeing fire and life safety, maintaining high voltage switchgear and fire alarms, recurring repairs, minor alterations, historic preservation, concessions, and energy management. Because of the size of the Reston buildings and the need to expend the facility funds in a manner corresponding to GSA's no-year funding (Federal Buildings Fund) mechanisms and the GSA National Capital Region long-range capital improvement plan, no-year funding is a prerequisite to administering the delegation. Public Law 104–208, Section 611, provides that, for the fiscal year ending September 30, 1997, and thereafter, any department or agency that has delegated authority shall retain that portion of the GSA rental payment available for operation, maintenance, and repair of the building and the funds shall remain available until expended. This component was established in 2004 to provide the USGS with this no-year flexibility.

Appropriation Language and Citations

P.L. 101-512 Department of the Interior and Related Agencies Appropriations Act, 1991. This authority established a Working Capital Fund account in 1991. The Telecommunications Amortization Fund was included as part of the WCF and all balances of the Telecommunications Amortization Fund existing at the end of 1990 were transferred to the WCF. These balances were to be used for the same purposes as originally authorized.

P.L. 103-332 Department of the Interior and Related Agencies Appropriations Act, 1995. This authority expanded the use to partially fund laboratory operations and facilities improvements and to acquire and replace publication and scientific instrumentation and laboratory equipment.

Program and Financing

Federal Funds
General and special funds:
WORKING CAPITAL FUND
(In millions of dollars)

Identification Code 14-4556-0-4-306		2017 Actual	2018 CR Annualized	2019 Request
	Obligations by program activity:			
08.01	Working Capital Fund	85	90	75
	Budgetary resources:			
	Unobligated balance:			
10.00	Unobligated balance carried forward, start of year	96	88	74
10.21	Recoveries of prior year unpaid obligations	3	0	0
10.50	Unobligated balance total	99	88	74
	Budget Authority:			
	Spending Authority from offsetting collections, disc			
17.00	Collected	74	76	78
19.30	Total budgetary resources available	173	164	152
	Memorandum (non-add) entries:			
19.41	Unexpired unobligated balance, end of year	88	74	77
	Change in obligated balances:			
	Obligated balance, start of year:			
30.00	Unpaid obligations, brought forward, Oct 1	27	34	46
30.10	Obligations incurred, unexpired accounts	85	90	75
30.20	Outlays, Gross	-75	-78	-78
30.40	Recoveries of prior year obligations	-3	0	0
	Obligated balance, end of year:			
30.50	Unpaid Obligations, end of year (gross)	34	46	43
	Budget authority and outlays, net:			
	Discretionary			
40.00	Budget authority, gross	74	76	78
	Outlays, gross:			
40.10	Outlays from new discretionary authority	38	34	35
40.11	Outlays from discretionary balances	37	44	43
40.20	Outlays, gross	75	78	78
	Offsets against gross budget authority and outlays:			
	Offsetting collections (collected) from:			
40.30	Federal Sources	-74	-76	-78
40.70	Budget authority, net (discretionary)			
40.80	Outlays, net (discretionary)	1	2	0
41.80	Budget authority, net (total)			
41.90	Outlays, net (total)	1	2	0

Balance Sheet

(In millions of dollars)		2016 Actual	2017 Actual
	ASSETS:		
	Federal assets:		
1101	Fund balances with Treasury	123	123
	Investments in U.S. securities:		
1106	Receivables, net		
1803	Other Federal assets: Property, plant and equipment, net	32	37
1999	Total assets	155	160
	LIABILITIES:		
2101	Federal liabilities: Accounts payable		
2201	Non-Federal liabilities: Accounts payable	2	2
2999	Total liabilities	2	2
	NET POSITION:		
3300	Cumulative results of operations	153	158
3999	Total net position	153	158
4999	Total liabilities and net position	155	160

Object Classification

	(In millions of dollars)	2017 Actual	2018 CR	2019 Request
	Reimbursable obligations:			
	Personnel compensation:			
11.1	Full-time permanent	9	9	9
11.3	Other than full-time permanent	0	0	0
11.5	Other personnel compensation	1	1	1
11.9	Total personnel compensation	10	10	10
12.1	Civilian personnel benefits	4	3	3
21.0	Travel and transportation of persons	2	1	0
23.1	Rental payments to GSA	2	2	2
23.3	Communications, utilities, and miscellaneous charges	0	0	0
24.0	Printing and reproduction	0	0	0
25.2	Other services	9	11	6
25.3	Other purchases of goods and services from Government Accounts	6	14	10
25.4	Operation and maintenance of facilities	9	9	9
25.7	Operation and maintenance of equipment	4	2	2
26.0	Supplies and materials	5	5	5
31.0	Equipment	34	33	28
32.0	Land and structures	0	0	0
99.9	Total new obligations	85	90	75

Employment Summary

	Identification Code 14-4556-0-4-306	2017 Actual	2018 CR Annualized	2019 Request
	Reimbursable:			
2001	Civilian full-time equivalent employment	133	133	133

USGS Accounts

Federal Funds

General and special funds:

SURVEYS, INVESTIGATIONS, AND RESEARCH

For expenses necessary for the United States Geological Survey to perform surveys, investigations, and research covering topography, geology, hydrology, biology, and the mineral and water resources of the United States, its territories and possessions, and other areas as authorized by 43 U.S.C. 31, 1332, and 1340; classify lands as to their mineral and water resources; give engineering supervision to power permittees and Federal Energy Regulatory Commission licensees; administer the minerals exploration program (30 U.S.C. 641); conduct inquiries into the economic conditions affecting mining and materials processing industries (30 U.S.C. 3, 21a, and 1603; 50 U.S.C. 98g(1)) and related purposes as authorized by law; and to publish and disseminate data relative to the foregoing activities; $859,680,000, to remain available until September 30, 2020; of which $72,948,000 shall remain available until expended for satellite operations; and of which $7,231,000 shall be available until expended for deferred maintenance and capital improvement projects that exceed $100,000 in cost: Provided, That none of the funds provided for the ecosystem research activity shall be used to conduct new surveys on private property, unless specifically authorized in writing by the property owner: Provided further, that no part of this appropriation shall be used to pay more than one-half the cost of topographic mapping or water resources data collection and investigations carried on in cooperation with States and municipalities.

Note.—A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution.

Appropriation Language and Citations

For expenses necessary for the United States Geological Survey to perform surveys, investigations, and research covering topography, geology, hydrology, biology, and the mineral and water resources of the United States,

- **43 U.S.C. 31(a)** provides for establishment of the Office of the Director of the Geological Survey, under the Interior Department, and that this officer shall have direction of the Geological Survey, and the classification of the public lands and examination of the geological structure, mineral resources, and products of the national domain.

A full listing of USGS appropriation language and citations is available at the USGS Office of Budget, Planning, and Integration Web site, under Resources and Tools.

Web site: https://www2.usgs.gov/budget/resources_tools.asp

Expiring Authorizations

Expiring Authorization Citation	
Bureau/Office Name	USGS/Core Science Systems Mission Area
Program Name	National Cooperative Geologic Mapping Program
Citation	P.L. 111-11 43 USC 31 h amended
Title of Legislation	Omnibus Public Land Bill of 2009
Last Year of Authorization	2018
BY Budget Request ($000)	$ 64,000
Explanation of Authorization Requirement for BY	No individual programmatic authorization is necessary for the USGS to continue this effort
Program Description	The National Cooperative Geologic Mapping Program surveys and researches the Nation's geological resources, and portrays the findings in maps, models, and databases, through a Federal-State-university partnership. The NCGMP cooperates with State geological surveys to provide publications, digital geologic maps, and multidimensional models and visualizations to sustain and improve the quality of life and economic vitality of the Nation and to mitigate natural hazards. The program makes geologic mapping data, from all of North America, publically and freely available by way of the National Geologic Map Database. Since its inception over 23 years ago, the program has leveraged more than $118 million in Federal funding matched by the State geological surveys to collaboratively produce modern geologic maps for the Nation and $9 million matched by universities to train over 1,100 college geoscience students.

Administrative Provisions

From within the amount appropriated for activities of the United States Geological Survey such sums as are necessary shall be available for contracting for the furnishing of topographic maps and for the making of geophysical or other specialized surveys when it is administratively determined that such procedures are in the public interest; construction and maintenance of necessary buildings and appurtenant facilities; acquisition of lands for Water Resources and Natural Hazards activities through permits and licenses; expenses of the United States National Committee for Geological Sciences; and payment of compensation and expenses of persons employed by the Survey duly appointed to represent the United States in the negotiation and administration of interstate compacts: Provided, That activities funded by appropriations herein made may be accomplished through the use of contracts, grants, or cooperative agreements as defined in section 6302 of title 31, United States Code: Provided further, That the United States Geological Survey may enter into contracts or cooperative agreements directly with individuals or indirectly with institutions or nonprofit organizations, without regard to 41 U.S.C. 6101, for the temporary or intermittent services of students or recent graduates, who shall be considered employees for the purpose of chapters 57 and 81 of title 5, United States Code, relating to compensation for travel and work injuries, and chapter 171 of title 28, United States Code, relating to tort claims, but shall not be considered to be Federal employees for any other purposes.

Administrative Provisions Language and Citations

A full listing of USGS appropriation language and citations is available at the USGS Office of Budget, Planning, and Integration Web site, under Resources and Tools.

Web site: https://www2.usgs.gov/budget/resources_tools.asp

Summary of Requirements

Activity/ Subactivity/ Program Element	2017	FY 2018 CR		Fixed Costs	Internal Transfers	Program Changes		2019 Request		Change from 2018	
	Amount	FTE	Amount			FTE	Amount	FTE	Amount	FTE	Amount
Status and Trends Program	20,473	103	20,334	92	0	-60	-9,101	43	11,325	-60	-9,009
Fisheries Program	21,136	124	20,992	113	0	-74	-11,404	50	9,701	-74	-11,291
Wildlife Program	46,007	262	45,695	227	0	-76	-12,482	186	33,440	-76	-12,255
Environments Program	37,415	191	37,161	176	0	-82	-12,768	109	24,569	-82	-12,592
Invasive Species Program	17,330	77	17,212	56	0	0	-172	77	17,096	0	-116
Cooperative Research Units	17,371	135	17,253	0	0	-135	-17,253	0	0	-135	-17,253
Ecosystems Total	**159,732**	**892**	**158,647**	**664**	**0**	**-427**	**-63,180**	**465**	**96,131**	**-427**	**-62,516**
National Land Imaging Program	85,794	148	85,211	153	0	-52	-9,850	96	75,514	-52	-9,697
Land Change Science Program	38,146	201	38,887	54	0	-93	-23,202	108	14,739	-93	-23,148
National and Regional Climate Adaptation Science Centers	25,335	63	25,163	227	0	-18	-12,401	45	12,989	-18	-12,174
Land Resources Total	**149,275**	**412**	**148,261**	**434**	**0**	**-163**	**-45,453**	**249**	**103,242**	**-163**	**-45,019**
Mineral Resources Program	48,371	301	48,043	301	0	4	9,882	305	58,226	4	10,183
Energy Resources Program	24,695	128	24,527	141	0	7	1,211	135	25,879	7	1,352
Contaminant Biology Program	10,197	62	10,128	0	0	-62	-10,128	0	0	-62	-10,128
Toxic Substance Hydrology Program	11,048	57	10,973	0	-200	-57	-10,773	0	0	-57	-10,973
Environmental Health Subtotal	21,245	117	21,101	0	-200	-119	-20,901	0	0	-119	-21,101
Energy and Mineral Resources Total	**94,311**	**548**	**93,671**	**442**	**200**	**-108**	**--9,808**	**440**	**84,105**	**-108**	**-9,566**
Earthquake Hazards Program	64,303	240	63,866	251	0	-18	-13,118	222	50,999	-18	-12,867
Volcano Hazards Program	28,121	142	27,930	153	0	-7	-5,777	135	22,306	-7	-5,624
Landslide Hazards Program	3,538	24	3,514	24	0	0	-27	24	3,511	0	-3
Global Seismographic Network	6,653	12	6,608	13	0	-2	-1,684	10	4,937	-2	-1,671
Geomagnetism Program	1,888	11	1,875	0	0	-11	-1,875	0	0	-11	-1,875
Coastal-Marine Hazards and Resources Program	40,510	213	40,235	220	0	-16	-4,906	197	35,549	-16	-4,686
Natural Hazards Total	**145,013**	**642**	**144,028**	**661**	**0**	**-54**	**--27,387**	**588**	**117,302**	**-54**	**-26,726**
Water Availability and Use Science Program	42,052	320	44,746	287	0	-71	-14,682	249	30,351	-71	-14,395
Groundwater and Streamflow Information Program	72,673	331	71,179	332	0	-31	-7,596	300	64,915	-31	-7,264
National Water Quality Program	90,529	635	89,914	569	200	-138	-21,028	497	69,656	-138	-20,259
Water Resources Research Act Program	6,500	1	6,456	0	0	-1	-6,456	0	0	-1	-6,456
Water Resources Total	**214,754**	**1,287**	**213,296**	**1,188**	**200**	**-241**	**-49,762**	**1,046**	**164,922**	**-241**	**-48,373**
National Geospatial Program	67,354	271	66,897	257	0	-26	-16,276	245	50,878	-26	-16,019
National Cooperative Geologic Mapping Program	24,397	108	24,231	109	0	-5	-1,950	103	22,390	-5	-1,841

Activity/ Subactivity/ Program Element	2017	FY 2018 CR		Fixed Costs	Internal Transfers	Program Changes		2019 Request		Change from 2018	
	Amount	FTE	Amount			FTE	Amount	FTE	Amount	FTE	Amount
Science Synthesis, Analysis and Research Program	24,299	91	24,134	90	0	-27	-5,214	64	19,010	-27	-5,124
Core Science Systems Total	**116,050**	**470**	**115,262**	**456**	**0**	**-58**	**-23,440**	**412**	**92,278**	**-58**	**-22,984**
Administration and Management	81,981	481	81,424	1,316	0	-150	-13,206	331	69,534	-150	-11,890
Information Services	23,630	66	23,470	62	0	-8	-3,816	58	19,716	-8	-3,754
Science Support Total	**105,611**	**547**	**104,894**	**1,378**	**0**	**-158**	**-17,022**	**389**	**89,250**	**-158**	**-15,644**
Rental Payments and Operations & Maintenance	93,141	78	92,508	-243	0	0	12,954	78	105,219	0	12,711
Deferred Maintenance and Capital Improvement	7,280	0	7,231	0	0	0	0	0	7,231	0	0
Facilities Total	**100,421**	**78**	**99,739**	**-243**	**0**	**0**	**12,954**	**78**	**112,450**	**0**	**12,711**
Total, USGS	**1,085,167**	**4,876**	**1,077,098**	**4,980**	**0**	**-1,209**	**-223,098**	**3,667**	**859,680**	**-1,209**	**-218,118**

United States Geological Survey

Justification of Fixed Costs and Internal Realignments

(Dollars In Thousands)

Fixed Cost Changes and Projections	2018 Total	2018 to 2019 Change
Change in Number of Paid Days This column reflects changes in pay associated with the change in the number of paid days between the CY and BY.	**+0**	**+2,024**
Pay Raise The change reflects the salary impact of the 1.9% pay raise for 2018 as signed by the President in February 2017. There is no pay raise for 2019 (0.0%).	**+10,102**	**+2,668**
Departmental Working Capital Fund The change reflects expected changes in the charges for centrally billed Department services and other services through the Working Capital Fund. These charges are detailed in the Budget Justification for Departmental Management.	**-59**	**+1,193**
Worker's Compensation Payments The amounts reflect projected changes in the costs of compensating injured employees who suffer accidental deaths while on duty. Costs will reimburse the Department of Labor, Federal Employees Compensation Fund, pursuant to 5 U.S.C. 8147(b) as amended by Public Law 94-273.	**-75**	**-355**
Unemployment Compensation Payments The amounts reflect projected changes in the costs of unemployment compensation claims to be paid to the Department of Labor, Federal Employees Compensation Account, in the Unemployment Trust Fund, pursuant to Public Law 96-499.	**+9**	**+0**
Rental Payments The amounts reflect changes in the costs payable to the General Services Administration (GSA) and others for office and non-office space as estimated by GSA, as well as the rental costs of other currently occupied space. These costs include building security; in the case of GSA space, these are paid to the Department of Homeland Security (DHS). Costs of mandatory office relocations, i.e. relocations in cases where due to external events there is no alternative but to vacate the currently occupied space, are also included.	**+11,800**	**-550**
Baseline Adjustments for O&M In accordance with space maximization efforts across the Federal Government, this adjustment captures the associated change to baseline operations and maintenance (O&M) requirements resulting from movement out of GSA or direct-leased (commercial) space and into Bureau-owned space. While the GSA portion of fixed costs will go down as a result of these moves, Bureaus often encounter a change to baseline O&M costs not otherwise captured in fixed costs. This category of funding properly adjusts the baseline fixed cost amount to maintain steady-state funding for these requirements.	**+0**	**+0**

Account and Sundry Exhibits

Summary of Requirements by Object Class

SURVEYS, INVESTIGATIONS, AND RESEARCH
(Millions of Dollars)

	Object Class	2018 CR Estimate FTE	2018 CR Estimate Amount	2019 Request (Estimated) FTE	2019 Request (Estimated) Amount
	Personnel compensation				
11.1	Full-time permanent		411		319
11.3	Other than full-time permanent		42		31
11.5	Other personnel compensation		11		8
	Total personnel compensation	4,876	464	3,667	358
12.1	Civilian personnel benefits		155		120
13.0	Benefits for former personnel		1		0
21.0	Travel and transportation of persons		26		21
22.0	Transportation of things		1		1
23.1	Rental payment to GSA		54		53
23.2	Rental payments to others		3		3
23.3	Communications, utilities, and miscellaneous charges		22		22
24.0	Printing and reproduction		1		1
25.1	Advisory and assistance services		20		15
25.2	Other services from non-Fed sources		93		73
25.3	Other goods and services from Fed sources		63		60
25.4	Operation and maintenance of facilities		14		14
25.5	Research and development contracts		1		1
25.7	Operation and maintenance of equipment		20		15
26.0	Supplies and materials		25		22
31.0	Equipment		39		30
32.0	Land and structures		1		1
41.0	Grants, subsidies, and contributions		75		50
	Total requirements		1,078		860

This information is displayed in budget authority (not obligations) by object class.

Summary of Requirements by Object Class

SURVEYS, INVESTIGATIONS, AND RESEARCH
(Millions of Dollars)

	Reimbursable Obligations	2018 CR Estimate FTE	2018 CR Estimate Amount	2019 Request Estimate FTE	2019 Request Estimate Amount	Change FTE	Change Amount
	Personnel compensation						
11.1	Full-time permanent		175		175		0
11.3	Other than full-time permanent		35		35		0
11.5	Other personnel compensation		3		3		0
	Total personnel compensation	2,993	213	2,993	213	0	0
12.1	Civilian personnel benefits		70		70		0
21.0	Travel and transportation of persons		10		10		0
23.1	Rental payments to GSA		23		23		0
23.3	Communications, utilities, and miscellaneous charges		7		7		0
25.1	Advisory and assistance services		7		7		0
25.2	Other services		89		89		0
25.3	Other purchases of goods and services from Government accounts		32		32		0
25.4	Operation and maintenance of facilities		7		7		0
25.7	Operation and maintenance of equipment		6		6		0
26.0	Supplies and materials		10		10		0
31.0	Equipment		19		19		0
41.0	Grants, subsidies, and contributions		38		38		0
	Total requirements		531		531		0

Program and Financing

General and special funds:
SURVEYS, INVESTIGATIONS, AND RESEARCH
(Millions of Dollars)

	Identification Code 14-0804-0-1-306	2017 Actual	2018 Estimate	2019 Estimate
	Obligations by program activity:			
00.01	Ecosystems	156	161	102
00.02	Land Resources	148	152	108
00.03	Energy and Mineral Resources, and Environmental Health	94	96	87
00.04	Natural Hazards	146	151	119
00.05	Water Resources	215	217	167
00.06	Core Science Systems	117	115	91
00.07	Science Support	106	106	103
00.08	Facilities	103	103	110
07.99	Total direct obligations	1,085	1,101	887
08.01	Reimbursable program	531	531	531
09.00	Total new obligations	1,616	1,632	1,418
	Budgetary resources:			
	Unobligated balance:			
10.00	Unobligated balance brought forward, Oct 1	518	588	566
10.01	Discretionary unobligated balance brought forward, Oct 1	484	555	0
10.21	Recoveries of prior year unpaid obligations	10	0	0
10.50	Unobligated balance (total)	528	588	566
	Budget authority:			
	Appropriations, discretionary:			
11.00	Appropriation	1,085	1,078	860
11.60	Appropriation, discretionary (total)	1,085	1,078	860
	Spending authority from offsetting collections, discretionary:			
17.00	Collected	510	531	531
17.01	Change in uncollected payments, Federal sources	81	0	0
17.50	Spending auth from offsetting collections, disc (total)	591	531	531
	Spending authority from offsetting collections, mandatory:			
18.00	Collected	0	1	0
18.01	Change in uncollected payments, Federal sources	1	0	0
18.50	Spending auth from offsetting collections, mand (total)	1	1	0
19.00	Budget authority (total)	1,677	1,610	1,391
19.30	Total budgetary resources available	2,205	2,198	1,957
	Memorandum (non-add) entries:			
19.40	Unobligated balance expiring	-1	0	0
19.41	Unexpired unobligated balance, end of year	588	566	539
	Change in obligated balance:			
	Unpaid obligations:			
30.00	Unpaid obligations, brought forward, Oct 1	350	379	445
30.10	New obligations, unexpired accounts	1,616	1,632	1,418
30.11	Obligations ("upward adjustments"), expired accounts	2	0	0
30.20	Outlays (gross)	-1,575	-1,566	-1,473
30.40	Recoveries of prior year unpaid obligations, unexpired	-10	0	0

	Identification Code 14-0804-0-1-306	2017 Actual	2018 Estimate	2019 Estimate
30.41	Recoveries of prior year unpaid obligations, expired	-4	0	0
30.50	Unpaid obligations, end of year	379	445	390
	Uncollected payments:			
30.60	Uncollected payments, Fed sources, brought forward, Oct 1	-548	-619	-619
30.70	Change in uncollected payments, Fed sources, unexpired	-82	0	0
30.71	Change in uncollected payments, Fed sources, expired	11	0	0
30.90	Uncollected payments, Fed sources, end of year	-619	-619	-619
	Memorandum (non-add) entries:			
31.00	Obligated balance, start of year	-198	-240	-174
32.00	Obligated balance, end of year	-240	-174	-229
	Budget authority and outlays, net:			
	Discretionary:			
40.00	Budget authority, gross	1,676	1,609	1,391
	Outlays, gross:			
40.10	Outlays from new discretionary authority	1,073	1,336	1,155
40.11	Outlays from discretionary balances	501	223	317
40.20	Outlays, gross (total)	1,574	1,559	1,472
	Offsets against gross budget authority and outlays:			
	Offsetting collections (collected) from:			
40.30	Federal sources	-294	-276	-276
40.33	Non-Federal sources	-226	-255	-255
40.40	Offsets against gross budget authority and outlays (total)	-520	-531	-531
	Additional offsets against gross budget authority only:			
40.50	Change in uncollected payments, Fed sources, unexpired	-81	0	0
40.52	Offsetting collections credited to expired accounts	10	0	0
40.60	Additional offsets against budget authority only (total)	-71	0	0
40.70	Budget authority, net (discretionary)	1,085	1,078	860
40.80	Outlays, net (discretionary)	1,054	1,028	941
	Mandatory:			
40.90	Budget authority, gross	1	1	0
	Outlays, gross:			
41.01	Outlays from mandatory balances	1	7	1
	Offsets against gross budget authority and outlays: Offsetting collections (collected) from:			
41.20	Federal sources: Additional offsets against gross budget authority only:	0	-1	0
41.40	Change in uncollected pymts, Fed sources, unexpired	-1	0	0
41.70	Outlays from mandatory balances	1	6	1
41.80	Budget authority, net (total)	1,085	1,078	860
41.90	Outlays, net (total)	1,055	1,034	942

Object Classification

SURVEYS, INVESTIGATIONS, AND RESEARCH
(Millions of Dollars)

	Identification Code 14-0804-0-1-306	2017 Actual	2018 Estimate	2019 Estimate
	Direct obligations:			
	Personnel compensation:			
11.1	Full-time permanent	408	411	319
11.3	Other than full-time permanent	41	42	31
11.5	Other personnel compensation	10	11	8
11.9	Total personnel compensation	459	464	358
12.1	Civilian personnel benefits	153	155	120
13.0	Benefits for former personnel	1	1	0
21.0	Travel and transportation of persons	26	26	21
22.0	Transportation of things	1	1	1
23.1	Rental payments to GSA	56	54	53
23.2	Rental payment to others	3	3	3
23.3	Communications, utilities, and miscellaneous charges	22	22	22
24.0	Printing and reproduction	1	1	1
25.1	Advisory and assistance services	20	20	15
25.2	Other services from non-Fed sources	114	116	100
25.3	Other goods and services from Fed sources	63	63	60
25.4	Operation and maintenance of facilities	11	14	14
25.5	Research and development contracts	1	1	1
25.7	Operation and maintenance of equipment	14	20	15
26.0	Supplies and materials	25	25	22
31.0	Equipment	39	39	30
32.0	Land and structures	1	1	1
41.0	Grants, subsidies, and contributions	75	75	50
99.0	Direct obligations	1,085	1,101	887
	Reimbursable obligations:			
	Personnel compensation:			
11.1	Full-time permanent	175	175	175
11.3	Other than full-time permanent	35	35	35
11.5	Other personnel compensation	3	3	3
11.9	Total personnel compensation	213	213	213
12.1	Civilian personnel benefits	70	70	70
21.0	Travel and transportation of persons	10	10	10
23.1	Rental payments to GSA	23	23	23
23.3	Communications, utilities, and miscellaneous charges	7	7	7
25.1	Advisory and assistance services	7	7	7
25.2	Other services from non-Fed sources	89	89	89
25.3	Other goods and services from Fed sources	32	32	32
25.4	Operation and maintenance of facilities	7	7	7
25.7	Operation and maintenance of equipment	6	6	6
26.0	Supplies and materials	10	10	10
31.0	Equipment	19	19	19
41.0	Grants, subsidies, and contributions	38	38	38
99.0	Reimbursable obligations	531	531	531
99.9	Total new obligations	1,616	1,632	1,418

Employment Summary

SURVEYS, INVESTIGATIONS, AND RESEARCH

	Identification Code 14-0804-0-1-306	2017 Actual	2018 Estimate	2019 Estimate
	Direct:			
1001	Civilian full-time equivalent employment	4,876	4,876	3,667
	Reimbursable:			
2001	Civilian full-time equivalent employment	2,993	2,993	2,993
	Allocation account:			
3001	Civilian full-time equivalent employment	36	36	36

Obligations by Program

Funding of U.S. Geological Survey Programs
(Obligations)
(Thousands of Dollars)

	2017 Actual	2018 Estimate	2019 Estimate
Surveys, Investigations, and Research (SIR)			
Ecosystems			
Appropriated			
Multi-Year appropriation	155,558	161,496	102,429
Total (appropriated)	**155,558**	**161,496**	**102,429**
Reimbursements			
Non-Federal (Domestic) sources			
Technology Transfer	4,284	4,284	4,284
Miscellaneous	13,029	13,029	13,029
Subtotal (non-Federal domestic sources)	17,313	17,313	17,313
State and local sources			
States-Coop (matched - In-Kind Services) NON ADD	790	790	790
Subtotal (state and local sources)	0	0	0
Federal sources			
Department of Agriculture	5,116	5,116	5,116
Department of Commerce			
Nat'l Oceanic & Atmospheric Admin	187	187	187
Department of Defense			
Corps of Engineers	16,360	16,360	16,360
National Geospatial-Intelligence Agency	1,718	1,718	1,718
Other	2,330	2,330	2,330
Department of Energy			
Bonneville Power Administration	1,936	1,936	1,936
Other	370	370	370
Department of Homeland Security	62	62	62
Department of Interior			
Bureau of Indian Affairs	20	20	20
Bureau of Land Management	8,518	8,518	8,518
Bureau of Ocean Energy Management	1,045	1,045	1,045
Bureau of Reclamation	14,330	14,330	14,330
Fish and Wildlife Service	7,814	7,814	7,814
National Park Service	2,665	2,665	2,665
Office of Secretary			
Interior Business Center	468	468	468
Other	1,280	1,280	1,280
Environmental Protection Agency	1,615	1,615	1,615
Health and Human Services	179	179	179
National Aeronautics & Space Admin	78	78	78
Subtotal (Federal sources)	66,091	66,091	66,091
Total (reimbursements)	**83,404**	**83,404**	**83,404**
Total: Ecosystems	**238,962**	**244,900**	**185,833**

	2017 Actual	2018 Estimate	2019 Estimate
Surveys, Investigations, and Research (SIR)			
Land Resources			
Appropriated			
Multi-Year appropriation	75,319	82,032	34,060
No-Year appropriation	72,484	70,197	74,101
Total (appropriated)	**147,803**	**152,229**	**108,161**
Reimbursements			
Non-Federal (Domestic) sources			
Technology Transfer	130	130	130
Miscellaneous	237	237	237
Subtotal (non-Federal domestic sources)	367	367	367
Non-Federal (Foreign) sources			
Corporacion Andina de Fomento	253	253	253
Saudi Geological Survey	17	17	17
Miscellaneous	1,182	1,182	1,182
Subtotal (non-Federal Foreign sources)	1,452	1,452	1,452
State and local sources			
States-Coop (matched - In-Kind Services) NON ADD	70	70	70
Subtotal (state and local sources)	0	0	0
Federal sources			
Agency for International Development	4,677	4,677	4,677
Department of Agriculture	562	562	562
Department of Commerce	125	125	125
Department of Defense			
Corps of Engineers	48	48	48
Other	276	276	276
Department of Energy	111	111	111
Department of Interior			
Bureau of Indian Affairs	145	145	145
Bureau of Land Management	1,263	1,263	1,263
Bureau of Reclamation	40	40	40
Fish and Wildlife Service	68	68	68
National Park Service	610	610	610
Office of Secretary			
Interior Business Center	4,843	4,843	4,843
Environmental Protection Agency	1,813	1,813	1,813
Health and Human Services	95	95	95
National Aeronautics & Space Admin	10,167	10,167	10,167
Sale of maps, photos, reproductions, & digital products	343	343	343
Miscellaneous	8	8	8
Subtotal (Federal sources)	25,194	25,194	25,194
Total (reimbursements)	**27,013**	**27,013**	**27,013**
Total: Land Resources	**174,816**	**179,242**	**135,174**

	2017 Actual	2018 Estimate	2019 Estimate
Surveys, Investigations, and Research (SIR)			
Energy and Mineral Resources, and Environmental Health			
Appropriated			
Multi-Year appropriation	93,561	95,849	86,457
No-Year appropriation	10	138	0
Total (appropriated)	**93,571**	**95,987**	**86,457**
Reimbursements			
Non-Federal (Domestic) sources			
Technology Transfer	1,215	1,215	1,215
Miscellaneous	363	363	363
Subtotal (non-Federal domestic sources)	1,578	1,578	1,578
Non-Federal (Foreign) sources			
Miscellaneous	447	447	447
Subtotal (non-Federal Foreign sources)	447	447	447
State and local sources			
States-Coop (matched - In-Kind Services) NON ADD	80	80	80
Subtotal (state and local sources)	0	0	0
Federal sources			
Central Intelligence Agency	75	75	75
Department of Agriculture	201	201	201
Department of Commerce			
Nat'l Oceanic & Atmospheric Admin	84	84	84
Other	20	20	20
Department of Defense			
Corps of Engineers	127	127	127
Other	1,451	1,451	1,451
Department of Energy	123	123	123
Department of Homeland Security	38	38	38
Department of Interior			
Bureau of Indian Affairs	184	184	184
Bureau of Land Management	1,276	1,276	1,276
Bureau of Reclamation	1	1	1
Fish and Wildlife Service	234	234	234
National Park Service	354	354	354
Office of Secretary			
Interior Business Center	37	37	37
Department of Justice	1	1	1
Department of State	38	38	38
Department of Transportation	24	24	24
Environmental Protection Agency	157	157	157
Health and Human Services	28	28	28
Subtotal (Federal sources)	4,453	4,453	4,453
Total (reimbursements)	**6,478**	**6,478**	**6,478**
Total: Energy and Mineral Resources, and Environmental Health	**100,049**	**102,465**	**92,935**

	2017 Actual	2018 Estimate	2019 Estimate
Surveys, Investigations, and Research (SIR)			
Natural Hazards			
Appropriated			
Multi-Year appropriation	145,465	145,201	118,638
Total (appropriated)	**145,465**	**145,201**	**118,638**
Reimbursements			
Non-Federal (Domestic) sources			
Technology Transfer	1,189	1,189	1,189
Miscellaneous	3,664	3,664	3,664
Subtotal (non-Federal domestic sources)	4,853	4,853	4,853
Non-Federal (Foreign) sources			
Saudi Geological Survey	1,877	1,877	1,877
Miscellaneous	141	141	141
Subtotal (non-Federal Foreign sources)	2,018	2,018	2,018
Federal sources			
Agency for International Development	5,919	5,919	5,919
Department of Agriculture	18	18	18
Department of Commerce	226	226	226
Department of Defense			
Corps of Engineers	371	371	371
National Geospatial-Intelligence Agency	511	511	511
Other	721	721	721
Department of Energy	4,323	4,323	4,323
Department of Homeland Security			
Federal Emergency Management Agency	5	5	5
Department of Interior			
Bureau of Ocean Energy Management	232	232	232
Bureau of Reclamation	15	15	15
National Park Service	139	139	139
Department of State	392	392	392
Department of Veterans Affairs	244	244	244
Environmental Protection Agency	58	58	58
National Aeronautics & Space Admin	9,606	9,606	9,606
National Science Foundation	7	7	7
Nuclear Regulatory Commission	213	213	213
Subtotal (Federal sources)	23,000	23,000	23,000
Total (reimbursements)	**29,871**	**29,871**	**29,871**
Total: Natural Hazards *	**175,336**	**175,072**	**148,509**

* This table does not include obligations for the Spectrum Relocation Fund, since it is a mandatory fund. MAX obligations do include the Spectrum Relocation Fund. The amounts included in MAX are: FY 2017 $1,038K, FY 2018 $6,288K, and FY 2019 $789K.

	2017 Actual	2018 Estimate	2019 Estimate
Surveys, Investigations, and Research (SIR)			
Water Resources			
Appropriated			
Multi-Year appropriation	214,607	217,021	167,341
Total (appropriated)	**214,607**	**217,021**	**167,341**
Reimbursements			
Non-Federal (Domestic) sources			
Permittees & licensees- Fed Energy Regulatory Commission	6,397	6,397	6,397
Technology Transfer	4,246	4,246	4,246
Miscellaneous	3,470	3,470	3,470
Subtotal (non-Federal domestic sources)	14,113	14,113	14,113
Non-Federal (Foreign) sources			
Agencia Nacional de Aguas of Brazil	1,798	1,798	1,798
Miscellaneous	80	80	80
Subtotal (non-Federal Foreign sources)	1,878	1,878	1,878
State and local sources			
States-Coop (matched)	59,927	59,927	57,210
States-Coop (matched - In-Kind Services) NON ADD	1,496	1,496	1,496
States-Coop (unmatched)	107,584	107,584	110,301
Subtotal (state and local sources)	167,511	167,511	167,511
Federal sources			
Agency for International Development	2,089	2,089	2,089
Department of Agriculture	1,393	1,393	1,393
Department of Commerce			
Nat'l Oceanic & Atmospheric Admin	67	67	67
Other	109	109	109
Department of Defense			
Corps of Engineers	37,451	37,451	37,451
National Geospatial-Intelligence Agency	727	727	727
Other	6,452	6,452	6,452
Department of Energy			
Bonneville Power Administration	445	445	445
Other	6,338	6,338	6,338
Department of Homeland Security			
Federal Emergency Management Agency	6,607	6,607	6,607
Other	733	733	733
Department of Interior			
Bureau of Indian Affairs	277	277	277
Bureau of Land Management	2,960	2,960	2,960
Bureau of Reclamation	18,266	18,266	18,266
Fish and Wildlife Service	2,047	2,047	2,047
National Park Service	1,983	1,983	1,983
Office of Secretary			
Interior Business Center	352	352	352
Office of Surface Mining	298	298	298

	2017 Actual	2018 Estimate	2019 Estimate
Surveys, Investigations, and Research (SIR)			
Water Resources, continued			
Department of Justice	187	187	187
Department of State	2,167	2,167	2,167
Environmental Protection Agency	29,821	29,821	29,821
Health and Human Services	130	130	130
Millenium Challenge Corporation	56	56	56
National Aeronautics & Space Admin	947	947	947
Nuclear Regulatory Commission	575	575	575
Tennessee Valley Authority	447	447	447
Subtotal (Federal sources)	122,924	122,924	122,924
Total (reimbursements)	**306,426**	**306,426**	**306,426**
Total: Water Resources	**521,033**	**523,447**	**473,767**

	2017 Actual	2018 Estimate	2019 Estimate
Surveys, Investigations, and Research (SIR)			
Core Science Systems			
Appropriated			
Multi-Year appropriation	116,847	114,890	91,122
Total (appropriated)	**116,847**	**114,890**	**91,122**
Reimbursements			
Non-Federal (Domestic) sources			
Technology Transfer	179	179	179
Miscellaneous	302	302	302
Subtotal (non-Federal domestic sources)	481	481	481
State and local sources			
States-Coop (unmatched)	8,270	8,270	8,270
Subtotal (state and local sources)	8,270	8,270	8,270
Federal sources			
Agency for International Development	50	50	50
Department of Agriculture	26,292	26,292	26,292
Department of Commerce			
Nat'l Oceanic & Atmospheric Admin	228	228	228
Other	169	169	169
Department of Defense			
Corps of Engineers	61	61	61
National Geospatial-Intelligence Agency	301	301	301
Department of Education	25	25	25
Department of Energy	376	376	376
Department of Homeland Security			
Federal Emergency Management Agency	23,682	23,682	23,682
Other	225	225	225
Department of Interior			
Bureau of Indian Affairs	75	75	75
Bureau of Land Management	659	659	659
Bureau of Reclamation	74	74	74
Fish and Wildlife Service	103	103	103
National Park Service	1,340	1,340	1,340
Department of Justice	63	63	63
Department of State	50	50	50
Department of Transportation	50	50	50
Department of Treasury	25	25	25
Department of Veterans Affairs	25	25	25
Environmental Protection Agency	225	225	225
General Services Administration	50	50	50
Health and Human Services	50	50	50
Housing and Urban Development	50	50	50
National Aeronautics & Space Admin	401	401	401
National Science Foundation	1,178	1,178	1,178
Tennessee Valley Authority	75	75	75
Miscellaneous	75	75	75
Subtotal (Federal sources)	55,977	55,977	55,977
Total (reimbursements)	**64,728**	**64,728**	**64,728**
Total: Core Science Systems	**181,575**	**179,618**	**155,850**

	2017 Actual	2018 Estimate	2019 Estimate
Surveys, Investigations, and Research (SIR)			
Science Support			
Appropriated			
Multi-Year appropriation	106,225	105,292	102,551
Total (appropriated)	**106,225**	**105,292**	**102,551**
Reimbursements			
Non-Federal (Domestic) sources			
Map Receipts	880	880	880
Sale of photos, reproductions, and digital products	2,493	2,493	2,493
Technology Transfer	62	62	62
Subtotal (non-Federal domestic sources)	3,435	3,435	3,435
Federal sources			
Department of Agriculture	48	48	48
Department of Commerce			
Nat'l Oceanic & Atmospheric Admin	70	70	70
Department of Defense	300	300	300
Department of Interior			
Bureau of Indian Affairs	94	94	94
Bureau of Safety and Environmental Enforcement	8	8	8
Fish and Wildlife Service	171	171	171
National Park Service	1	1	1
Office of Secretary			
Interior Business Center	951	951	951
Other	543	543	543
Office of Surface Mining	7	7	7
Department of State	15	15	15
General Services Administration	12	12	12
Sale of maps, photos, reproductions, & digital products	1,729	1,729	1,729
Miscellaneous	13	13	13
Subtotal (Federal sources)	3,962	3,962	3,962
Total (reimbursements)	**7,397**	**7,397**	**7,397**
Total: Science Support *	**113,622**	**112,689**	**109,948**

* This table does not include obligations for the Spectrum Relocation Fund, since it is a mandatory fund. MAX obligations do include the Spectrum Relocation Fund. The amounts included in MAX are: FY 2017 $172K, FY 2018 $208K, and FY 2019 $216K.

	2017 Actual	2018 Estimate	2019 Estimate
Surveys, Investigations, and Research (SIR)			
Facilities			
Appropriated			
Multi-Year appropriation	92,719	92,820	102,700
No-Year appropriation	10,816	9,630	7,266
Total (appropriated)	**103,535**	**102,450**	**109,966**
Reimbursements			
Non-Federal (Domestic) sources			
Miscellaneous	201	201	201
Subtotal (non-Federal domestic sources)	201	201	201
Federal sources			
Department of Commerce	532	532	532
Department of Defense	1,904	1,904	1,904
Department of Interior			
Bureau of Land Management	253	253	253
Bureau of Safety and Environmental Enforcement	79	79	79
National Park Service	1,060	1,060	1,060
Office of Secretary			
Interior Business Center	2,051	2,051	2,051
Subtotal (Federal sources)	5,879	5,879	5,879
Total (reimbursements)	**6,080**	**6,080**	**6,080**
Total: Facilities	**109,615**	**108,530**	**116,046**

SIR Summary:

Appropriated			
Multi-Year appropriation	1,000,301	1,014,601	805,298
No-Year appropriation	83,310	79,965	81,367
subtotal (appropriated)	1,083,611	1,094,566	886,665
Reimbursements			
Non-Federal Sources			
Map Receipts	880	880	880
Domestic	41,461	41,461	41,461
Foreign	5,795	5,795	5,795
State and local sources	175,781	175,781	175,781
Federal Sources	307,480	307,480	307,480
subtotal (reimbursements)	531,397	531,397	531,397
Total: SIR *	**1,615,008**	**1,625,963**	**1,418,062**

* This table does not include obligations for the Spectrum Relocation Fund, since it is a mandatory fund. MAX obligations do include the Spectrum Relocation Fund. The amounts included in MAX are: FY 2017 $1,210K, FY 2018 $6,496K, and FY 2019 $1,005K.

	2017 Actual	2018 Estimate	2019 Estimate
Surveys, Investigations, and Research (SIR)			
Contributed Funds:			
Permanent, indefinite appropriation:			
Ecosystems	602	943	665
Land Resources	12	9	9
Energy and Mineral Resources, and Environmental Health	24	48	70
Natural Hazards	7	12	11
Water Resources	167	100	72
Core Science Systems	1	0	0
Total: Contributed Funds	**813**	**1,112**	**827**
Operation and Maintenance of Quarters:			
Permanent, indefinite appropriation:			
Ecosystems	22	45	22
Natural Hazards	26	50	44
Total: Operation and Maintenance of Quarters	**48**	**95**	**66**
Working Capital Fund:			
National Water Quality Lab	14,119	17,000	16,000
Hydrologic Instrumentation Facility	22,176	20,323	20,192
Other	45,684	61,473	38,945
Total: Working Capital Fund	**81,979**	**98,796**	**75,137**
Allocations from other Federal Agencies: *			
Department of the Interior: Departmental Offices			
Natural Resource Damage Assessment	2,821	2,700	2,700
Central Hazardous Materials Fund	250	200	200
Total: Allocations	**3,071**	**2,900**	**2,900**

* Allocations are shown in the year they are received, not when they are obligated.

Special and Trust Funds

Receipts

Trust Funds
CONTRIBUTED FUNDS
(Millions of Dollars)

	Identification Code 14-8562-0-7-306	2017 Actual	2018 Estimate	2019 Estimate
01.00	Balance, start of year	0	0	0
	Receipts:			
	Current law:			
11.30	Contributed Funds, Geological Survey	1	1	1
20.00	Total: Balances and receipts	1	1	1
	Appropriations:			
	Current law:			
21.01	Contributed Funds	-1	-1	-1
50.99	Balance, end of year	0	0	0

Program and Financing

Trust Funds
CONTRIBUTED FUNDS
(Millions of Dollars)

	Identification Code 14-8562-0-7-306	2017 Actual	2018 Estimate	2019 Estimate
	Obligations by program activity:			
08.01	Donations and contributed funds	1	1	1
09.00	Total new obligations, unexpired accounts	1	1	1
	Budgetary resources:			
	Unobligated balance:			
10.00	Unobligated balance brought forward, Oct 1	1	1	1
	Budget authority:			
	Appropriation, mandatory:			
12.01	Appropriation (trust fund)	1	1	1
12.60	Appropriation, mandatory (total)	1	1	1
19.30	Total budgetary resources available	2	2	2
	Memorandum (non-add) entries:			
19.41	Unexpired unobligated balance, end of year	1	1	1
	Change in obligated balance:			
	Unpaid obligations:			
30.00	Unpaid obligations, brought forward, Oct 1	0	0	1
30.10	New obligations, unexpired accounts	1	1	1
30.20	Outlays (gross)	-1	0	-1

	Identification Code 14-8562-0-7-306	2017 Actual	2018 Estimate	2019 Estimate
30.50	Unpaid obligations, end of year	0	1	1
	Memorandum (non-add) entries:			
31.00	Obligated balance, start of year	0	0	1
32.00	Obligated balance, end of year	0	1	1
	Budget authority and outlays, net:			
	Mandatory:			
40.90	Budget authority, gross	1	1	1
	Outlays, gross:			
41.01	Outlays from mandatory balances	1	0	1
41.10	Outlays, gross (total)	1	0	1
41.80	Budget authority, net (total)	1	1	1
41.90	Outlays, net (total)	1	0	1

Object Classification

(Millions of Dollars)

	Identification Code 14-8562-0-7-306	2017 Actual	2018 Estimate	2018 Estimate
	Direct obligations:			
99.5	Adjustment for rounding	1	1	1
99.9	Total new obligations	1	1	1

Employment Summary

CONTRIBUTED FUNDS

	Identification Code 14-8562-0-7-306	2017 Actual	2018 Estimate	2019 Estimate
	Direct:			
1001	Civilian full-time equivalent employment	6	6	6

Employee Count by Grade
(Total Employment)

		2017 Actual	2018 Estimate	2019 Estimate
Executive Level V		0	1	1
SES		18	19	20
	Subtotal	18	20	21
SL – 00		10	12	12
ST – 00		44	48	43
	Subtotal	54	60	55
GS/GM – 15		477	481	405
GS/GM – 14		730	736	621
GS/GM – 13		1,223	1,232	1,040
GS – 12		1,519	1,527	1,289
GS – 11		1,226	1,235	1,042
GS – 10		17	17	14
GS – 9		925	932	787
GS – 8		240	242	204
GS – 7		588	593	500
GS – 6		241	243	205
GS – 5		403	407	343
GS – 4		177	179	151
GS – 3		71	72	61
GS – 2		32	33	27
GS – 1		8	8	7
	Subtotal	7,873	7,936	6,695
Other Pay Schedule Systems		269	269	269
Total employment (actual/estimate)		**8,218**	**8,285**	**7,040**

Section 403 Compliance

This section describes details related to any assessments to, or within the USGS to support bureau-wide services and functions. Details regarding the USGS's payments to the Department of the Interior's Working Capital Fund, and payments to other Federal Agencies are included in the External Administrative Costs subsection. Additional information on internal assessments and cost allocation methodologies can be found in the Bureau Administrative Costs subsection.

External Administrative Costs	2019 Estimate ($000)
Department of the Interior Working Capital Fund	
WCF Centralized Billings	*$17,769*
WCF Direct Billings	*$11,735*
Payments to Other Federal Agencies	
Worker's Compensation Payments	*$2,052*
Unemployment Compensation Payments	*$492*
GSA Rental Payments	*$98,851*
Bureau Administrative Costs	
Shared Program Costs	*$13,768*
Internal Bureau Overhead	*$38,500*

External Administrative Costs

The Department's Working Capital Fund was established pursuant to 43 U.S.C. 1467, to provide common administrative and support services efficiently and economically at cost. The Fund is a revolving fund, whereby capital is expended to provide services for customers who pay for the services. Customers consist of the Department's bureaus and offices, as well as other Federal agencies. Through the use of centrally provided services, the Department standardized key administrative areas such as commonly used administrative systems, support services for those located in and around the Main and South Interior building complex, and centrally managed departmental operations that are beneficial to the bureaus and offices.

Centralized billing is used whenever the product or service being provided is not severable or it is inefficient to bill for the exact amount of product or service being procured. Customers are billed each year using a pre-established basis that is adjusted annually to reflect change over time. These bills are paid for by both the Administrative & Management and the Information Services subactivities within Science Support, and payment may be adjusted accordingly between these lines during the year of execution based on the enacted appropriation. The following table provides the actual centralized billing to the USGS for 2017, and estimates for 2018 and 2019.

Direct billing is used whenever the product or service provided is again severable, but is sold through a time and materials reimbursable support agreement or similar contractual arrangement. The following tables provide the actual direct and reimbursable collections from the USGS for 2017, and estimated billings and collections for 2018 and 2019.

Bureau Administrative Costs

Shared Program Costs

The USGS maintains less than two percent of its budget submission for other bureau-wide support and science-related activities. These funds are used for initiatives which may be unfunded mandates, are crosscutting in nature, or respond to new and emerging scientific issues.

The funding for the initiatives in the Shared Program Costs are assessed at the budget activity level, based upon one of two methodologies: proportionately based on total appropriated funds for the mission area; or proportionately based on total funds for the mission area, including reimbursable funding sources, and are distributed to the initiatives efficiently. The methodology used is tied to the nature of the initiative. For instance, an initiative that is crosscutting to all the mission areas, but is purely an Interior priority (one in which an external partner is not a stakeholder, nor receives direct benefit of the service) would receive its funding based upon a calculation on appropriated funds only. Conversely, an initiative where all customers of the USGS either directly or indirectly receive benefit, such as the aforementioned information technology compliance and security upgrades, would be calculated to each of the mission areas based upon all funding sources, both appropriated and reimbursable. The initiatives on the Shared Program Cost Chart are vetted each year with the Executive Leadership Team of the USGS, and are decided upon in a voting process to ensure bureauwide concurrence.

The following initiatives are currently planned for the USGS's 2019 Shared Program Costs:

2019 Shared Program Cost Chart ($000)

Mission Area	Ecosystems	Land Resources	Energy and Mineral Resources	Natural Hazards	Water Resources	Core Science Systems	Total
Delta Science **	120.3	112.4	71.0	109.2	161.7	87.4	662.1
Grand Canyon Monitoring **	183.0	171.0	108.1	166.2	246.1	133.0	1,007.4
Regional Science **	473.3	442.3	279.4	429.7	636.3	343.9	2,604.8
John Wesley Powell Center **	90.8	84.9	53.6	82.5	122.1	66.0	500.0
International Program **	293.2	274.0	173.1	266.2	394.2	213.0	1,613.8
QMS Laboratory Review **	45.2	42.3	26.7	41.1	60.8	32.9	248.9
Innovation Center **	90.8	84.9	53.6	82.5	122.1	66.0	500.0
NAGT program **	36.3	34.0	21.5	33.0	48.9	26.4	200.0
Information Management and Technology *	717.2	520.8	298.5	517.8	1,541.4	535.1	4,130.7
Web Re-engineering *	399.3	290.0	166.2	288.3	858.3	297.9	2,300.0
Total Program Costs	2,449.6	2,056.5	1,251.8	2,016.3	4,191.9	1,801.6	13,767.8

* Proportionally spread by total funds.

** Proportionally spread by appropriated funds.

Delta Science – The California Bay-Delta is recognized as one of the world's threatened treasures of biodiversity, which supports unique native species and their tidal habitats. The USGS participates in the Delta Science Federal-State partnership, which coordinates the efforts of 25 State and Federal agencies to improve the quality and reliability of California's water supplies while restoring the Bay-Delta ecosystem. This activity supports the USGS lead delta scientist, liaison, and support activity that contributes to restoration challenges such as water supply reliability, water quality, sustainability of native species, and flood risk.

Grand Canyon Monitoring – The USGS's Grand Canyon Monitoring and Research Center (GCMRC) is the science provider for the Glen Canyon Dam Adaptive Management Program. In this role, the research center provides the public and decision makers with relevant scientific information about the status and

trends of natural, cultural, and recreational resources found in those portions of Grand Canyon National Park and Glen Canyon National Recreation Area affected by Glen Canyon Dam operations.

Regional Science – The implementation of the USGS Science Strategy calls for the integration of the full breadth and depth of USGS capabilities; building on existing strengths and partnerships. To that end, many of the USGS's historical "single-discipline" science centers are now reflections of this science strategy, and perform research and conduct science across many USGS mission areas, and need to respond quickly to new and emerging science issues. This funding brings scientists together to work across teams and across regions, to respond to the Nation's highest and changing priorities, respond to global trends, and conduct the best possible science.

John Wesley Powell Center – The John Wesley Powell Center for Analysis and Synthesis serves as a catalyst for innovative thinking in Earth system science research. Initiated as one means of implementing the USGS Science Strategy, the Powell Center supports scientist-driven interdisciplinary analysis and synthesis of complex natural science problems. USGS scientists are encouraged to propose working groups reflecting a mix of USGS scientists and their colleagues from government and academia focused on major Earth science issues. The Powell Center work generates cutting-edge, high-visibility publications.

International Programs – The Office of International Programs is dedicated to high quality, timely, scientific study that is international in scope and that focuses on the USGS Science Strategy's themes. As one of the world's premier science agencies, the USGS has long recognized the mutual benefits resulting from interaction with scientific partners abroad and extending research and investigations to other countries. By providing reliable scientific information about the Earth and its resources from an international perspective, the USGS Office of International Programs supports U.S. foreign policy and national security; provides a basis for science diplomacy, and improves the scientific basis for managing ecosystems and natural resources.

QMS Laboratory Review – All of USGS laboratories will conduct a multi-phase review on processes, procedures, and best practices to meet our Nation's need. The multi-phase study will be independently conducted to assure our facilities across the Nation have an overall Quality Management System (QMS). QMS is a written and documented collection of quality assurance manuals, standard operating procedures (SOPs), laboratory practices and policies, and commitments by an organization to report data of known and documented quality in terms of traceability, transparency, reliability, consistency, and reproducibility.

Innovation Center – The center will identify national scientific problems where USGS core interests are aligned with our external partners and pursue innovative technological solutions together. By developing new capabilities and research with public and private technology partners, our mission will be strengthened by these designs and bring into operation a new generation of technical and engineering tools to solve national problems.

National Association of Geoscience Teachers (NAGT) – This activity supports the Cooperative Summer Field Training Program at USGS. Students are enrolled in this camp from geoscience field camps operated by colleges and universities throughout the United States. USGS scientists and candidates are matched by the Education Office based on course work, skill sets, and interest for the proposed field and laboratory projects. NAGT program provides a professional experience to students early in their careers and a path for future scientists.

DOI Information Management & Technology – This funding will be used for bureau specific implementation costs to identify and implement immediate and long-term solutions to realize cost saving, cost avoidance, cost efficiencies, and (or) innovations across the Department of the Interior IMT environment. These funds will support the Department's activities related to data center optimization,

expanding ESN gateway/bandwidths, and implementation of enterprise infrastructure, records, documents and content management solutions.

Web Reengineering – This funding will streamline and organize USGS's Web presence to create a more effective and manageable Web presence and to provide Web-enabled technology, real-time access, social and collaborative cloud-based tools, and extensive use of mobile and tablet devices.

Internal Bureau Overhead Cost Allocation Methodology

The USGS manages overhead costs at two levels—the bureau and science center. Bureau level costs include headquarters and area executive, managerial, supervisory, administrative, and financial functions and bureauwide systems. At the bureau level, funding appropriated to the Science Support budget activity pays the bureau-wide overhead costs in the same proportion as appropriated funding is to total funding. For this reason, bureau-wide overhead costs collected on reimbursable support agreements are deposited within Science Support program areas, as well.

The USGS assesses a bureau overhead rate, estimated to remain at 12 percent, on reimbursable work from non-Interior customers to recoup their share of bureau-level costs. In some cases, the USGS assesses a special or reduced rate when it can be demonstrated that indirect costs are substantially and consistently less than the norm and the amount collected covers the full costs, such as with pass-through funding where the USGS does not perform any of the actual work. The following table shows the funding available to the Science Support program, including the anticipated overhead collections to pay for bureauwide costs.

(Dollars in Thousands)

Source of Funding	2019 Budget Request	2019 Estimated Bureau Overhead Distribution	2019 Estimated Total
Science Support			
Administration and Management	69,534	29,995	99,529
Information Services	19,716	8,505	28,221
Total Funding	**89,250**	**38,500**	**127,750**

At the science center level, because there generally is not a direct appropriated funding source to pay the local overhead (common services) costs, both the direct appropriated and reimbursable funding are assessed a percentage to cover their share of science center-level costs. Science center common services costs include center costs that are not directly attributable to a specific activity or project, such as managerial, supervisory, administrative, and financial functions and related systems, as well as costs incidental to providing services and products, such as postage, training, miscellaneous supplies and materials. The cost during 2017, for the local overhead, totaled $208 million from both direct appropriated and reimbursable funds.

In recognition of the USGS role as the science bureau for the Department of the Interior, the USGS is continuing to give Interior bureaus and offices a "preferred" customer rate on overhead charges for a significant portion of reimbursable work, to the extent that matching funds are available within the USGS budget. The maximum rate that cost centers may charge other Interior bureaus for common services and bureau costs combined remains 15 percent net. In 2017, of the 15 percent, 7.5 percent is applied to bureau costs, and the remaining 7.5 percent is applied to common services costs. Cost centers must fund the common services costs not recovered (e.g., the difference between the cost center's standard common services costs and the 7.5 percent) from USGS appropriated funds. In this way, the USGS is partnering on the science needs of Interior from both the bureau and cost centers.

The Associate Director for Administration establishes the USGS bureau special rate for each fiscal year. The special rate for 2018 is estimated to remain at three percent. Cost centers do not charge more than the bureau special rate for facilities-related costs or their standard common services rate when funding is approved for a bureau-level special rate. Special rates are applied under the following circumstances:

- When the USGS receives funds from a non-USGS organization and awards a grant to a third-party entity.

- When the USGS receives funds from one or more non-USGS organizations to support, under USGS leadership, a strategic science objective that includes the USGS passing through funds to one or more third-party entities.

- When the USGS receives funds from a non-USGS organization for the purpose of the customer acquiring services through the Cartographic Services or the Remotely Sensed Data Contracts. The special rate helps encourage other Federal agencies to use these contracts for cartographic services and remotely sensed data, rather than establishing and managing their own contracts, and ensures greater data consistency through the use of common service providers.

- When the USGS receives funds from a non-USGS organization for the purpose of passing through the customer's funds to State and local governments for the direct purchase of geospatial data.