BUDGET JUSTIFICATIONS

The United States Department of the Interior

and Performance Information
Fiscal Year 2024

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 and Executive Summary

Bureau 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 amended the USGS Organic Act to include examinations outside the national domain. In 1996, the National Biological Service, the biological resources research branch of the U.S. Department of the Interior (Interior) at the time, was transferred into the USGS to continue objective science to support effective management and conservation of the Nation's biological resources. Today, the USGS is the primary Federal source of science-based information on ecosystems, land use, energy and mineral resources, natural hazards, water use and availability, and updated maps and images of the Earth's features available to the public. As the science arm of the Department of the Interior, the USGS mission is to monitor, analyze, and predict current and evolving dynamics of complex human and natural Earth-system interactions and to deliver actionable information at scales and timeframes relevant to decision makers. The USGS works with many partners to provide objective and impartial science to land and natural resource managers, emergency management officials, and the public.

The USGS provides science for a changing world that reflects and responds to society's continuously evolving needs. To better meet demand for scientific products and tools that are useful, relevant, and accessible to the American public and decision makers, the USGS engages with Federal, State, local, academic, and tribal partners early in its research formulation process. The USGS continues to build strong partnerships with colleges, universities, and professional organizations to lay the foundation for the next-generation workforce.

For more than a century, the USGS has served an essential role in understanding the Earth's changing environmental conditions. USGS science addresses the local to global implications of climate change and other environmental factors on many issues that affect our lands, waters, wildlife, and the lives and livelihoods of all people. USGS employs the best and brightest experts who bring together a range of earth and life science disciplines that help understand impacts and address complex environmental, natural resource, and public safety issues.

Budget Highlights

The 2024 budget request for the USGS is $1.8 billion, an increase of $288.3 million over the 2023 enacted budget. The USGS estimates that staffing is 5,198 full-time equivalents (FTEs), an increase of 392 FTEs from 2023.

The following two tables highlight the USGS FY 2024 budget request.

2024 President's Budget ($000)

Budget Authority	2022 Actual	2023 Enacted	2024 Request	Changes from 2023 Enacted
Current	1,394,360	1,497,178	1,785,509	288,331
Permanent	1,722	758	758	0
Total Current, w/o Supplemental	**1,396,082**	**1,497,936**	**1,786,267**	**288,331**
2022 Bipartisan Infrastructure Law (BIL) P.L. 117-58	*239,668*	*69,000*	*69,000*	0
OIG Oversight for P.L. 117-58	*-1,198*	*-345*	*-345*	0
2022 Inflation Reduction Act (LRA) P.L 117-169	*23,500*	*0*	*0*	0
2022 Disaster Supplemental P.L. 117-43	*26,284*	*0*	*0*	0
2023 Emergency Supplemental P.L. 117-328	*0*	*41,040*	*0*	*-41,040*
Total Current w/Supplemental [1]	**1,684,336**	**1,607,631**	**1,854,922**	**247,291**
Direct FTEs	*4,589*	*4,806*	*5,198*	*392*

[1] Supplemental funding reflects amounts made available in the fiscal year, not estimated allocations or obligations.

Mission Area/Subactivity/Programs (Dollars in Thousands)	2022 Enacted	2023 Enacted	2024 Fixed Costs	2024 Program Changes	2024 Request
Ecosystems	**277,897**	**307,176**	**10,209**	**77,603**	**394,988**
Energy and Mineral Resources	**95,223**	**104,220**	**4,502**	**42,029**	**150,751**
Natural Hazards	**185,998**	**200,256**	**6,772**	**19,135**	**226,163**
Water Resources	**285,894**	**304,434**	**9,419**	**-500**	**313,353**
Core Science Systems	**263,802**	**284,607**	**6,182**	**77,822**	**368,611**
Science Support	**99,736**	**106,304**	**6,865**	**21,003**	**134,172**
Facilities	**184,810**	**188,051**	**5,217**	**4,203**	**197,471**
Special Initiatives	**1,000**	**2,130**	**0**	**-2,130**	**0**
Total	**1,394,360**	**1,497,178**	**49,166**	**239,165**	**1,785,509**
Supplementals (less OIG transfer)	**288,254**	**109,695**	**0**	**-41,040**	**68,655**
Grand Total	**1,682,614**	**1,606,873**	**49,166**	**198,125**	**1,854,164**

Administration Priorities

Transforming Fire and Drought Science Delivery for Natural Resource Managers

The 2024 budget reflects the Administration's ongoing commitment to deliver science to support sound land management decisions and address the effects of environmental changes on our Nation's physical and biological infrastructure. The budget makes critical investments in transformational science delivery for natural resource management, including response to and recovery from two critical issues impacting the Nation: wildfire and drought. With USGS' request in 2024, the bureau would be able to seamlessly integrate models and data across multiple scientific disciplines, providing resource managers with the state-of-the-art decision support tools to better understand, react to, and mitigate issues surrounding wildfire and drought. The USGS would engage with Federal, State, local, and tribal partners to support their specific decision-making needs on wildfire and drought, prioritizing the co-development and co-production of relevant science, products, and tools with these partners to meet their needs. Combining ecological and hydrological data and models— as proposed with the 2024 increases to the Ecosystems

and Water Resources Mission Areas— would provide a more complete picture of the landscape-level changes resulting from these critical issues and would enable resource managers to develop strategies to prevent and mitigate impacts from drought and wildfire in the future.

The Backbone of Transformational Science: Advanced Scientific Computing

To provide transformational science in a variety of areas critical to the Nation, including and beyond drought and wildfire, the USGS needs a modernized advanced computing capability that can serve as the foundation for the science. Targeted investments in high-performance computing capabilities can advance the type of complex scenario modeling and real-time or near-real-time delivery of information critical to decision makers at all levels of government. For example, for the most recent Kīlauea volcanic eruption in Hawai'i, USGS high performance computing capabilities facilitated the development of state-of-the-art lava flow models, which provided much-improved calculations and graphical representations of where lava was likely to go and how quickly—information that emergency managers used to help keep the public safe. Using in-house high performance computing resources and computational expertise, the USGS was able to produce lava flow models in thirty seconds, moving the time up from the 27 hours it had previously taken without the advanced computing capabilities.

With the proposed 2024 investment in the Advanced Research Computing Environment within the Science Synthesis, Analysis, and Research Program, the USGS would be able to transform its capabilities to process, analyze, and model data that inform critical science, including by: developing evacuation response scenarios for natural disasters like volcanic eruptions, earthquakes, landslides, and tsunamis; locating critical minerals necessary for a variety of the Nation's needs, spanning national security to health care to everyday consumer products such as mobile phones; and characterizing and monitoring wildland/urban interface risk from wildfires; among many more practical applications.

Landsat Next: Continuing the Longest Space-Based Record of Earth's Land Surface

Among the most useful tools in providing actionable data to inform natural resource management are the Landsat satellites, managed in close partnership between the USGS and the National Aeronautics and Space Administration (NASA). The Landsat 7, 8, and 9 satellites currently in orbit continue to collect and contribute to the over 50-year continuous observational record of the Earth's land surface, providing the basis for decision making in a variety of areas, including agriculture, forest and water management, land use energy development, biodiversity, disaster risk reduction, and human health, among many others.

The 2024 budget proposes an investment in the future of the Landsat program and its enduring benefits to ever-changing scientific needs. Following its launch no earlier than November 2030, Landsat Next, the successor of Landsat 8 and 9, will extend the continuous record of Earth observations with several upgrades, including increasing the frequency of observations, producing better imagery, and including more than twice the spectral bands as the previous Landsat satellites. Landsat Next will be a constellation of three smaller satellites, each of which will enable finer spatial resolution and expanded spatial imagery capabilities, with the ability to revisit the equator every six days. Landsat Next's improvements will allow it to collect on average more than 20 times the data as its predecessor, Landsat 9, making it an exceptional tool for advanced decision support. Furthermore, all users will be able to continue to have free and open access to Landsat data.

In 2024, the USGS proposes a new pilot program to augment Landsat data with commercial satellite data, which can improve data collection efforts through targeted, high-resolution monitoring of changing land conditions. Commercial satellite data, coupled with Landsat data, can provide even better information for decision makers, with applications such as the ability to monitor the aftermath of natural disasters (including landslides, floods, wildfires, and volcanic eruptions) and capabilities to provide data on land subsidence, forest structure, and other changing conditions. The pilot will allow USGS to investigate how

commercial data can advance the National Land Imaging Program's suite of remote sensing products and services, including by potentially allowing for higher spatial resolution, more rapid revisit times, or additional spectral coverage compared to current Landsat or the European Space Agency's Sentinel satellite system capabilities.

Supplemental Funding for Natural Disasters: Spurring Advancements in USGS Science Delivery

Using supplemental funding, the USGS has been able to improve delivery of scientific information to the public before, during, and after natural disasters, building on successes from previous disaster efforts to enhance future monitoring, response, and recovery efforts. Following the 2018 Kīlauea eruption in Hawai'i, disaster supplemental funds supported important upgrades to the USGS Volcano Science Center (VSC), including improvements in monitoring tools and scientific expertise, as well as the replacement of the Hawai'ian Volcano Observatory (HVO). In turn, these improvements significantly enhanced HVO and VSC's response to the subsequent eruption of Mauna Loa in 2022, and the resumption of activity at

Left: Image of instrumentation deployed to monitor the Northeast Rift Zone eruption of Mauna Loa in 2022. The equipment was purchased using supplemental funds. Source: K. Mulliken, USGS. Right: Taken from the intersection of the Daniel K. Inouye Highway and the Old Saddle Road, USGS scientists take laser rangefinder measurements of the main flow front of fissure 3 from Mauna Loa's Northeast Rift Zone eruption in 2022 to determine where it is relative to the highway. Equipment was purchased using supplemental funds. Source: J. Ball, USGS.

Kīlauea's summit in 2023. Examples of supplemental-funded improvements that led to these successful responses include field-rugged video cameras that captured visual and thermal imagery of eruptive activity in high resolution; uncrewed aerial system (drone)-mounted cameras that enabled rapid estimates of lava effusion rates; and infrasound sensors that allowed HVO to pinpoint locations of active eruption. These improvements helped inform emergency managers about areas at highest risk, thereby allowing them to send out timely public safety alerts.

Similarly, the improvements made to the Puerto Rico Seismic Network and the Puerto Rico Strong Motion Program with disaster supplemental funds have enhanced the quality and robustness of critical earthquake monitoring functions in this region. Because of these improvements, earthquake monitoring in Puerto Rico remained operational during and following the impact of the 2022 Hurricane Fiona on Puerto Rico.

Supplemental funding has greatly improved USGS capabilities supporting hurricane response as well. The USGS used disaster supplemental funds to update eighty stream gage discharge ratings from hydraulic-model studies, incorporating the extreme flood levels from Hurricane Maria into their models. The updated data and models directly benefited the USGS' ability to accurately measure the high stream

flows in Puerto Rico during Hurricane Fiona in September 2022. In addition, supplemental funding following the Hurricane Maria disaster provided the additional rainfall monitoring stations operated across Puerto Rico, which provided definitive and useful information to local governments and the public during Hurricane Fiona.

Keeping USGS on the Cutting Edge: Facilities

Modernizing facilities continues to be an important issue for the USGS, as the bureau implements important renovations, moves, and repairs that have allowed the bureau to keep pace with modern scientific capabilities and to ensure a safe and healthy working environment for its employees. These include Congressionally funded/approved projects to build a new Hydrological Instrumentation Facility at the University of Alabama; move from Menlo Park to Moffett Field (NASA Ames campus) in California; rebuild the Hawaiian Volcano Observatory and field station following the eruption of Kīlauea; construct a new Energy and Minerals Research Facility at the Colorado School of Mines; and construct replacement laboratories and office space at the National Wildlife Health Center in Madison, Wisconsin. The USGS has begun efforts to identify and develop new laboratory process water sources to replace a source that was contaminated by per- and poly-fluoroalkyl substances (PFAS) at the Upper Midwest Environmental Science Center in La Crosse, Wisconsin. The USGS is continuing to proactively look for opportunities to upgrade or replace aging facilities. The USGS continues to experience construction cost increases driven by market factors. While the USGS continues to refine its estimates as projects progress from the design phase into the construction award phase, and taking into consideration current funding levels, the USGS estimates that it will complete the major construction projects mentioned above in 2030.

Attracting and Maintaining a Talented Workforce

In 2024, the USGS will continue efforts to provide programs and tools to attract a highly skilled, innovative, and well-trained workforce while strengthening and maintaining the existing workforce. This includes developing educational and outreach strategies that address workforce recruitment and retention for diverse and complementary technical skills, expanding the pathway for early career scientists and other professionals from diverse backgrounds that reflect our Nation, and ensuring a safe and inclusive workplace environment. In the last year, the USGS has focused on increasing STEM (Science, Technology, Engineering and Math) education and training efforts throughout the bureau. Providing pathways for all students to excel in these areas will help to ensure that the USGS and others attract and maintain the best and the brightest in earth and biological sciences. The USGS now has five partnerships in place with Minority Serving Institutions (MSIs), including Tennessee State University, the City College of New York, Alaska Pacific University, Nueta Hidasta Sahnish College, and United Tribes Technical College (the latter two are both Tribal colleges in North Dakota). Additionally, the USGS began piloting a neurodiversity internship program, including college students on the autism spectrum, with the Colorado School of Mines and George Mason University. This builds on a similar program that the USGS has in place with high-school students that has proven successful (STEP-UP). The USGS is also continuing its partnership with academic institutions such as the Alaska Native Science and Engineering Program (ANSEP) to help increase the number of Native American and Alaska native students in STEM while simultaneously strengthening Indigenous American science capacity. The USGS continues to expand these efforts as well, including by developing a new Native Youth in STEM program with tribal partners in the Colorado River Basin, partnering with the Tuba City Unified School District for an educational program for 8th graders from the Navajo, Hopi, and Paiute tribes. The USGS also continues to support the GeoGirls geology and technology camp at Mount St. Helens for seventh and eighth grade girls to explore and understand the 1980 volcanic eruption of Mount St. Helens, the hazards that volcanic eruptions pose to the human population, and the technology used by scientists to monitor volcanoes. The program, started by a USGS scientist while completing her post-doctoral studies, is a

collaboration between the Mount St. Helens Institute and the USGS, with additional partners from universities and the private sector.

DOI Field Communication Modernization Initiative

On a given day, Interior field operations include firefighters battling fires in Eastern Oregon, NPS law enforcement officers in Big Bend National Park interdicting smugglers, BLM search and rescue teams providing assistance to a distressed family in the Sonoran desert, USGS installing early warning systems on a high threat Aleutians volcano, FWS conducting duck counts for harvest management, and dozens of other critical functions to effectively manage the Nation's natural and cultural resources. Field communications modernization helps enable capabilities being implemented across DOI communities of practice. From first responder needs to applications such as hazard warning systems, resource management data collection and, in-field collaboration, modernization enables last mile connectivity to these tools in the field, improves safety, increases efficiency, and delivers better data for management decisions.

The decades-old land mobile radio (LMR) systems that DOI operates have a backlog of at least $185 million to bring to acceptable condition and require tens of millions annually to maintain that condition. Meanwhile, cost-effective modern solutions meet requirements for voice, high-speed data, and video, while reducing the footprint of DOI-owned infrastructure and the costs of maintaining those systems. Where replaced, the modern systems will support streamlined interoperability with other agencies. The 2024 budget includes $32.2 million for field communications modernization, including $176,000 for USGS. In 2024, DOI will focus on modernization in Alaska, the Southeastern United States, and the Pacific Islands as, where feasible, it leverages deployment of communications networks outside of Interior's owned infrastructure, such as FirstNet and other dedicated public safety broadband, as well as improved satellite systems in locations where terrestrial broadband is not feasible. This approach will assess and invest in updated technology where it makes sense while considering the Department's historical reliance on the traditionally more expensive LMR network in areas of the country where LMR remains the most reliable means of communication.

Good Accounting Obligation in Government Act Report

The Good Accounting Obligation in Government Act (GAO-IG Act, P.L. 115-414) enacted January 3, 2019, requires that Agencies report the status of each open audit recommendation issued more than one year prior to the submission of the Agency's annual budget justification to Congress. The Act requires Agencies to include the current target completion date, implementation status, and any discrepancies on closure determinations.

The Department of the Interior takes audit follow-up very seriously and considers our external auditors, to include the Government Accountability Office (GAO) and Office of the Inspector General, valued partners in not only improving the Department's management and compliance obligations but also enhancing its programmatic and administrative operations. As stewards of taxpayer resources, the Department applies cost-benefit analysis and enterprise risk management principles in implementing recommendation decisions.

The Department's GAO-IG Act Report will be available at the following link: https://www.doi.gov/cj

USGS Budget At A Glance Dollars in Thousands ($000)						
	2022	2023	2024 Fixed Costs (+/-)	2024 Internal Transfers (+/-)	Program Change (+/-)	2024
Appropriation: SIR						
Ecosystems	**277,897**	**307,176**	**+10,209**	**0**	**+77,603**	**394,988**
Environmental Health Program	**26,489**	**30,457**	**+984**	**0**	**0**	**31,441**
Contaminant Biology	***11,100***	***12,582***	***+442***	***0***	***0***	***12,970***
Toxic Substances Hydrology	***15,389***	***17,929***	***+542***	***0***	***0***	***18,471***
Species Management Research Program	**55,418**	**63,904**	**+2,474**	**0**	**+11,000**	**77,378**
Great Lakes Deep Water Fisheries	[1,000]	[3,000]	0	0	-3,000	[0]
Monitoring and Forecasting Aquatic Ecosystem Health	[0]	[0]	0	0	+2,000	[2,000]
Applied Science in Support of Bureau Conservation and Adaptation	[25,000]	[25,000]	0	0	+7,500	[32,500]
Decision Support for Clean Energy Development on Federal Lands and Water	[3,816]	[3,816]	0	0	+5,000	[8,816]
USA National Phenology Network	[0]	[500]	0	0	-500	[0]
Land Management Research Program	**58,103**	**54,806**	**+1,546**	**0**	**+23,200**	**79,552**
Chesapeake Bay	[6,000]	[8,000]	0	0	-2,300	[5,700]
Sagebrush Sea Ecosystems	[750]	[1,750]	0	0	-1,000	[750]
Renewable Energy and Carbon Management on Federal Lands	[0]	[0]	0	0	+1,500	[1,500]
Understanding and Quantifying Ecosystem Services	[1,100]	[1,100]	0	0	+10,000	[11,100]
Applied Science and Support of Bureau Conservation and Adaptation	[28,340]	[28,340]	0	0	+7,500	[35,840]

USGS Budget At A Glance Dollars in Thousands ($000)						
	2022	**2023**	**2024 Fixed Costs (+/-)**	**2024 Internal Transfers (+/-)**	**Program Change (+/-)**	**2024**
Science Supporting Fire Management Before, During and After Fires	[0]	[0]	0	0	+2,000	[2,000]
Migration Corridor Mapping	[412]	[412]	0	0	+2,000	[2,412]
Transforming Fire and Drought Science Delivery for Natural Resource Managers	[0]	[0]	0	0	+3,500	[3,500]
Biological Threats and Invasive Species Research Program	**40,431**	**46,622**	**+1,607**	**0**	**+1,170**	**49,399**
Coral Disease	[600]	[700]	0	0	-200	[500]
Invasive Carp	[11,000]	[11,000]	0	0	-380	[10,620]
Chronic Wasting Disease	[4,720]	[4,970]	0	0	-1,250	[3,720]
Effects of Interacting Threats and Stressors	[190]	[190]	0	0	+5,000	[5,190]
Tick Management and Research	[0]	[2,000]	0	0	-2,000	[0]
Cooperative Research Units Program	**26,006**	**28,206**	**+1,168**	**0**	**-117**	**29,257**
CRUs	[25,250]	[26,067]	0	0	+933	[27,000]
New CRU - Lake Michigan/Ohio River	[0]	[800]	0	0	-800	[0]
Brown Bullhead Research	[250]	[250]	0	0	-250	[0]
Climate Adaptation Science Center and Land Change Science Program	**71,450**	**83,181**	**+2,430**	**0**	**+42,350**	**127,961**
Land Change Science	***19,547***	***20,066***	***+1,702***	***0***	***+18,850***	***40,618***
Biologic Carbon Sequestration	[150]	[150]	0	0	+1,850	[2,000]
Climate Impacts on Physical and Biological Systems	[15,168]	[15,168]	0	0	+10,000	[25,168]
Assessing Biological Greenhouse Gases	[0]	[0]	0	0	+5,000	[5,000]

USGS Budget At A Glance Dollars in Thousands ($000)						
	2022	**2023**	**2024 Fixed Costs (+/-)**	**2024 Internal Transfers (+/-)**	**Program Change (+/-)**	**2024**
Developing a Climate Risk Framework to Inform Management Options	[2,753]	[2,753]	0	0	+2,000	[4,753]
National and Regional Climate Adaptation Science Centers	***51,903***	***63,115***	***+728***	***0***	***+23,500***	***87,343***
Tribal Climate Adaptation Science	[2,000]	[7,000]	0	0	+3,500	[10,500]
Support for Climate Adaptation Science Centers	[37,335]	[42,335]	0	0	+19,000	[61,335]
USGCRP/National Nature Assessment	[400]	[400]	0	0	+1,000	[1,400]
Energy and Mineral Resources	**95,223**	**104,220**	**+4,502**	**0**	**+42,029**	**150,751**
Energy Resources Program	**31,486**	**33,365**	**+1,497**	**0**	**+22,529**	**57,391**
Geologic Carbon Sequestration	[2,177]	[3,177]	0	0	+6,375	[9,552]
Inventory of Greenhouse Gas Emissions and Sinks on Federal Lands	[175]	[175]	0	0	+9,875	[10,050]
Geothermal Energy	[1,552]	[1,552]	0	0	+3,250	[4,802]
Energy Resource Assessments and Scenario Analysis Tools	[13,837]	[13,837]	0	0	+3,029	[16,866]
Mineral Resources Program	**63,737**	**70,855**	**+3,005**	**0**	**+19,500**	**93,360**
Mine Waste Research and Assessments	[3,774]	[8,774]	0	0	+7,500	[16,274]
Supply Chain Research for Emerging Technologies	[1,670]	[1,670]	0	0	+5,000	[6,670]
Critical Minerals - Location and Assessments	[5,172]	[5,172]	0	0	+4,000	[9,172]
Critical Minerals - Forecasting	[1,195]	[1,195]	0	0	+3,000	[4,195]
Natural Hazards	**185,998**	**200,256**	**+6,772**	**0**	**+19,135**	**226,163**
Earthquake Hazards	**90,037**	**92,651**	**+2,541**	**0**	**+7,100**	**102,292**

USGS Budget At A Glance Dollars in Thousands ($000)						
	2022	2023	2024 Fixed Costs (+/-)	2024 Internal Transfers (+/-)	Program Change (+/-)	2024
National Seismic Hazard Model Improvements and Updates	[2,660]	[2,660]	0	0	-500	[2,160]
Subduction Zone Science	[2,700]	[2,700]	0	0	+4,600	[7,300]
Induced Seismicity	[1,100]	[1,100]	0	0	+2,000	[3,100]
Modernization and Hardening of Infrastructure in Support of Earthquake Analysis	[2,000]	[3,000]	0	0	+1,000	[4,000]
Volcano Hazards Program	**33,282**	**37,500**	**+1,426**	**0**	**-3,091**	**35,835**
National Volcano Early Warning System (NVEWS)	[15,758]	[18,349]	0	0	-3,091	[15,258]
Landslide Hazards Program	**8,929**	**14,432**	**+356**	**0**	**-3,024**	**11,764**
Actionable Landslide Hazard Data and Science	[750]	[4,524]	0	0	-1,524	[3,000]
Cooperative Landslide Hazards and Assessment Competitive Grant Program	[0]	[1,000]	0	0	-1,000	[0]
Landslide Hazard Assessments in Alaska	[4,000]	[4,500]	0	0	-500	[4,000]
Global Seismographic Network Program	**7,212**	**7,273**	**+100**	**0**	**+0**	**7,373**
Geomagnetism Program	**4,673**	**5,251**	**+119**	**0**	**+500**	**5,870**
Expansion of Magnetometer Observatories	[500]	[1,000]	0	0	+500	[1,500]
Coastal/Marine Hazards and Resources Program	**41,865**	**43,149**	**+2,230**	**0**	**+17,650**	**63,029**
Coastal Blue Carbon	[1,200]	[1,200]	0	0	+3,800	[5,000]
Risk Reduction and Community Resilience	[950]	[950]	0	0	+3,850	[4,800]
Modeling and Forecasting Coastal Change Hazards	[10,674]	[10,674]	0	0	+10,000	[20,674]
Water Resources	**285,894**	**304,434**	**+9,419**	**0**	**-500**	**313,353**
Water Availability and Use Science Program	**64,501**	**74,296**	**+2,656**	**0**	**-2,250**	**74,702**

USGS Budget At A Glance Dollars in Thousands ($000)						
	2022	**2023**	**2024 Fixed Costs (+/-)**	**2024 Internal Transfers (+/-)**	**Program Change (+/-)**	**2024**
Integrated Water Availability Assessments	[6,975]	[7,475]	0	0	+4,250	[11,725]
Open ET	[1,500]	[3,500]	0	0	-3,000	[500]
Hydrologic Science Talent Pipeline	[2,000]	[2,000]	0	0	-2,000	[0]
Water Use Withdrawal Models	[2,000]	[2,000]	0	0	+1,500	[3,500]
Transforming Fire and Drought Science Delivery for Natural Resource Managers	[0]	[0]	0	0	+3,000	[3,000]
Water Cycle Center	[0]	[5,000]	0	0	-5,000	[0]
Streamflow Permanence Modeling in Coordination with the Bureau of Land Management	[0]	[1,000]	0	0	-1,000	[0]
Groundwater and Streamflow Information Program	**110,651**	**114,558**	**+3,499**	**0**	**+2,250**	**120,307**
Next-Generation Water Observing System	[29,000]	[29,500]	0	0	+1,400	[30,900]
Federal Priority Streamgages	[25,215]	[25,715]	0	0	+4,600	[30,315]
Klamath Basin Water Availability Activities	[1,214]	[1,214]	0	0	-1,000	[214]
Hydrologic Science Talent Pipeline	[2,000]	[2,000]	0	0	-2,000	[0]
Baseline Water-Quality Assessments of Transboundary Rivers (includes Kootenai Watershed)	[1,500]	[2,250]	0	0	-750	[1,500]
National Water Quality Program	**96,742**	**100,080**	**+3,264**	**0**	**+0**	**103,344**
PFAS Methods and Sampling	[1,600]	[2,100]	0	0	-1,000	[1,100]
Ecological Flows	[1,630]	[1,630]	0	0	+1,000	[2,630]
Water Resources Research Act Program	**14,000**	**15,500**	**+0**	**0**	**-500**	**15,000**
Water Resources Research Institutes - Annual Base Grants	[8,000]	[9,000]	0	-1,000	0	[8,000]

USGS Budget At A Glance Dollars in Thousands ($000)						
	2022	2023	2024 Fixed Costs (+/-)	2024 Internal Transfers (+/-)	Program Change (+/-)	2024
Water Resources Research Institutes - General National Competitive Grants	[2,000]	[2,000]	0	+1,000	0	[3,000]
PFAS Research	[2,500]	[3,000]	0	0	-500	[2,500]
Core Science Systems	**263,802**	**284,607**	**+6,182**	**0**	**+77,822**	**368,611**
National Geospatial Program	**87,526**	**93,650**	**+2,146**	**0**	**+1,722**	**97,518**
3D Elevation Program (3DEP)	[39,905]	[42,905]	0	0	[-6,250]	[36,655]
National Digital Trails	[850]	[1,350]	0	0	-1,170	[180]
USGS topoBuilder	[0]	[250]	0	0	-250	[0]
Geospatial and Geologic Research and Collection on Tribal Lands	[230]	[330]	0	0	+3,670	[4,000]
Alaska Mapping and Map Modernization	[9,500]	[10,000]	0	0	-2,278	[7,722]
3D National Topography Model (3DNTM)	[0]	[500]	0	0	+1,000	[1,500]
Federal Climate Data Portal	[0]	[0]	0	0	+10,000	[10,000]
Digital Surface Models	[3,000]	[3,000]	0	0	-3,000	[0]
National Cooperative Geologic Mapping Program	**42,431**	**44,556**	**+1,118**	**-350**	**-3,000**	**42,324**
National Cooperative Geologic Mapping Program Projects and 3D Geologic Mapping	[41,897]	[43,397]	0	0	-3,000	[40,397]
NGGDPP Internal Transfer	[350]	[350]	0	-350	0	[0]
Science Synthesis, Analysis and Research Program	**26,353**	**30,480**	**+782**	**350**	**+53,450**	**85,062**
Advanced Research Computing Environment	[0]	[3,650]	0	0	+26,350	[30,000]
The American Conservation and Stewardship Atlas	[900]	[900]	0	0	+24,600	[25,500]

USGS Budget At A Glance Dollars in Thousands ($000)						
	2022	**2023**	**2024 Fixed Costs (+/-)**	**2024 Internal Transfers (+/-)**	**Program Change (+/-)**	**2024**
Assessment of Biodiversity	[0]	[0]	0	0	+2,500	[2,500]
NGGDPP Internal Transfer	[0]	[0]	0	350	0	[350]
National Land Imaging Program	**107,492**	**115,921**	**+2,136**	**0**	**+25,650**	**143,707**
Science Research and Investigations	***22,704***	***23,737***	***+1,068***	***0***	***8,650***	***33,455***
Remote Sensing State Grants	[1,250]	[1,465]	0	0	-215	[1,250]
Land Change Monitoring, Assessment, and Projection (LCMAP)	[3,858]	[3,893]	0	0	+5,365	[9,258]
Biologic Carbon Sequestration	[0]	[500]	0	0	+3,500	[4,000]
Satellite Operations	***84,788***	***92,184***	***+1,068***	***0***	***17,000***	***110,252***
Sustainable Land Imaging Development-Landsat Next	[84,788]	[91,334]	0	0	+12,000	[103,334]
Commercial Satellite Data Pilot	[0]	[0]	0	0	+5,000	[5,000]
Science Support	**99,736**	**106,304**	**+6,865**	**0**	**+21,003**	**134,172**
Administration and Management Program	**77,520**	**82,179**	**+6,070**	**0**	**+11,139**	**99,388**
Scientific Integrity and Diversity and Support for Enterprise Science	[1,943]	[2,667]	0	0	+7,761	[10,428]
Federal Electric Fleet/Vehicle AFE Premium	[150]	[250]	0	0	+3,378	[3,628]
Information Services Program	**22,216**	**24,125**	**+795**	**0**	**+9,864**	**34,784**
Integration of Standard Cybersecurity Architecture	[0]	[0]	0	0	+2,492	[2,492]
IT Support for R&D, including Cloud and High-Performance Computing	[2,500]	[4,000]	0	0	+6,500	[10,500]
IT Enhancements	[0]	[0]	0	0	+872	[872]
Facilities	**184,810**	**188,051**	**+5,217**	**0**	**+4,203**	**197,471**

USGS Budget At A Glance

Dollars in Thousands ($000)

	2022	2023	2024 Fixed Costs (+/-)	2024 Internal Transfers (+/-)	Program Change (+/-)	2024
Rental Payments and Operations & Maintenance Program	**110,146**	**113,211**	**+5,203**	**0**	**+0**	**118,414**
Facilities Maintenance, Modernization, and Restoration	**74,664**	**74,840**	**+14**	**0**	**+4,203**	**79,057**
Department of the Interior Field Communications Modernization (DIFCOM)	[0]	[176]	0	0	+176	[352]
Charging Infrastructure	[0]	[0]	0	0	+1,425	[1,425]
Priority Facility Projects	[0]	[0]	0	0	+2,602	2,602
Special Initiative - 2022 -EEW Alaska	**1,000**	**0**	**0**	**0**	**0**	**0**
Special Initiative - 2023	**0**	**2,130**	**0**	**0**	**-2,130**	**0**
TOTAL, SIR w/o Supplemental Funding	**1,394,360**	**1,497,178**	**+49,166**	**0**	**+239,165**	**1,785,509**
2022 Bipartisan Infrastructure Law (P.L. 117-58) /1/2	**238,470**	**68,655**	**0**	**0**	**0**	**68,655**
2022 Disaster Supplemental (P.L. 117-43)/1	**26,284**	**0**	**0**	**0**	**0**	
2022 Inflation Reduction Act (P.L. 117-169)/1	**23,500**	**0**	**0**	**0**	**0**	**0**
2023 Disaster Supplemental (P.L. 117-328)/1	**0**	**41,040**	**0**	**0**	**-41,040**	**0**
2024 Contributed Funds	**1,670**	**690**	**0**	**0**	**0**	**690**
2024 Quarters	**52**	**68**	**0**	**0**	**0**	**68**
TOTAL, SIR with Supplemental and Permanent Funding	**1,684,336**	**1,607,631**	**+49,166**	**0**	**+198,125**	**1,854,922**

[1] BIL, IRA, and Other Supplemental Funding displayed reflects the amounts made available in the fiscal year not estimated allocations or obligations.
[2] BIL funding is net of transfers to the Department's Office of Inspector General.

Ecosystems

Ecosystems $ in thousands	2022 Actual	2023 Enacted	2024 Fixed Cost (+/-)	2024 Internal Transfers (+/-)	2024 Program Changes (+/-)	2024 Request	Change from 2023 Enacted (+/-)
Environmental Health Program	**26,489**	**30,457**	**+984**	**0**	**0**	**31,441**	**+984**
FTE	***120***	***128***	***0***	***0***	***0***	***128***	***0***
Species Management Research Program	**55,418**	**63,904**	**+2,474**	**0**	**+11,000**	**77,378**	**+13,474**
FTE	***240***	***322***	***0***	***0***	***0***	***322***	***0***
Land Management Research Program	**58,103**	**54,806**	**+1,546**	**0**	**+23,200**	**79,552**	**+24,746**
FTE	***227***	***165***	***0***	***0***	***+40***	***205***	***+40***
Biological Threats and Invasive Species Research Program	**40,431**	**46,622**	**+1,607**	**0**	**+1,170**	**49,399**	**+2,777**
FTE	***199***	***236***	***0***	***0***	***-7***	***229***	***-7***
Cooperative Research Units Program	**26,006**	**28,206**	**+1,168**	**0**	**-117**	**29,257**	**+1,051**
FTE	***146***	***152***	***0***	***0***	***-3***	***149***	***-3***
Climate Adaptation Science Center and Land Change Science Program	**71,450**	**83,181**	**+2,430**	**0**	**+42,350**	**127,961**	**+44,780**
FTE	***204***	***216***	***0***	***0***	***+106***	***322***	***+106***
Ecosystems Total	**277,897**	**307,176**	**+10,209**	**0**	**+77,603**	**394,988**	**+87,812**
FTE	***1,136***	***1,219***	***0***	***0***	***+136***	***1,355***	***+136***

The 2024 budget request for the Ecosystems Mission Area is $394,988,0000 and 1,355 FTE, a program change of +$77,603,000 and +136 FTE from the 2023 Enacted.

Mission Area Overview

The quality of life in and economic strength of the U.S. hinges on healthy ecosystems that support living things and natural processes, and the Ecosystems Mission Area (EMA) helps conserve these vital interests. The EMA is the biological research arm of the Department of the Interior (Interior) and provides the science needed to ensure the Nation's ecosystems are managed sustainably, and biological resources are conserved now and into the future. This work is done within the broader mission of the USGS to serve the Nation with science that advances understanding of our natural resources and informs

land and water stewardship. The lands managed by Interior and the ecosystems within them are a significant national asset. Scientists in EMA provides impartial research in the development of tools and decision support for the resource managers entrusted with the stewardship of those lands. This includes science that:

- Managers, policy makers, and others use for decisions that ***protect, conserve, and enhance*** fish and wildlife populations across the U.S. and beyond.
- Improves the effectiveness of land management and informs restoration of priority ecosystems on millions of acres including public lands such as National Parks, wildlife refuges, and other landscapes that support the biodiversity of fish, wildlife, and plant species, as well as thriving economies.
- Delivers information used to ***protect public safety, property, and ecosystems*** from invasive plants and animals and infectious fish and wildlife diseases that pose significant ecologic and economic threats to the resources of the U.S.
- Informs stakeholder decisions to manage fish and wildlife health and provides ***environmental exposure information*** to partners in public health.
- Works closely with partners and stakeholders to examine regional issues related to ***climate impacts and adaptation strategies.***
- Strives to advance the understanding of the physical, chemical, and biological components of the Earth system, the causes and consequences of climate and land use change, and the ***vulnerability and resilience of ecosystems*** to such changes.
- Meets the actionable science needs of cooperators, provides technical assistance, and develops the ***future workforce*** through fellowships and mentoring.

EMA science is essential for resource management decisions that protect and conserve the lands and waters enjoyed by communities across the Nation and that provide critical habitat for fish, wildlife, and plant species. EMA scientists deliver innovative and forward-thinking science and develop new management tools and techniques using many methods including remote sensing, artificial intelligence/machine learning, data visualization, and crowdsourcing, to produce timely information to meet diverse stakeholder needs.

The work of the EMA ranges from molecular-level to ecosystem-scale studies, but the common thread across these efforts is science to advance the understanding of biological resources. The EMA funds a wide variety of USGS capabilities and consists of six national programs supporting research conducted at fifteen (15) Ecological Science Centers with numerous field stations, a national Climate Adaptation Science Center, nine (9) regional Climate Adaptation Science Centers, forty-two (42) Cooperative Research Units, and a broad range of science centers from other scientific disciplines.

FY 2022 Selected Mission Area Accomplishments

- USGS expertise on monitoring of seabird abundance and distribution and seabird vulnerability to offshore wind energy contributed to a new framework that can be applied globally for assessing and mitigating the impacts of offshore wind energy development. In the U.S., offshore wind energy is growing on the East Coast and is under consideration on the West Coast. The new framework, supported by the Bureau of Ocean Energy Management (BOEM), will inform planning for offshore wind development.

- USGS advanced the understanding of per- and polyfluoroalkyl substances (PFAS) by working with Federal agencies, Tribal Nations, academia, industry, drinking water purveyors, and the public to provide needed information about the processes driving contaminants from their sources through aquifers, watersheds, drinking water facilities, and aging distribution infrastructure to homes. Data were collected on complex mixtures of over 500 chemicals and pathogens where human exposure occurs — at the tap. USGS scientists have expertise in transport, fate, and analysis of contaminants that is shared with public health experts to understand if such exposures influence human health. These studies have resulted in numerous scientific products outlining the organic and inorganic contaminants mixtures in drinking water across the Nation and within special focus areas including underserved rural and urban communities.
- USGS and partners developed the first North American Tree-Ring, Fire-Scar Network (NAFSN) which includes 2,562 sites and over 37,000 fire-scarred trees. This new network of data helps inform our understanding of historic fires on the landscape and helps better predict the impacts of climate change on future fire risk and severity. This dataset will improve the precision and accuracy of calculating the baseline fire return interval across different parts of North America.
- USGS collaborated with the Western Association of Fish and Wildlife Agencies (WAFWA), other Federal and NGO partners to release Sagebrush Conservation Design in support of WAFWA's Sagebrush Conservation Strategy. This framework quantifies changes in ecological integrity of sagebrush rangelands as a result of threats driving loss and degradation including fire and invasive annual grasses and can be used to help resource managers target limited resources to deliver conservation and restoration action in areas more likely to be effective and to defend and grow healthy sagebrush rangelands.
- Some of the largest consequences and challenges posed by drought are social and the dimensions of drought are diverse and interrelated. Drought can have substantial economic impacts on industries such as agriculture and forestry, while from an institutional perspective, drought outcomes are influenced by water laws determining who has rights to water. A new report co-authored by National and North Central Climate Adaptation Science Center researchers provides managers, decision makers, and other practitioners with a flexible approach for designing and implementing a rapid assessment of the social dimensions of drought. The rapid assessment method is an efficient, cost-effective approach for providing a “snapshot” of the social landscape as it relates to drought, in a matter of days to months. Ultimately, the guide can help practitioners make informed decisions about drought preparedness and response.
- USGS scientists partnered with the National Park Service (NPS), U.S. Fish and Wildlife Service (USFWS), Bureau of Land Management (BLM) and the Colorado State University to produce INHABIT (Invasive Species Habitat Tool; http://gis.usgs.gov/inhabit). This novel decision support tool provides high-resolution spatial predictions of invasive plant species habitat suitability, provides ongoing maintenance to meet shifting management needs, and caters to a broad suite of potential end users. This web tool delivers species distribution models for priority invasive terrestrial plant species for the contiguous U.S. to deliver priority invasive terrestrial plant species distribution models. The 2022 publication introducing this new decision support tool included two management case studies to demonstrate the impact and integration of user feedback to INHABITs iterative evolution.

Ecosystems
Environmental Health Program

Ecosystems $ in thousands	2022 Actual	2023 Enacted	2024 Fixed Costs (+/-)	2024 Internal Transfers (+/-)	2024 Program Changes (+/-)	2024 Request	Change from 2023 Enacted (+/-)
Environmental Health Program	**26,489**	**30,457**	**+984**	**0**	**0**	**31,441**	**+984**
Contaminant Biology	**11,100**	**12,528**	**+442**	**0**	**0**	**12,970**	**+442**
Toxic Substances Hydrology	**15,389**	**17,929**	**+542**	**0**	**0**	**18,471**	**+542**
FTE	***120***	***128***	***0***	***0***	***0***	***128***	***0***

Justification of 2024 Program Changes

The 2024 budget request for Environmental Health is $31,441,000 and 128 FTE. There are no program changes proposed for the Environmental Health Program in 2024.

Program Overview

America has an abundance of natural resources that are vital to our health and well-being and to the Nation's economic security. Toxicological or pathogenic disease agents in the environment (collectively referred to as "environmental contaminants") can pose a threat to the health and sustainability of these resources. The "One Health" paradigm recognizes that the health of humans, animals, and the environment are inextricably linked and that successful efforts to protect and optimize the health of natural resources as well as people requires an interdisciplinary approach. The Environmental Health (EH) Program utilizes a "One Health" approach to deliver science focused on documenting, better understanding and mitigating some of the highest priority health threats associated with environmental contaminants. The science is used by resource managers and other stakeholders to sustainably protect, balance and optimize the health of people, animals and ecosystems.

The EH Program examines the effects of pathogens, toxins, and contaminants on a variety of wildlife species such as assessing exposure to environmental contaminants in Chesapeake Bay ospreys. Source: USGS.

The EH Program brings together interdisciplinary teams of science expertise and laboratory capabilities hydrologists, geologists, chemists, toxicologists, biologists, ecologists, microbiologists and modelers -- who advance USGS scientific understandings of environmental contaminant exposures and hazard mitigation.

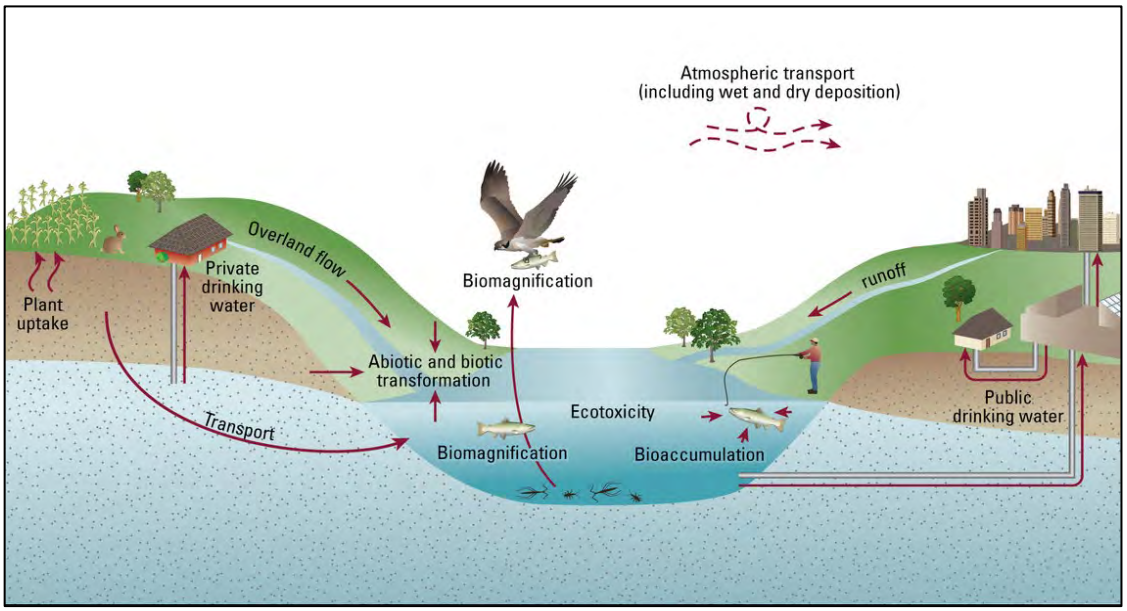
Environmental exposures to a range of naturally occurring and human-sourced contaminants are investigated including mercury, lead, arsenic, natural and synthetic hormones, and pharmaceuticals,

per- and polyfluoroalkyl substances (PFAS), and pesticides; pathogens such as avian influenza, viruses, and antibiotic-resistant bacteria and genes; and a variety of algal toxins. The integration of natural-science disciplines produces extensive, comprehensive, peer-reviewed science and actionable data and related decision tools for situational awareness, planning, and forecasting.

> The EH Program supports integrated natural science expertise and capabilities across the USGS related to environmental contaminants and pathogens. The Program supports science to address the full range of questions related to contaminant and pathogen sources, environmental transport, exposure/transmission pathways, uptake, biological effects, and human health implications. This science informs stakeholder decisions to manage fish and wildlife health and provides environmental exposure information to partners in public health.

The EH Program is a national leader addressing science related to new and emerging contaminants and makes a concerted effort to maintain strong capability in this area of research. The EH Program addresses pertinent scientific questions and can pivot to partner-identified new concerns that pose pressing threats to safeguarding health of wildlife and the public. This research helps anticipate and inform when, where, and how environmental contaminants will emerge from sources in watersheds and aquifers to point-of-use where the public is exposed and in ecosystems where fish and wildlife health can be impacted. For example, in response to the recent increase in public concern over PFAS in water resources and drinking water and the need for information on this topic, the USGS created a strategic vision document for PFAS science and quickly began to implement aspects of the vision document through a topical team focused on PFAS identification and analyses, occurrence, fate and transport in the environment, exposure for wildlife and humans, and bioaccumulations and effects on wildlife.

A multitude of stakeholders, including State agencies, the Environmental Protection Agency (EPA), USFWS, Centers for Disease Control (CDC) and U.S. Department of Agriculture (USDA), and industry use the EH Program's science, data, and tools to identify, understand, and prioritize management practices that reduce the risk of environmental contamination. Working with partners in academia and other science and health agencies, the EH Program contributes to a foundation of knowledge for a range of land and other resource management and related economic decisions such as maintaining the safety of



Conceptual diagram of per- and polyfluoroalkyl substance (PFAS) sources, movement, and exposures in a watershed. Source: USGS.

harvested fish and wildlife species; the re-use of solid and liquid wastes from municipal, energy, and mineral activities; and protection of recreational and drinking water resources.

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Ecosystems
Species Management Research Program

Ecosystems $ in thousands	2022 Actual	2023 Enacted	2024 Fixed Costs (+/-)	2024 Internal Transfers (+/-)	2024 Program Changes (+/-)	2024 Request	Change from 2023 Enacted (+/-)
Species Management Research Program	**55,418**	**63,904**	**+2,474**	**0**	**+11,000**	**77,378**	**+13,474**
Great Lakes Deep Water Fisheries	[1,000]	[3,000]	0	0	-3,000	[0]	[-3,000]
Monitoring and Forecasting Aquatic Ecosystem Health	[0]	[0]	0	0	+2,000	[2,000]	[+2,000]
Applied Science in Support of Bureau Conservation and Adaptation	[25,000]	[25,000]	0	0	+7,500	[32,500]	[+7,500]
Decision Support for Clean Energy Development on Federal Lands and Water	[3,816]	[3,816]	0	0	+5,000	[8,816]	[+5,000]
USA National Phenology Network	[0]	[500]	0	0	-500	[0]	[-500]
FTE	***240***	***322***	***0***	***0***	***0***	***322***	***0***

Justification of 2024 Program Changes

The 2024 budget request for Species Management Research Program (SMRP) is $77,378,000 and 322 FTE, a program change of +$11,000,000 and 0 FTE from the 2023 Enacted.

Great Lakes Deep Water Fisheries (-$3,000,000 / -20 FTE) – The budget does not request funding for this program. Through base funding, USGS would continue to undertake surveys in the Great Lakes, but would reduce the frequency and scope.

Monitoring and Forecasting Aquatic Ecosystem Health (+$2,000,000 / 0 FTE) – The proposed increase would fund cross-Mission Area science that would build on recent advancements in monitoring, modeling, and multidisciplinary research to improve capacity to forecast impacts of environmental change and land management on water availability, ecosystem health, and species sustainability. Working collaboratively in Water Mission Area (WMA) Integrated Water Science basins, the EMA and WMA would develop complimentary methods, including genetic and genomic capabilities, and models to study continuing challenges to water supply, infrastructure, resource management, and aquatic ecosystems due to population growth, increasing floods and droughts, and aging water delivery systems. Funding would support the integration of data from hydrologic, biogeochemical, and ecological studies to model the

impacts of hydrologic change and sea level rise on ecosystem and species vulnerabilities and resilience, including on culturally significant aquatic species that provide ecosystem services to disadvantaged and vulnerable communities. This would enable aquatic resource managers to understand and anticipate conditions under various potential scenarios in order to sustain aquatic systems and the ecosystem services they provide to communities.

Applied Science in Support of Bureau Species Conservation and Adaptation (+$7,500,000 / +12 FTE) – The SMRP would expand work on threats to fish and wildlife like land use change, climate, drought, extreme storm events, and invasive species and disease. The SMRP would develop new tools and technologies to help managers consider species responses to alternative management scenarios and incorporate uncertainty about outcomes into decision-making at broad scales. Species and their habitats are interdependent and complex in their relationships; the SMRP would work in tandem with the Land Management Research Program to direct resources to participatory science supporting the full spectrum of management information needs for species and their habitats. Outcomes would support species management decisions by providing current and future species status metrics and would allow resource managers to prioritize actions with the highest probability of success.

Decision Support for Clean Energy Development on Federal Lands and Water (+$5,000,000 / +10 FTE) – Accelerating deployment of clean energy facilities while ensuring robust protection of sensitive species, habitat, and biodiversity will require science that informs strategies to avoid or reduce harmful impacts to fish and wildlife and their habitats. With these funds, USGS fish and wildlife biologists and ecologists would work with land managers, regulatory agencies and the clean energy industry to produce science-based tools and strategies to help decision-makers determine optimal placement of clean energy infrastructure on lands and in waters, minimizing or mitigating the risks and harmful impacts to protected species and habitats. This would help streamline siting and permitting of clean energy projects. Products would include maps of desert tortoise connectivity to guide solar energy development in the southwest and novel high-resolution models and GIS tools identifying high and low risk areas for protected species, developed in collaboration with Federal research laboratories such as the Department of Energy labs (e.g. National Renewable Energy Laboratory and others).

USA National Phenology Network (USA-NPN) (-$500,000 / -2 FTE) – The budget does not request funding for this program.

Program Overview

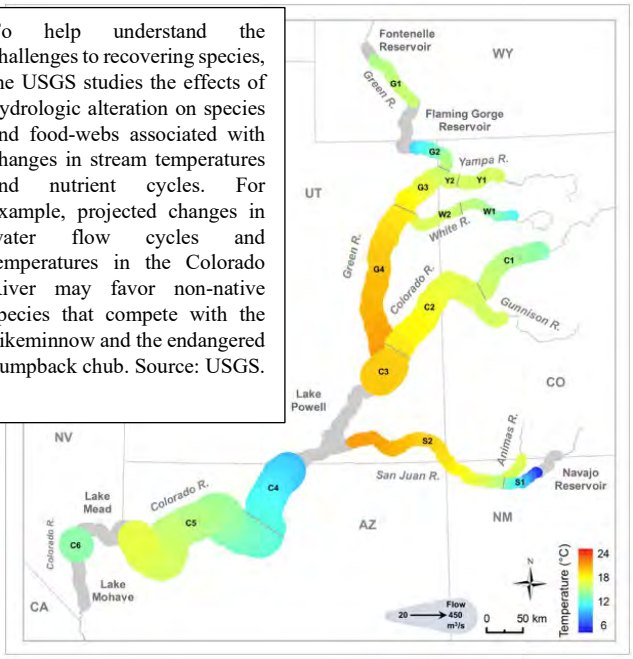
Preserving the Nation's rich fish and wildlife species diversity requires an understanding of how species like cutthroat trout, grizzly bear, or golden eagle respond to changes in the ecosystems they live in, and of how those species respond to management actions that managers take to preserve or recover those species. Species management research seeks to understand why some species are declining and others are not; why some species are more affected by energy development or warmer streams while others are not. Species management science also uses this information gained to design and evaluate management actions, whether for reasons of sustainable harvest or species recovery, to help managers make more effective decision to preserve species.

A Cape May Warbler banded at the USGS Bird Banding Lab's Fall Migration Station. The USGS Bird Banding Laboratory manages the permits and bands as well as the resulting data, enabling a wide range of professional researchers to conduct studies - and making it easier for the public to help by report a sighting via www.reportband.gov. Source: USGS.

Biodiversity is declining at a significant rate, both nationally and on a global scale. Various natural and manmade stressors are exacerbating species diversity declines and leading to uncertainty about the resilience and sustainability of species and entire ecosystems. Moreover, species distributions are changing, with consequences for a wide range of decisions. land and water resource managers need targeted science to make strategic and informed decisions about species and ecosystems management. The SMRP studies stressors like climate change with the goal of providing decision-ready science to DOI and other agency resource managers to support conservation of species and biodiversity. Federal and State resource management agencies, Tribes, non-governmental organizations, industry and the public rely on the SMRP for information to guide a range of on-the-ground programs and activities related to meeting statutory requirements, permitting, habitat conservation planning, mitigation practices, Endangered Species Act (ESA) compliance, restoration best practices, and more. This information is essential for agencies to meet societal needs and expectations in the face of a complex array of species stressors and projected changes in environmental conditions and improve relationships with communities of color, low-income families, and rural and Indigenous communities.

The SMRP conducts research to address key uncertainties in aquatic and terrestrial species biology and population status. This work often involves co-producing science with Interior and other Federal and State fish and wildlife management agencies, Tribal entities, and other stakeholders. Currently, the SMRP is conducting research on over 160 at-risk species to identify and address stressors and threats, preserve biodiversity, support Species Status Assessments to inform ESA listing decisions and recovery, conduct species risk and vulnerability assessments, predict species adaptations to climate change, and prioritize lands and waters for protection, conservation and restoration actions.

The SMRP maintains robust research portfolios on numerous species in support of Interior's management responsibility in light of climate change and other species stressors. Research focus includes birds, amphibians, salmon, bats, pollinators, insects, manatees, sea otters, mollusks, walrus, and polar bears. For example, SMRP science was used in support of species status assessments (pre-listing) for U.S. Fish and Wildlife Service for three bat species (little brown bats, northern long-eared bats and tricolored bats) and for migrating whooping cranes. Long-standing SMRP initiatives such as the Breeding Bird Survey and the Bird Banding Laboratory provide the primary long-term data on the abundance and distribution of avian species in North America.



To help understand the challenges to recovering species, the USGS studies the effects of hydrologic alteration on species and food-webs associated with changes in stream temperatures and nutrient cycles. For example, projected changes in water flow cycles and temperatures in the Colorado River may favor non-native species that compete with the pikeminnow and the endangered humpback chub. Source: USGS.

The SMRP provides the science to support management of harvested species, including migratory bird population models used to develop recommendations on waterfowl harvest by Flyway Councils, accelerate responsible development of renewable energy on public lands and waters, and provide technical support for multi-jurisdictional fisheries, harvest, and allocation. The SMRP develops advanced technologies such as remote sensing and genetic tools to improve the ability to assess species population status and health, and models that incorporate stressors such as climate change to predict biodiversity response. These tools are helping managers develop a more accurate and comprehensive understanding of species population trajectories and distribution shifts in the coming decades.

Water is a critical resource for humans and ecosystems, and decisions involving water can have far-reaching implications. Ecohydrology is science focused on the complex interface between ecological and hydrological systems. The SMRP works with the USGS WMA to integrate data from hydrologic, biogeochemical, and ecological studies to improve our capacity to model the impacts of hydrologic change on species vulnerability and distributions, including on culturally significant aquatic species that provide ecosystem services to disadvantaged and vulnerable communities.

Ecosystems
Land Management Research Program

Ecosystems $ in thousands	2022 Actual	2023 Enacted	2024 Fixed Costs (+/-)	2024 Internal Transfers (+/-)	2024 Program Changes (+/-)	2024 Request	Change from 2023 Enacted (+/-)
Land Management Research Program	**58,103**	**54,806**	**+1,546**	**0**	**+23,200**	**79,552**	**+24,746**
Chesapeake Bay	[6,000]	[8,000]	0	0	-2,300	[5,700]	[-2,300]
Sagebrush Sea Ecosystems	[750]	[1,750]	0	0	-1,000	[750]	[-1,000]
Renewable Energy and Carbon Management on Federal Lands	[0]	[0]	0	0	+1,500	[1,500]	[+1,500]
Understanding and Quantifying Ecosystem Services	[1,100]	[1,100]	0	0	+10,000	[11,100]	[+10,000]
Applied Science and Support of Bureau Conservation and Adaptation	[28,340]	[28,340]	0	0	+7,500	[35,840]	[+7,500]
Science Supporting Fire Management Before, During and After Fires	[0]	[0]	0	0	+2,000	[2,000]	[+2,000]
Migration Corridor Mapping	[412]	[412]	0	0	+2,000	[2,412]	[+2,000]
Transforming Fire and Drought Science Delivery for Natural Resource Managers	[0]	[0]	0	0	+3,500	[3,500]	[+3,500]
FTE	***227***	***165***	***0***	***0***	***+40***	***205***	***+40***

Justification of 2024 Program Changes

The 2024 budget request for Land Management Research Program (LMRP) is $79,552,000 and 205 FTE, a program change of +$23,200,000 and +40 FTE from the 2023 Enacted.

Chesapeake Bay (-$2,300,000 / -10 FTE) – Funding for the Chesapeake Bay Priority Ecosystems Studies program would be reduced, impacting the availability of up-to-date science used by partners to develop and evaluate the effectiveness of management plans, reducing USGS work with partners on best management practices, and decreasing coordination and monitoring for fish habitat, brook trout, and climate resiliency. Work on integrated science themes including water quality, coastal habitats, and

watershed management would continue at a reduced level guided by the USGS Chesapeake Science Strategy.

Sagebrush Sea Ecosystems (-1,000,000 / -5 FTE) - The USGS would reduce science support for BLM, slowing the integration of science into National Environmental Policy Act (NEPA) planning documents and into practical application in the field. Ongoing research and tool development focused on greater sage-grouse, invasive species, and fire would continue at a reduced level.

Renewable Energy and Carbon Management on Federal Lands (+$1,500,000 / +3 FTE) – The USGS would work with resource managers to co-produce new science and tools that support the transition to renewable energy and other priorities, including recycling and managing mine wastes, reducing greenhouse gas (GHG) emissions, and managing carbon. This research would allow the USGS to inform and improve decision making related to NEPA planning, siting, prescriptions, restoration, and monitoring at both site and regional-cumulative scales. The USGS would continue to work with stakeholders, science providers, and industry to develop a scenario modeling framework that allows users to integrate local, regional, and national scale data for multiple resources and incorporate uncertainty into decisions.

Understanding and Quantifying Ecosystem Services (+$10,000,000 / +18 FTE) – Science has made remarkable gains in understanding the complicated natural systems that support human communities, particularly in the face of climate change. This investment would build a stronger understanding of the benefits that ecosystems offer and what ecosystem services are most beneficial to communities and would entail quantitative analysis of benefits and trade-offs across the range of land management alternatives. This would help to better measure the value of green infrastructure – using natural systems, such as wetlands for purifying water, instead of traditional infrastructure – which can be incorporated into a portfolio of solutions to increase water storage capacity, flood risk mitigation, coastal storm protection, carbon sequestration, and climate change adaptation. This would allow the USGS to provide better information to land managers and decision makers to achieve conservation and restoration goals.

New USGS research on ecosystem services would support NEPA planning and provide stakeholders with unbiased information to prioritize and achieve multiple conservation outcomes, and integrate land and species conservation research into adaptive management decisions. The research would also inform the development of public-private partnerships and investment in green infrastructure to enhance ecosystem services. This would also assist communities and land managers who face a growing threat from wildfire, drought, climate change impacts on biodiversity and the ongoing socio-economic transition to sustainable energy, manage lands and natural resources for multiple uses.

Applied Science in Support of Interior Bureau Conservation and Adaptation (+$7,500,000 / +12 FTE) – The USGS would provide additional, actionable science to assist natural resource managers, particularly at Interior, better understand climate impacts to natural resources as well as adaptation and mitigation options. This work would be conducted in partnership with the USGS SMRP and focus on better understanding the complex linkages among ecosystems, land and resource management, climate change, and habitats for fish and wildlife.

The USGS would also expand work with decision makers within the DOI land management bureaus to create targeted adaptation planning frameworks linked to explicit conservation goals and outcomes. The USGS would use targeted monitoring as a critical adaptive management approach to land and waters with complex, interacting, and dynamic challenges. This work would assist decision makers as they choose among possible actions, maximizing the likelihood of success. It would also enable the USGS to produce

the biodiversity and ecosystem components of the National Climate Assessment, explicitly assessing linkages between climate and biodiversity to identify effective mechanisms to support conservation. This would inform environmental planning across sectors, benefitting Federal and State agencies, the public, and industry, resulting in better outcomes and reduced costs.

Science Supporting Fire Management Before, During and After Fires (+$2,000,000 / +4 FTE) – The USGS released its first Wildland Fire Science Strategic Plan in FY 2021, which emphasizes working with stakeholders to identify, develop, and share essential information, data and tools that support critical decision-making by fire, resource and emergency managers. The USGS is poised to provide critical science support for mitigating and responding to fire/post-fire risk and recovery at local to national scales. With this increase, the USGS would fund advanced integrated fire research focused on the complicated, interacting, and dynamic fire/post-fire challenges. For example, the USGS would identify how pre-fire fuel conditions affect fire behavior and how burn severity will improve fuel treatments to reduce direct fire effects and cascading post-fire impacts from debris flows, flooding, water quality and sedimentation. Integrated research approaches with advanced sensors, satellite data, analytics (artificial intelligence) and models would also provide managers better understanding and decision support to address such factors as climate change, invasive species, drought and human development, which all interact to affect fire behavior and fire risk to society and ecosystems. Land, fire, and community managers working with scientists would be better able to plan and implement actions that reduce wildfire and post-fire risk to people, wildlife habitat, water supply, land uses and other ecosystem services.

Migration Corridor Mapping (+2,000,000 / +4 FTE) – The USGS would expand its work with States and Tribes to map big game migration corridors in the western U.S. This funding would allow the USGS to build additional scientific and technical capacity for leadership of a national effort to advance the science and management of big game migrations. In 2018, in response to Secretarial Order 3362, the USGS worked in partnership with western wildlife agencies to create a Corridor Mapping Team. The team has begun to map corridors of elk, mule deer, pronghorn, moose and bison, with all 11 public land States participating in the effort. Building on these successes, new funding would help leverage USGS science to: (1) implement a comprehensive effort to map migration corridors in the western U.S.; (2) develop powerful mapping software to facilitate corridor mapping; (3) make corridor maps viewable, publicly available, and actionable for conservation; (4) conduct new studies with western States and Tribes to map undocumented migrations; (5) conduct new migration research on climate change, development, and mitigation; and (6) train the next generation of wildlife managers. USGS would work with State and Federal partners to incorporate the mapped migrations into conservation planning at various levels, including work with USDA Natural Resources Conservation Service to provide corridor maps for conservation work with private landowners, and work with State transportation departments and wildlife agencies, Tribes, and other partners to make migration maps available to guide planning and implementation of crossing structures, land conservation, and other ecosystem restoration activities.

Transforming Fire and Drought Science Delivery for Natural Resource Managers (+$3,500,000 / +14 FTE) – The USGS is proposing a $6.5 million total increase (including a $3.0 million increase in the Water Resources Mission Area) to transform delivery of USGS science, information and tools to support decision making on wildfire and drought. This increase would allow the USGS to better align its science with the comprehensive decision support needs related to wildfire and drought with emphasis on Interior bureaus and their stakeholders. This initiative would build upon work that has taken place across the

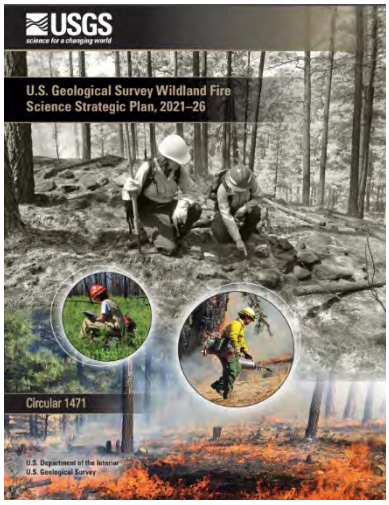
USGS, bringing a more integrated approach to science that can help Interior carry out its stewardship responsibilities. This funding would be split between the USGS EMA and WMA, but all Mission Areas would participate in providing the appropriate science and information as needed.

The effect of long-term drought and increased wildfires, particularly in the West, are increasingly detrimental to ecosystems and communities, threatening the ability of Interior natural resource managers and other USGS partners to meet their mission responsibilities. This initiative would prioritize decision-support development and delivery activities that would leverage and build on ecosystem restoration and Bipartisan Infrastructure Law wildfire investments, support water resource and ecosystem objectives sensitive to future drought and fire conditions and respond to the diverse stakeholder needs already identified through extensive stakeholder engagement. The USGS brings a wide range of relevant science to bear on these issues, supporting Interior land management bureaus, the U.S. Forest Service, State natural resource agencies, and communities across the West, including Tribes. USGS Partners want science to assist in decision-making under future uncertainty, such as dam operation scenarios that reflect unprecedented low reservoir storage; projections of water availability for drinking water, irrigation, and ecological health; animal and habitat response to wildfire and vegetation change; forecasts of the onset, severity, and duration of droughts regionally; pre-fire estimates of potential vegetation and water quantity and quality impacts to evaluate effectiveness of fuel treatments and other mitigation actions; and state-of-the-art models to assess fire-ecosystem-water interdependencies and their cumulative impacts to the people, lands, and water of drought impacted areas.

With this funding, USGS would prioritize co-development and co-production of necessary and useful scientific products and tools with Federal, State, local and tribal partners in a timely manner to support decision-making needs. Co-production would include partner-guided products that reflect the scale at which decisions are made, and convening and engaging with our partners at all stages of the product life. The USGS would work with partners to develop decision support tools (such as advanced linked models, robust observation networks, integrated analyses, and forecasts at the scales relevant to natural resource decision making) that bring together projections on species vulnerability, drought, water availability, fire risk, and other drivers of ecological change. This activity would utilize expanded access to advanced scientific computing technology that is requested within the Core Science Systems Mission Area. Advances in technology and advanced scientific computing would make it possible to deliver our science in new ways and at a scale that is needed for decision-making.

Program Overview

Conserving or restoring ecosystem functions and processes at landscape or watershed scale is vital to maintaining biodiversity, our cultural heritage, human communities, and the economy. Land management research seeks to understand how ecosystems interact with each other and are affected by various stressors across local to global scales. Land management research also aims to understand how conservation and restoration practices can mitigate some of the stressors.

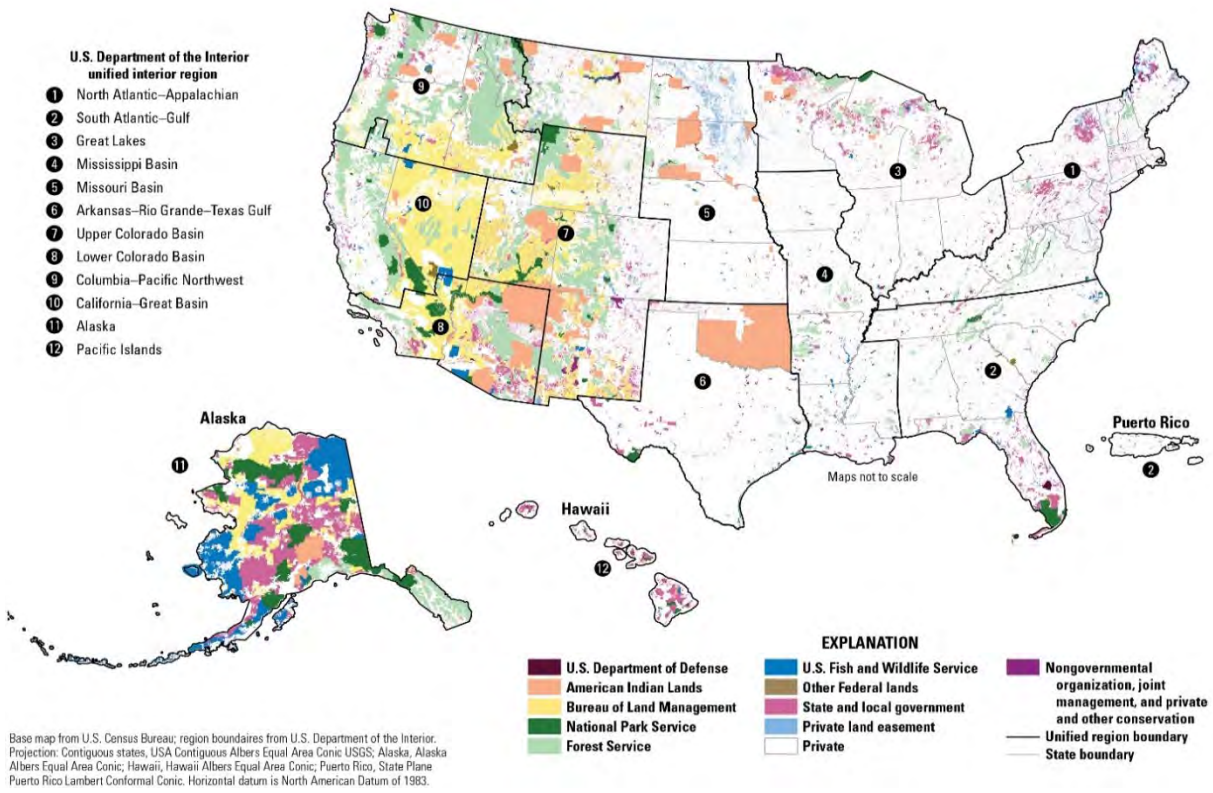


The USGS Wildland Fire Strategic Science Plan, represents the most integrated and detailed plan for fire research to date in Federal government. It combines the extraordinary breadth of the USGS fire science activities into a coherent vision for how integrated, actionable fire science can help address the nation's wildfire problems, working closely with stakeholders. Source: USGS.

The LMRP is working to transform the ability of Tribal Nations, land-management agencies, landowner organizations, and local communities to plan and make informed decisions by co-producing integrated, scenario-based modeling and monitoring approaches. Land management science brings together the information resulting from ecosystem, socio-economic, remote-sensing, and management research. In FY 2024, the LMRP will continue working with partners to implement the USGS Landscape Science Strategy and co-produce science and tools that are used in natural resource management. Using new state-of-the-art integrated data and models, this effort aims to improve the quality, relevance, and timeliness of information available on land change, fire, hydrology, and ecosystem services to provide consistent, cross-disciplinary science products that can project the impact of important resource management decisions.

The LMRP provides science for understanding natural and human influences on lands, waters, and ecosystems under management responsibility of Interior bureaus and other Federal, State, and Tribal partners. In FY 2024, the LMRP will increase research focused on applied science for Interior in support of conservation and adaptation. This information is indispensable for achieving the goals of the America the Beautiful initiative and for managing for multiple resources and uses on public lands. The program supports research in FY 2024 to identify and reduce or avoid resource management conflicts, support the transition to sustainable energy, enhance and maintain public lands for future generations, and keep U.S. communities safe. LMRP work in FY 2024 will also include working with partners to inform management of big-game migration corridors, wildfire, and drought.

Lands managed by Federal, State, Tribal, local, private, and non-governmental entities in the U.S. and territories, and Interior unified regions.



(Source data: USGS)

Ecosystems
Biological Threats and Invasive Species Research Program

Ecosystems $ in thousands	2022 Actual	2023 Enacted	2024 Fixed Costs (+/-)	2024 Internal Transfers (+/-)	2024 Program Changes (+/-)	2024 Request	Change from 2023 Enacted (+/-)
Biological Threats and Invasive Species Research Program	**40,431**	**46,622**	**+1,607**	**0**	**+1,170**	**49,399**	**+2,777**
Coral Disease	[600]	[700]	0	0	-200	[500]	[-200]
Invasive Carp	[11,000]	[11,000]	0	0	-380	[10,620]	[-380]
Chronic Wasting Disease	[4,720]	[4,970]	0	0	-1,250	[3,720]	[-1,250]
Effects of Interacting Threats and Stressors	[190]	[190]	0	0	+5,000	[5,190]	[+5,000]
Tick Management and Research	[0]	[2,000]	0	0	-2,000	[0]	[-2,000]
FTE	***199***	***236***	***0***	***0***	***-7***	***229***	***-7***

Justification of 2024 Program Changes

The 2024 budget request for the Biological Threats and Invasive Species Research Program (BTISRP) is $49,399,000 and 229 FTE, a program change of +$1,170,000 and -7 FTE from the 2023 Enacted.

Coral Disease (-$200,000 / 0 FTE) – The USGS would reduce cooperative efforts with the National Oceanic and Atmospheric Administration to investigate causes of stony coral tissue loss disease along the coasts of Florida and U.S. territories. The USGS would continue to provide training for coral sample collection and standard lab techniques and technical assistance.

Invasive Carp (-$380,000 / 0 FTE) – This reduction would delay testing of a pesticide the USGS is developing to control invasive carp, and data analysis for ongoing research evaluating the efficacy of behavioral deterrents. USGS would continue to fund other innovative science to address invasive carp.

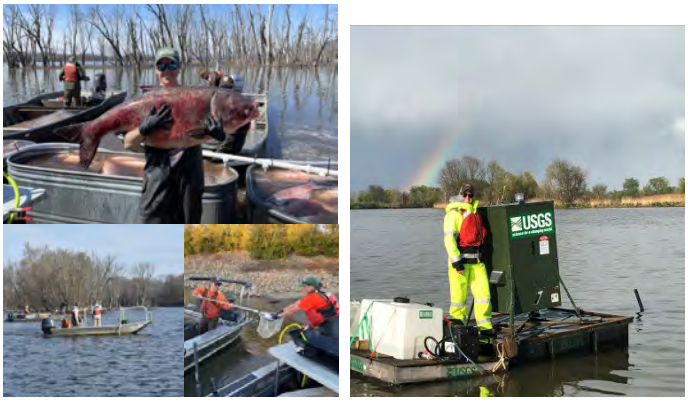
Chronic Wasting Disease (CWD) (-$1,250,000 / -2 FTE) – The USGS would reduce cooperative efforts with the USFWS and State agencies to investigate the human dimensions influence on controlling CWD, and discontinue collaborations with EPA to research CWD carcass disposal methods and environmental testing. The USGS would continue to facilitate a structured-decision making approach to management of deer, elk, and moose in the context of CWD.

Effects of Interacting Threats and Stressors (+$5,000,000 / +10 FTE) – The USGS would address the interacting effects of climate change and biological threats using a systematic risk-based approach to

surveillance, risk reduction, and mitigation of these threats. A changing climate brings additional pathways for the introduction and spread of invasive species and wildlife diseases; range shifts for native and invasive species; and phenological mismatches between species' needs and habitat (e.g., critical food resources being too large to consume or no longer available when needed because of warming temperatures). This effort would initially focus on three regions that are being disproportionately affected by climate change (Alaska, Hawaii and U.S. insular territories in the Pacific, and the Northeast) and that support critical habitat and species of conservation concern. In these locations, the USGS would connect biosurveillance, risk reduction, and mitigation tools with key stakeholders in Tribal Nations and other underserved communities in addition to traditional Federal and State partners.

Tick Management and Research (-$2,000,000 / -15 FTE) – The budget does not request funding for this program.

Program Overview



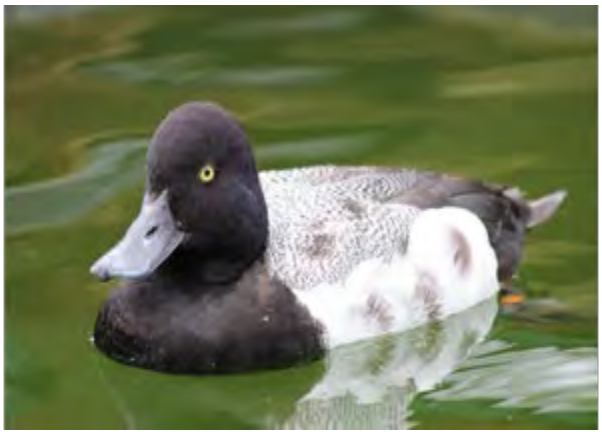
The USGS collaboratively works with partners to develop, evaluate, and transfer research findings and technology to resource agencies in the fight against invasive carp. (Images shown left-right clockwise) Scientists capture, tag and release 79 pound bighead carp on the Upper Mississippi River; deploy and test an algal attractant and bait station in Ohio for grass carp; capture, tag and monitor invasive carp movement as part of the BioAcoustic Fish Fence in Barkley Lock on the Cumberland River in Kentucky; and train and assist resource agencies to harvest carp using the Modified Unified Method on Pool 8 on the Mississippi River. Source: USGS.

Biological threats such as invasive species and wildlife disease negatively affect the economies and eocsystems in every State in the country, including urban centers and wilderness areas. Approximately 60 percent of emerging human infectious pathogens like SARS-CoV-2 are zoonotic (transmitted between animals and humans). Over 70 percent of these zoonoses originate in wildlife. The effects of emerging wildlife diseases are global and profound, often resulting in economic and agricultural impacts, declines in wildlife populations, and ecological disturbance. The BTISRP develops decision-support tools and technologies to detect, monitor, assess risk, and control nationally significant invasive species and fish and wildlife diseases. Research and technology development focuses on species that have the potential to cause significant economic or ecological concerns. A strong emphasis of the program is technology transfer to management agencies.

A focus of USGS research is to combine mitigation and control strategies so land and water managers can be empowered to respond quickly and effectively to a wide variety of new invasions. For example, USGS scientists have developed tools to deter further spread of invasive carp (bighead, black, grass, and silver carps), including a portable environmental DNA (eDNA) detection kit and evaluating drift models used to predict where invasive carp spawn. USGS researchers will continue validating models predicting where, when, and under what flow characteristics invasive carp spawn. These models could be applied elsewhere where spawning of one or more species of invasive carp is known or suspected, such as the Colorado River and Hudson River. USGS researchers will continue evaluating the effectiveness of deterrents designed to reduce upstream movement of invasive carp, improving data management and

standardization, and working with partners to inform the selection of deterrents to reduce the risk of grass carp spawning in the Great Lakes.

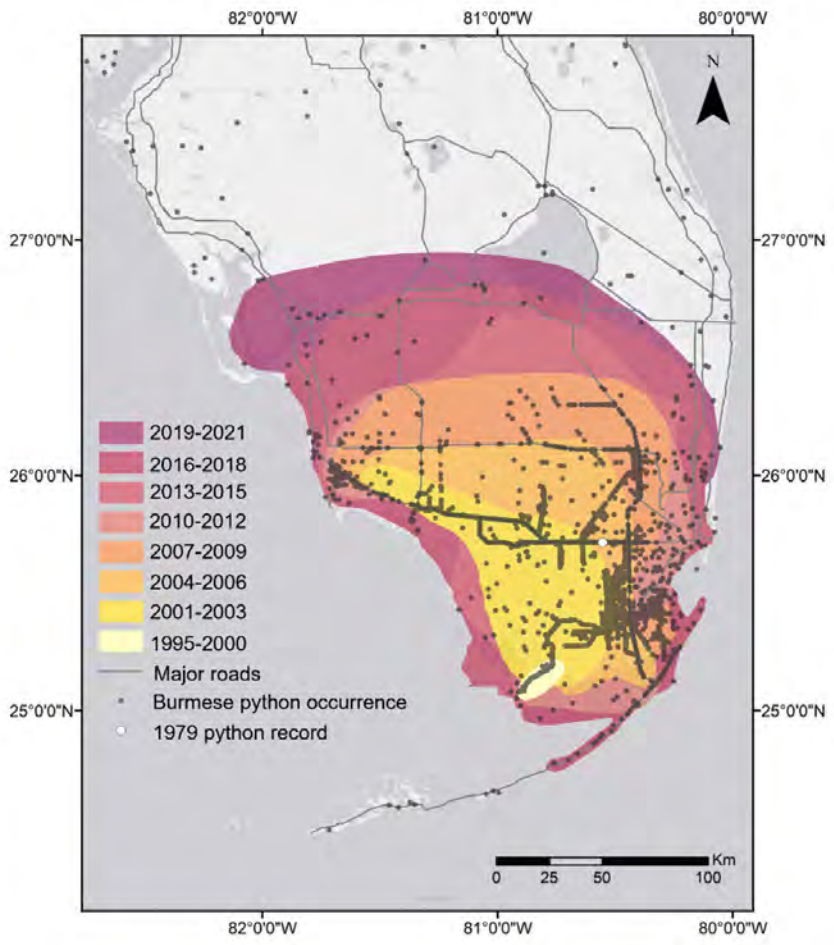
The USGS is investigating the dynamics of avian influenza (AI) in wild birds and the environment to support risk assessments, poultry outbreak tracebacks, and management actions. Following USDA confirmation, the USGS reported the first detection of highly pathogenic avian influenza (HPAI) in a live bird – a lesser scaup, pictured below, in the Chesapeake Bay in Maryland. The first East Coast intrusion of HPAI in 2022 aligned with USGS research showing avian influenza viruses circulate in wild birds in Iceland, providing a connection between mainland Europe and North America. The USGS developed and maintains a comprehensive North American map of HPAI detections in wildlife and poultry. As the climate changes, the USGS is collaborating with the USDA and other partners across the U.S. to underpin AI surveillance and response with avian ecology and influenza genomic data.



The USGS National Wildlife Health Center is USDA's primary partner for investigating avian influenza wild bird mortality events. USGS avian ecology research includes live bird avian influenzas surveillance in Maryland (including lesser scaup shown left) and other States. Source: USGS.

Similarly, the USGS is supporting surveillance and response to White Nose Syndrome, which has killed millions of bats across the U.S. The USGS is facilitating an adaptive management approach and assessing the efficacy of a vaccine. In addition, the USGS is partnering with USFWS and others to understand the ecological implications by monitoring bats (North American Bat Monitoring Program) and tracking disease spread and characterizing persistent populations.

The USGS continues to produce data and other scientific information on Burmese pythons that directly informs how the National Park Service and other partners manage this highly impactful species. In FY 2023, the first comprehensive synthesis of Burmese python biology, impacts, and management tools in Florida was released. This publication and ongoing studies provide critical information on python size distribution (see map below), reproduction and other life history characteristics needed to determine population demographics and estimate efficacy of control efforts. USGS support also is expediting promising new approaches to detecting traces of eDNA from Burmese pythons, a particularly important advancement given the low success of visually spotting these invasive snakes in the Everglades and other natural areas.



This map illustrates the chronology of python removals across southern Florida and represents the best professional estimate of the invasion front, which is not exact and will change over time. Occurrence records were obtained from a large geospatial database of invasive species reports submitted by both researchers and the public. Source: USGS.

The USGS Nonindigenous Aquatic Species (NAS) database is the central federal repository for aquatic invasive species information and data, an integrated hub to meet the needs of resource managers, researchers, decision makers and the public. The NAS database tracks 1,392 nonindigenous aquatic species (fishes, mammals, reptiles, amphibians, invertebrates, and plants) for the entire U.S., including for territories and transboundary waterbodies and drainages. Since 1990, the NAS database has provided scientific reports, online/real-time queries, spatial data sets, distribution maps, actionable tools, risk models, and general information on any nonindigenous aquatic species found in the U.S. inland and marine waters. The NAS database added 41,950 observations last year, with some of those sightings representing new occurrences to the U.S. (4), a state (36), drainage basin (128), or a county (138). In 2023, environmental DNA data of nonindigenous aquatic species will be able to be displayed in the NAS. In FY 2024, the USGS will assess eDNA reporting to ensure partner needs for data archiving and delivery are met. In addition, USGS will begin developing standards for genetic metabarcoding, which allows for identification of multiple species within a single sample.

Ecosystems
Cooperative Research Units Program

Ecosystems $ in thousands	2022 Actual	2023 Enacted	2024 Fixed Costs (+/-)	2024 Internal Transfers (+/-)	2024 Program Changes (+/-)	2024 Request	Change from 2023 Enacted (+/-)
Cooperative Research Units Program	**26,006**	**28,206**	**+1,168**	**0**	**-117**	**29,257**	**+1,051**
CRUs	[25,250]	[26,067]	0	0	+933	[27,000]	[+933]
New CRU - Lake Michigan/Ohio River	[0]	[800]	0	0	-800	[0]	[-800]
Brown Bullhead Research	[250]	[250]	0	0	-250	[0]	[-250]
FTE	***146***	***152***	***0***	***0***	***-3***	***149***	***-3***

Justification of 2024 Program Changes

The 2024 budget request for the Cooperative Research Units (CRU) Program is $29,257,000 and 149 FTE, a program change of -$117,000 and -3 FTE from the 2023 Enacted.

Cooperative Research Units (CRUs) (+$933,000 / 0 FTE) – The additional funding would be used to continue to fill vacant scientist positions in existing CRUs. Filling scientist vacancies allows units to better meet the scientific information and training needs of State and Federal partners and meets the USGS commitments made in the cooperative agreement that established each unit. The USGS would continue to leverage available resources for the benefit of all cooperators, as every federally-allocated dollar is levered on a 1:3 basis by State and host university contributions and grant funds.

New CRU – Lake Michigan/Ohio River (-$800,000 / -3 FTE) – The budget does not request funding for a new CRU.

Brown Bullhead Research (-$250,000 / 0 FTE) – The budget does not request funding for this program. Some activities may continue pending the availability of partner support.

Program Overview

List of cooperators the CRU program partners with for research, both internal and external partners. Source: USGS.

The CRU Program is a unique cooperative relationship between the USGS, State fish and wildlife agencies, host universities, and the Wildlife Management Institute, a non-profit that works to improve the professional foundation of wildlife management. The USFWS is also a formal cooperator at most of the individual CRUs. Since 1935, this cooperative relationship has provided a strong connection between the USGS, State and Federal fish and wildlife management agencies, and the national university community. The individual resources of each cooperator are leveraged to deliver program outcomes that far exceed what any one cooperator could achieve alone.

The goals of the CRU program are to sustain and maintain:

A cost-effective, national network of Federal, State, and university partnerships pursuant to the Cooperative Research and Training Units Act of 1960 (P.L. 86-686), with a legislated mission of research, education, and technical assistance focused on fish, wildlife, ecology, and natural resources.

A customer-oriented network of expertise for actionable science, research, teaching, and technical assistance that is responsive to information needs of State and Federal resource agency decision makers.

Science capabilities responsive to resource management needs of Interior bureaus.

A premier program for graduate education, mentoring, and training of future natural resources professionals from diverse backgrounds having skills to serve the broad natural resource management community successfully.

The CRU Program is currently composed of 42 cooperative units located at universities in 40 States. The program is designed to leverage cooperative partnerships with Federal and State agencies to address mutual needs of all partners in a cost-effective manner. Through the CRU Program, the USGS stations Federal scientists at universities to help identify and respond to natural resource information needs through pooling of resources among agencies; participate in advanced scientific training and mentoring of university graduate students to represent the various agencies workforce of the future; and provide Federal and other natural resource managers' access to university expertise and facilities. Federal support of the CRUs is multiplied by State and university cooperator contributions of expertise, equipment, facilities, and project funding, thereby enhancing the program's cost effectiveness. The program's appropriated dollars continue to be leveraged by Federal, State, university, and other entities' contributions at a ratio of three matching dollars to each appropriated dollar. Through university affiliations, CRU scientists train a diverse group of future natural resource professionals and provide opportunities through graduate education to diversify the Federal workforce.

Each CRU is directed by a Coordinating Committee composed of Federal, State, university, and Wildlife Management Institute representatives. Each Coordinating Committee establishes goals and expectations for its unit within the program's mission of research, education, and technical assistance. The mix of priorities is established locally and is updated annually based on the needs of cooperators and available funding. Program accountability measures and standards, and oversight of Federal scientists are used to ensure research and the resulting scientific information products support the goals of the USGS and Interior.

Graphic displays the research funding for Federal and State projects, the number of students and university staff member supported and the amount of support for tuition and reduced overhead. Source: USGS.

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Ecosystems
Climate Adaptation Science Center and Land Change Science Program

Ecosystems $ in thousands	2022 Actual	2023 Enacted	2024 Fixed Costs (+/-)	2024 Internal Transfers (+/-)	2024 Program Changes (+/-)	2024 Request	Change from 2023 Enacted (+/-)
Climate Adaptation Science Center and Land Change Science Program	**71,450**	**83,181**	**+2,430**	**0**	**+42,350**	**127,961**	**+44,780**
Land Change Science	**19,547**	**20,066**	**+1,702**	**0**	**+18,850**	**40,618**	**+20,552**
Biologic Carbon Sequestration	[150]	[150]	0	0	+1,850	[2,000]	[+1,850]
Climate Impacts on Physical and Biological Systems	[15,168]	[15,168]	0	0	+10,000	[25,168]	[+10,000]
Assessing Biological Greenhouse Gases	[0]	[0]	0	0	+5,000	[5,000]	[+5,000]
Developing a Climate Risk Framework to Inform Management Options	[2,753]	[2,753]	0	0	+2,000	[4,753]	[+2,000]
National and Regional Climate Adaptation Science Centers	**51,903**	**63,115**	**+728**	**0**	**+23,500**	**87,343**	**+24,228**
Tribal Climate Adaptation Science	[2,000]	[7,000]	0	0	+3,500	[10,500]	[+3,500]
Support for Climate Adaptation Science Centers	[37,335]	[42,335]	0	0	+19,000	[61,335]	[+19,000]
USGCRP/National Nature Assessment	[400]	[400]	0	0	+1,000	[1,400]	[+1,000]
FTE	***204***	***216***	***0***	***0***	***+106***	***322***	***+106***

Justification of 2024 Program Changes

The 2024 budget request for Climate Adaptation Science Centers and Land Change Science Program (CASC/LCS) is $127,961,000 and 322 FTE, a program change of +$42,350,000 and +106 FTE from the 2023 Enacted.

Biologic Carbon Sequestration (+$1,850,000 / +10 FTE) – The USGS would use this funding to improve the understanding of how resource management activities and climate change influence the sequestration of carbon. Biologic carbon storage and fluxes are central controls over the Earth's climate and are highly susceptible to environmental factors such as increasing temperatures, fire, drought, and a broad range of other climate and land use stressors. New research by the USGS would address the significant needs of resource managers to understand ways to sustain carbon sequestration in the face of change, and to increase carbon storage under different climate and management scenarios. An improved understanding of carbon management challenges and opportunities would provide the Nation powerful options for addressing climate change, both now and into the future. New studies would expand research to provide actionable information on how physical, biological, and ecological processes interact to control carbon sequestration and improve models used to anticipate changes in carbon based on various resource management scenarios. These studies include: development of spatially-explicit, landscape-scale models of wetland vegetation and biogeochemical processes; comparison of carbon storage and flux rates in wetlands throughout the Nation, including coastal, inland, and permafrost sites; development of a novel approach to determine how climate change affects the cycling of carbon in dryland soils of the Southwest; analyses of impacts of droughts, floods, and land management on aquatic export of carbon from terrestrial systems through rivers to estuaries and oceans; and the impacts of changing climate and receding glaciers on the transport of carbon and nutrients to downstream ecosystems and oceans.

Climate Impacts on Physical and Biological Systems (+$10,000,000 / +50 FTE) – In support of Interior bureaus and other partners responsible for managing the country's natural resources, the USGS would expand and accelerate research that integrates coupled physical and biological observations over multiple scales, conduct targeted experiments to determine the changing controls over systems, and complete modeling activities to better anticipate the impacts of a range of climate and land management scenarios. The USGS is responding to partners who are requesting regional- to national-scale research efforts to understand and forecast responses of coastal, wetland, dryland, forest, Arctic, and aquatic ecosystems to changing climates and environments. These activities would provide high-resolution records to our partners of past and on-going changes over regional to national scales. The proposed increase would improve capabilities that project potential impacts of different management and climate scenarios. By providing natural resource decision makers the information needed to evaluate the impacts of various management plans, USGS research would help decrease the vulnerability and increase the resilience of critical ecosystems to extreme events including wildfire, flooding and drought throughout the Nation.

Assessing Biological Greenhouse Gases (+$5,000,000 / +25 FTE) – The USGS would provide biologic information to further the Federal lands GHG emissions inventory and sequestration assessment. Specifically, the activities would include development of a methodology to measure, monitor, report, and verify carbon sequestration and GHG reductions to monitor progress in meeting goals on Federal lands. The U.S. Federal Land GHG Emissions and Sequestration Assessment (2005 - 2014) would be updated to include a more recent inventory of GHG on Federal lands. A geographic information systems (GIS) database of identified geologic sources of GHG (e.g. carbon dioxide and methane seeps) would be

compiled, and tools would be developed for Interior bureaus and other Federal agencies to identify restoration targets and methods that could optimize the protection of carbon resources and sequestration rates.

Developing a Climate Risk Framework to Inform Management Options (+$2,000,000 / +10 FTE) – In support of Interior bureaus, other partners, and stakeholders, the USGS would develop a climate risk assessment for resource managers. USGS would use remotely-sensed and ground-based data collection, modeling, and integration of habitat and species information to produce syntheses and analyses of risks related to fire, water resources, and, initially, forested and aquatic ecosystems and species. Outcomes would include identification of critical data gaps, advancement of integrated physical and biological watershed-scale research on drivers and understanding of the risks associated with climate and land use changes on species and habitat distributions at regional- to national-scales for use by natural resource decision makers. For example, research on near-term forecasting and climate risk responses of both "natural" and managed forest and aquatic systems and their anticipated influence on species distributions would result in products that inform local and regional management of climate-related impacts to water, fish, and wildlife and support management decisions for ecosystems throughout the Nation.

Tribal Climate Adaptation Science (+$3,500,000 / +2 FTE) – The USGS would expand upon existing partnerships started in FY 2023 with Tribal and indigenous communities to integrate traditional knowledge into climate research, and expand capacity building efforts so that Tribal communities, including remote communities such as those in Alaska and the western Pacific, can more easily participate in research endeavors and access needed information. The USGS is uniquely positioned to develop and manage the leading edge of institutional mechanisms to promote co-production of knowledge processes while ensuring that agencies maintain appropriate validation standards for data quality and dissemination. The USGS is currently collaborating with the Bureau of Indian Affairs to host Tribal Resilience Liaisons at the regional CASCs; these liaisons work across the boundary between the USGS and American Indian Tribes and Alaska Native villages. USGS scientists have established relationships with many American Indian and Alaska Native Tribes and indigenous communities in the Pacific islands and would use this increase to build a science portfolio that provides information directly responsive to their needs.

Support for Climate Adaptation Science Centers (+$19,000,000 / +8 FTE) – With this increase, the USGS would expand the work conducted by the network of university-based Climate Adaptation Science Centers (CASCs). The effort would be along two complementary approaches started in FY 2023: development of climate adaptation services and furthering ongoing work in support of the climate science needs identified in the DOI Climate Action Plan; and ramping up efforts by our regional CASCs' stakeholder advisory committees to support Interior and its partners' science priorities. Specifically, the USGS would develop new scientific approaches to use and integrate climate information and model output into management and planning efforts, furthering our ability to provide actionable science to help natural resource managers adapt to future climate related changes. The USGS would focus basic scientific efforts on regional partner priorities, such as climate change in the Arctic, climate driven changes in wildfire and drought, understanding how the loss of winter impacts natural resources in northern climates and how coastal and nearshore resources will be impacted by climate change. Additionally, the USGS would expand our efforts to provide support in the intersection between climate science and natural and

cultural resource management through development of climate adaptation services. This service would, for example, provide single points of contact to identify appropriate climate science for use in natural and cultural resources management planning and management, develop training for individuals in management communities to assure that best practices are used to incorporate climate in plausible futures, and develop broad approaches to integrating climate science in management actions. Once implemented, these services would ensure management agencies could integrate the best available climate science into everyday activities.

Water cascades down Gibbon Falls in Yellowstone National Park as a scientist works, where resource managers use decision making frameworks such as Resist-Accept-Direct (RAD) to incorporate climate data into their management strategies. Source: USGS.

United States Global Change Research Program (USGCRP)/National Nature Assessment (+$1,000,000 / +1 FTE) – The USGS and Interior are providing technical support to help assess the status of nature across the U.S. The National Nature Assessment (NNA) is the first comprehensive attempt to assess, across the U.S., the current state of nature, to understand the future of nature and to identify approaches to adaptation and mitigation. Work under this initiative is being closely coordinated with other administration priorities such as the Natural Capital Accounting effort and the Conservation and Stewardship Atlas attached to the America the Beautiful initiative. The funding would be used for data and information management support, to further develop online tools and accessibility to Federal environmental data, and to provide products that can directly support adaptation efforts in natural resource management.

Program Overview

The Climate Adaptation Science Center and Land Change Science Program is composed of two components: 1) the Land Change Science (LCS) component, and 2) the National and Regional Climate Adaptation Science Centers (CASCs). Each of these components is discussed further below.

Land Change Science

The LCS component is at the frontier of interdisciplinary scientific research understanding patterns, processes, and impacts (past, present and future) of changing climate, environment, and land use on ecosystems to address pressing socioenvironmental challenges and inform decision making. Scientists work with other Interior partners including the USFWS, NPS, and BLM, and also work with other stakeholders providing key scientific information that helps local, regional, and State land and resource managers.

Current research foci of the LCS component are:

- Understanding the impacts of environmental extremes and disturbance on ecosystem processes and services including impacts of drought, fires, land use change, sea level rise, and flooding on many natural resources including forests, rangelands, freshwater resources, glaciers, permafrost, urban areas, and coastal ecosystems;

- Researching and modeling environmental, land, and climate change interactions to better understand ecosystem resilience and ways in which nature can help buffer human communities from natural hazards; and
- Understanding past climate change using paleoecology and paleoclimate approaches and using this knowledge to inform and improve models of future climate change and its impacts. This research provides the scientific basis for land use decisions that affect the safety and prosperity of human communities and our Nation's natural resources.

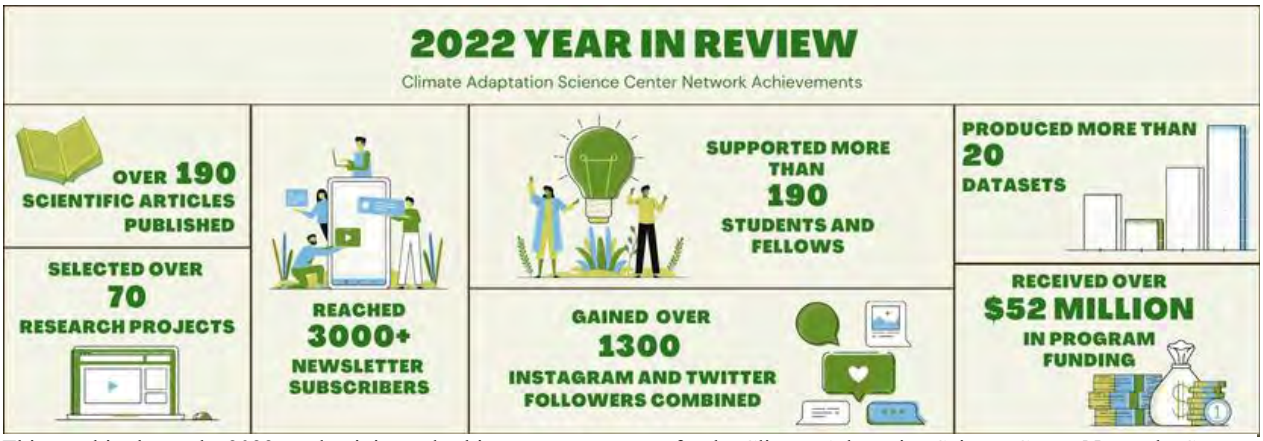
This graphic shows the productivity and science highlight for the Land Change Science component. Source: USGS.

National and Regional Climate Adaptation Science Centers

The CASC component develops science to help natural and cultural resource managers address the impacts of climate change on fish, wildlife, ecosystems, and the communities. The CASC network comprises a national CASC and nine regional CASCs covering the continental U.S., Alaska, Hawai'i, the U.S.-Affiliated Pacific Islands, Puerto Rico, and the U.S. Virgin Islands. Each regional CASC is a Federal-university partnership made up of a consortium of institutions, including university, Tribal, and non-governmental partners, with each center housed at a host university.

CASCs collaborate with managers and scientists from State and Federal agencies, Tribal Nations and Indigenous communities, universities, and NGOs to address science needs and inform adaptation planning. The CASC network emphasizes generating actionable science that address identified needs and directly supports resource management decisions.

The CASCs' portfolio includes research on the highest priorities of Interior, such as wildfires, wildlife disease, invasive species, drought, climate effects on federally-listed species or critical habitat, recreational fisheries, permafrost thaw, and Tribal lands and waters. The CASCs work collaboratively with scientific expertise found throughout the USGS EMA and in other USGS programs, along with scientific expertise available among external partners.



This graphic shows the 2022 productivity and achievements summary for the Climate Adaptation Science Center Network. Source: USGS.

Energy and Mineral Resources

Energy and Mineral Resources $ in thousands	2022 Actual	2023 Enacted	2024 Fixed Costs (+/-)	2024 Internal Transfers (+/-)	2024 Program Changes (+/-)	2024 Request	Change from 2023 Enacted (+/-)
Energy Resources Program	**31,486**	**33,365**	**+1,497**	**0**	**+22,529**	**57,391**	**+24,026**
FTE	***132***	***133***	***0***	***0***	***+22***	***155***	***+22***
Mineral Resources Program	**63,737**	**70,855**	**+3,005**	**0**	**+19,500**	**93,360**	**+22,505**
FTE	***268***	***278***	***0***	***0***	***+41***	***319***	***+41***
Energy and Mineral Resources Total	**95,223**	**104,220**	**+4,502**	**0**	**+42,029**	**150,751**	**+46,531**
FTE	***400***	***411***	***0***	***0***	***+63***	***474***	***+63***

The 2024 budget request for the Energy and Mineral Resources Mission Area is $150,751,000 and 474 FTE, a program change of +$42,029,000 and +63 FTE from 2023 Enacted.

Mission Area Overview

The Nation relies on a variety of energy and mineral resources to power homes and businesses and to manufacture products and technologies, from phones to vehicles. The USGS Energy and Mineral Resources Mission Area (EMMA) is the Nation's primary source of impartial scientific information on domestic and global geologic resources and their supply chains. The USGS maps and conducts research on both traditional resources and emerging resources including critical mineral supply chains essential to energy transitions, and geologic carbon and energy storage potential. USGS research includes the full life cycle of these resources: geologic resource occurrence, extraction, use, disposal, and environmental and socioeconomic effects such as wastes and demands on water supplies. USGS energy and mineral resources research and global mineral supply chain analyses inform sustainable natural resource management; economic, technological, national security, and global trade strategies and investments; and the development of infrastructure and new technologies.

Resource Assessments: The USGS is the primary provider of unbiased, publicly available estimates of geological resources for the United States; the USGS also provides publicly available estimates of global resource potential. These assessments describe the potential for undiscovered geologic resources, including mineral resources, oil, natural gas, coal, and uranium. In addition, the USGS assesses unconventional resources, including gas hydrates and helium, and the energy and storage potential of the subsurface, including geothermal energy, and carbon capture, utilization, and storage potential. USGS assessments also illustrate the environmental impacts of and constraints on resource extraction, including the quality and quantity of water and wastes associated with development. This USGS science helps inform strategic decision-making regarding the Nation's reliance on domestic versus foreign resources and supports the management of geologic resources; in particular, those on Federal lands. USGS science also helps

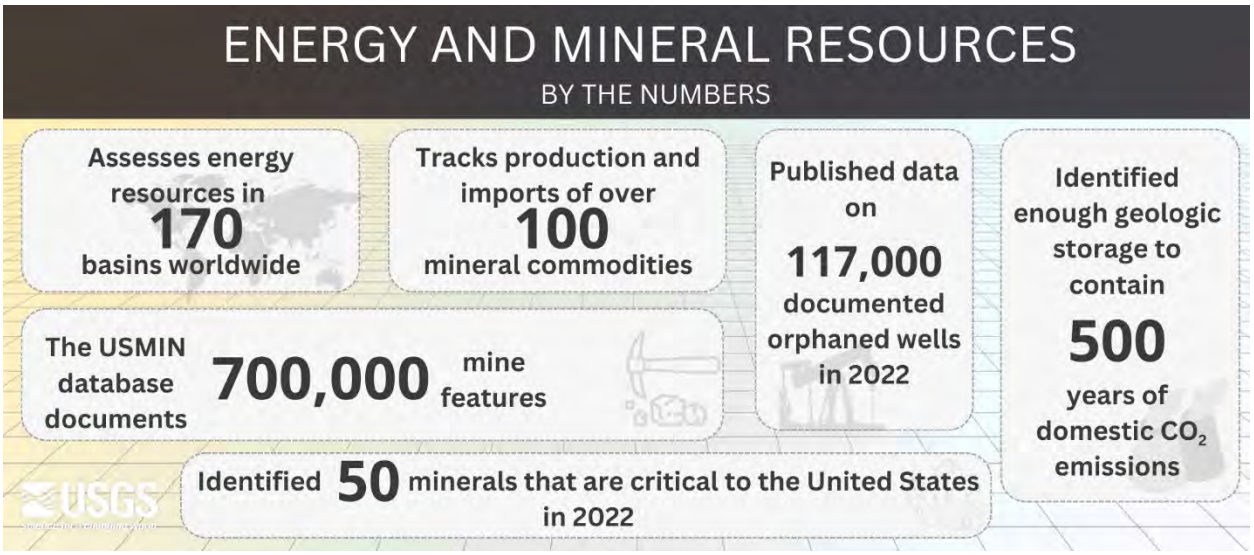
decision makers evaluate the potential to reclaim legacy mine sites and/or reprocess legacy wastes for critical minerals and supports policies and Federal investments to strengthen critical mineral supply chains.

Research for Decision Support: The USGS develops tools to make information on energy and mineral resources more useful for decisions impacting the economy, water supplies, ecosystems, and underserved communities. This research includes methods for combining energy and mineral resource assessments with information about those resources' effects on the quantity and quality of other natural resources, such as water. Recent USGS research spanning EMMA programs has highlighted the importance of mineral supplies and wastes in the energy technology transition and identified opportunities to use geologic formations and mine wastes for carbon dioxide mineralization (i.e., turning carbon dioxide into a solid mineral to prevent escape of gases). The EMMA also collaborates with other USGS mission areas and Department of the Interior (Interior) bureaus to produce analyses and tools that span multiple science disciplines. For example, the EMMA has worked with the USGS Ecosystems Mission Area to provide the Bureau of Land Management (BLM) expertise and resource analysis to support the development of reasonably foreseeable development scenarios.

Data Quality, Data Delivery, and Workforce: The USGS is investing in data quality and data delivery to ensure seamless public access to the results of ongoing large-scale data collection and interpretation. This effort ensures that foundational data sets are transparent and traceable and that historical data sets are accessible into the future. The Earth Mapping Resources Initiative (Earth MRI) is collecting an unprecedented volume of foundational data to transform and modernize the Nation's mapping of the surface and subsurface. The USGS is also partnering with the Defense Advanced Research Projects Agency (DARPA) to apply artificial intelligence tools and techniques to streamline data synthesis workflows for resource assessments, an efficiency that has the potential to significantly accelerate the delivery of critical mineral assessments as called for in the Energy Act of 2020.

The USGS is also leveraging these new data assets, legacy data, and data rescue efforts to support Interior in identifying candidate sites for remediation under the Bipartisan Infrastructure Law (BIL). Examples include the oil and gas wells database first developed for Energy Resources Program work on the Greenhouse Gas Emissions and Sequestration Inventory for Federal Lands and the U.S. Mineral Deposit (USMIN) database first developed by the Mineral Resources Program (MRP) in collaboration with the BLM as the authoritative database of historical and present-day mining sites.

The USGS is also investing significantly in rebuilding its own, and the Nation's, geoscience workforce. This workforce is essential to address future challenges posed by the energy transition and the economy's vulnerability to mineral supply chain weaknesses. The MRP is providing technical assistance to sister agencies, States, and universities in their efforts to rebuild and update expertise in every aspect of the mineral life cycle, from the evolution of ore deposits through extraction and processing to waste management. Recently, the MRP developed a course on ore deposits and economic geology for the BLM and the Department of Agriculture's U.S. Forest Service. The MRP will develop a continuing education course for both agencies that includes field trips illustrating the state of the art in recovery of critical minerals from mine wastes. In addition, the EMMA has launched a series of USGS cross-disciplinary workshops to develop new methods to assess potential mineral resources in mine waste and is training State geological surveys in methods for sampling and analysis of mine waste.



FY 2022 Selected Mission Area Accomplishments

- Published the first national assessment of the potential for carbon dioxide-enhanced oil recovery technologies to both enhance the recovery of oil and gas resources and store carbon dioxide associated with fossil fuel production and use.
- Published the first publicly available national database of 117,000 documented and unplugged orphaned oil and gas wells, in support of BIL-funded remediation activities.
- Completed a joint USGS/BLM database showing projected coal production from mines on Federal lands from 2022 through 2050.
- Published the 2022 whole-of-government list of critical minerals in the Federal Register. The updated list advanced the state of the art in evaluating criticality, and the approach is being adopted by allied countries and trade partners. 2022 Final List of Critical Minerals
- Through Earth MRI, collected the Nation's largest high-quality airborne geophysical surveys, covering an area larger than the state of Montana and modernizing the Nation's mapping of critical mineral resources. Earth Mapping Resources Initiative (Earth MRI)
- Through a Cooperative Research and Development Agreement with Apple Inc., published a new metric to quantify the waste produced by mining for 25 mineral commodities. Rock-to-Metal Ratio: A Foundational Metric for Understanding Mine Wastes | Environmental Science & Technology

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Energy and Mineral Resources
Energy Resources Program

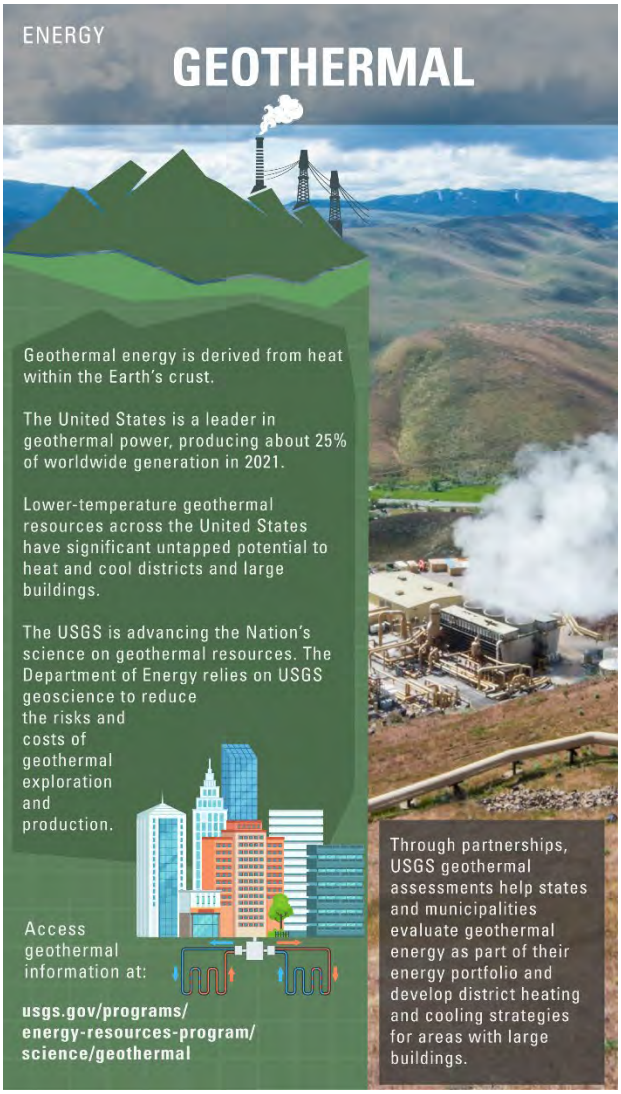
Energy and Mineral Resources $ in thousands	2022 Actual	2023 Enacted	2024 Fixed Costs (+/-)	2024 Internal Transfers (+/-)	2024 Program Changes (+/-)	2024 Request	Change from 2023 Enacted (+/-)
Energy Resources Program	**31,486**	**33,365**	**+1,497**	**0**	**+22,529**	**57,391**	**+24,026**
Geologic Carbon Sequestration	[2,177]	[3,177]	0	0	+6,375	[9,552]	[+6,375]
Inventory of Greenhouse Gas Emissions and Sinks on Federal Lands	[175]	[175]	0	0	+9,875	[10,050]	[+9,875]
Geothermal Energy	[1,552]	[1,552]	0	0	+3,250	[4,802]	[+3,250]
Energy Resource Assessments and Scenario Analysis Tools	[13,837]	[13,837]	0	0	+3,029	[16,866]	[+3,029]
FTE	***132***	***133***	***0***	***0***	***+22***	***155***	***+22***

Justification of 2024 Program Changes

The 2024 budget request for the Energy Resources Program is $57,391,000 and 155 FTE, a program change of +$22,529,000 and +22 FTE from 2023 Enacted.

Geologic Carbon Sequestration (+$6,375,000/ +6 FTE) – Capture and storage of carbon dioxide in geologic formations can be incorporated into existing fossil fuel operations both to enhance the recovery of oil and gas resources and to store carbon dioxide associated with fossil fuel production and use. A number of geologic formations are also suited to storage or production of hydrogen for energy storage. With the requested increase, the USGS would conduct integrated assessments of subsurface pore space availability for carbon and refine recent work to identify the most promising areas for low-risk storage. The USGS would also initiate a national assessment of carbon mineralization potential, building on mapping and characterization work initiated in FY 2023.

Inventory of Greenhouse Gas Emissions and Sinks on Federal Lands (+$9,875,000/ +8 FTE) – The USGS would deliver an updated and improved inventory of greenhouse gas emissions and sinks on Federal lands, including emissions associated with current and historical energy development sites and wetland and vegetation management. The inventory will integrate new data from BIL-funded activities related to orphaned oil and gas wells and abandoned coal mines. In addition, the USGS would collaborate with other Interior bureaus and other Federal agencies toward an authoritative national geospatial database of energy development sites and a system to measure and monitor associated emissions.



Geothermal Energy (+$3,250,000/ +6 FTE) – The USGS would conduct an updated and expanded national assessment of geothermal energy resources, as directed by P.L. 116-260 Energy Act of 2020. Geothermal energy is a significant source of renewable electric power in the western U.S. Recent research shows that with advances in exploration and development technologies, lower-temperature geothermal energy is a potential source of baseload electric power, as well as district heating and cooling, for the entire country. This funding increase would support a new assessment quantifying the potential for geothermal resources across the U.S., including Alaska and Hawaii.

Energy Resource Assessments and Scenario Analysis Tools (+$3,029,000/ +6 FTE) – Most forms of energy development depend on water supply and create land disturbances that could potentially affect wildlife. Energy resource assessments that quantify energy development's dependencies and effects on land, water, and biological resources are needed to support future energy needs while managing conflicting demands for natural resources. Understanding opportunities for carbon storage alongside energy development is also critically important. With this funding change, the USGS would scale back assessments focused solely on oil, gas and coal resources and would increase the number of assessments that look holistically at a traditional, emerging, or renewable (e.g., geothermal and wind) energy resource along with the location, quantity, and quality of other natural resources in order to provide Federal decision-makers, local communities, and land managers tools to analyze tradeoffs among energy development scenarios. This work would leverage work across other USGS mission areas.

Program Overview

The Energy Resources Program (ERP) is the sole provider of unbiased, publicly available estimates of undiscovered, technically recoverable energy resources for the U.S. (exclusive of the U.S. Outer Continental Shelf). The USGS addresses the challenge of increasing demand for energy resources by conducting basic and applied research on geologic energy resources and the environmental and economic impacts of energy resource extraction and use. The ERP studies traditional, unconventional, and renewable energy resources including oil, natural gas, gas hydrates, geothermal, and hydrogen. The Program also conducts research on other uses of the subsurface, including geologic carbon and energy storage. This USGS science informs strategic decision-making related to the Nation's reliance on domestic versus foreign resources and the management of energy resources on Federal and State lands.

This information is critical in efforts to meet increased energy demands while simultaneously increasing the sustainability of energy development and ensuring energy security.

This work supports the Energy Act of 2020, and the diversification of the U.S. energy portfolio.

Energy Resource Assessments and Methods Development: The USGS conducts assessments of many types of traditional, renewable, and emerging energy resources, as well as carbon dioxide storage resources and the effects of energy development on other natural resources. The USGS's traditional energy resource assessments identify oil and gas resource potential across the United States and internationally in over 170 petroleum provinces. Studies of the geologic, geophysical, and geochemical framework of these areas allow for better understanding of the resource potential and environmental impacts of oil and gas development. These USGS resource assessments are used by a variety of stakeholders including local, tribal, State, and Federal governments, other land resource managers, the private sector, and the public. In 2023-2024, the USGS expects to complete close to a dozen energy resource assessments for significant basins in the U.S. and abroad.

The USGS also studies and quantifies the Nation's renewable and emerging energy resources, including geothermal energy resources, gas hydrate resources, and hydrogen resources, which have the potential to further diversify the U.S. energy portfolio. The USGS works collaboratively with the U.S. Department of Energy to develop and maintain geospatial databases of renewable energy infrastructure including wind turbines and large-scale solar photovoltaics. Quantifying the Nation's renewable and emerging energy potential is important input to decision-making on the Nation's energy futures and potential effects on the economy and environment.

The USGS is also pioneering the development of tools and techniques to combine energy resource assessments with assessments of other co-located natural resources to quantify potential trade-offs in resource availability and use. Providing tools to quantify and model these trade-offs, such as the relationship between energy development and water quality and availability, will help natural resource managers better balance development of interdependent resources and adapt to changing natural conditions, such as drought and fluxes in societal demand for energy and water resources.

Energy Resources Research: The USGS conducts research on the geologic processes that form energy resources. This fundamental geologic research enables geology-based assessments of a wide variety of energy resources, including coal, oil, gas, geothermal energy, energy gases such as carbon dioxide and hydrogen, and gas hydrates.

The USGS' research addresses the complete life cycle of energy resources from how and where resources form and accumulate prior to resource extraction by industry to reclamation, recycling, and disposal once extraction activities are complete. This research is used by a variety of decision-makers, including by industry to identify best practices to limit adverse environmental impacts, and by land use managers and regulators to enhance stewardship of public lands for multiple uses and for national energy and economic security.

The USGS continues to invest in data delivery to ensure that energy resources research, assessments, and other information are accessible to a variety of decision-makers. Products include the Geologic Carbon Sequestration interactive map, U.S. Wind Turbine Database, National Produced Waters Geochemical Database, and National and Global Oil and Gas Assessment website.

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Energy and Mineral Resources
Mineral Resources Program

Energy and Mineral Resources $ in thousands	2022 Actual	2023 Enacted	2024 Fixed Costs (+/-)	2024 Internal Transfers (+/-)	2024 Program Changes (+/-)	2024 Request	Change from 2023 Enacted (+/-)
Mineral Resources Program	**63,737**	**70,855**	**+3,005**	**0**	**+19,500**	**93,360**	**+22,505**
Mine Waste Research and Assessments	[3,774]	[8,774]	0	0	+7,500	[16,274]	[+7,500]
Supply Chain Research for Emerging Technologies	[1,670]	[1,670]	0	0	+5,000	[6,670]	[+5,000]
Critical Minerals - Location and Assessments	[5,172]	[5,172]	0	0	+4,000	[9,172]	[+4,000]
Critical Minerals - Forecasting	[1,195]	[1,195]	0	0	+3,000	[4,195]	[+3,000]
FTE	***268***	***278***	***0***	***0***	***+41***	***319***	***+41***

Justification of 2024 Program Changes

The 2024 budget request for the Minerals Resources Program is $93,360,000 and 319 FTE, a program change of +$19,500,000 and +41 FTE from 2023 Enacted.

Mine Waste Research and Assessments (+$7,500,000/ +15 FTE) – Federal agencies have a long history of cooperation with States, Tribes, non-governmental organizations, and the private sector on mine waste issues, but these efforts have centered on individual projects rather than scaling up to larger successes. Lack of concerted, strategic action on mine waste prolongs the impact of waste on communities and ecosystems and creates significant barriers to reprocessing economically crucial minerals from waste. The USGS is leveraging the USMIN database developed in collaboration with the Bureau of Land Management (BLM) and State geological surveys to launch a national mine waste inventory. With the proposed increase, the USGS would accelerate development of the inventory, delivering in 2024 the first version of the inventory, including documentation of the mineral content of mine waste at individual legacy mine sites. In addition, the USGS would launch a series of the Nation's first assessments quantifying those potential "above ground" mineral resources in mine waste. The USGS and partners would also initiate the development of a national mine waste strategy to accelerate and coordinate Federal and State mine waste management actions, informing decisions on the benefits and risks of reprocessing, reclaiming, and restoring mine waste sites. This strategy would leverage the inventory and assessments, as well as a recently expanded collaboration with other Interior bureaus and Federal and State agencies responsible for mine waste management.

Sampling an iron spring at the Daisy Mine site near Crested Butte, Colorado. Credit: USGS

Supply Chain Research for Emerging Technologies (+$5,000,000/ +6 FTE) – The world's adoption of low-carbon energy generation and storage technologies is greatly increasing demand for critical minerals used in batteries, electric power generation applications, such as in wind turbines and solar cells, and other high technology industries. With the proposed increase, in FY 2024, the USGS would build on recent analyses of the mineral dependencies of emerging energy generation and storage technologies to identify 1) cumulative risks to emerging technology supply chains and 2) potential for cross-sector competition for mineral commodities. As called for in the BIL, the USGS would partner with the Energy Information Administration and develop supply risk analyses for a variety of emerging technology uptake and adoption scenarios. These scenarios could then be used to help forecast future demand, supply chain vulnerabilities, and potential impacts on the broader economy. They could also be used to identify opportunities for economic investment. These analyses would provide timely technical assistance to other Federal agencies, including through the American Battery Materials Initiative and interagency efforts under Executive Order 14017, America's Supply Chains (2021), the BIL, and the Inflation Reduction Act.

Critical Minerals – Location and Assessments (+$4,000,000/ +11 FTE) – Through a partnership with Geoscience Australia and the Geological Survey of Canada, the USGS has developed an innovative mineral systems approach to evaluate multiple mineral commodities simultaneously. At the same time Earth MRI is collecting an unprecedented volume of geoscience data that will inform assessments of undiscovered critical mineral resources. With the proposed increase, in FY 2024, the USGS would leverage these activities to accelerate the pace of critical mineral resource assessments required by the Energy Act of 2020 by roughly 50 percent. The USGS would also build on its Defense Advanced Research Projects Agency partnership on artificial intelligence tools to further accelerate the pace of quantitative assessments in the future, investing new funding in scaling those tools and broadening their application. These data and assessments provide an essential strategic understanding of long-term sources of critical mineral resources both domestically and for trade partners, which will in turn strengthen longer-term forecasts of supply chain health.

Critical Minerals – Forecasting (+$3,000,000/ +9 FTE) – The USGS provides mineral supply chain analyses to inform Federal agencies' strategies and investments. Federal agencies currently requesting such analyses include the U.S. Departments of Commerce, Defense, Energy, and State, intelligence agencies, the Federal Reserve Board, and foreign investment and credit agencies including the U.S. International Development Finance Corporation and Export-Import Bank. In addition, the USGS is increasingly asked for analyses of the economic impacts of fast-moving supply chain disruption events ranging from trade sanctions and overseas conflicts to pandemics and natural disasters. In FY 2024, with

the proposed increase, the USGS would leverage its experience providing interagency technical assistance to launch the development of an automated analytical capability. These analyses are currently performed "on demand" for each requesting agency and each commodity but have many common data sources and workflows well suited to automation, as demonstrated by a 2022 pilot project. This investment would support the nimble, near-real-time supply risk and economic impact analysis required to take immediate action during a supply crisis, in accordance with the Energy Act of 2020 and the BIL. This capability would also include projections of critical minerals production, consumption, and recycling; these projections are essential to drive the longer-term Federal interagency coordination on critical minerals called for in the BIL.

Program Overview

The Mineral Resources Program (MRP) provides the Nation with science and data on nonfuel mineral potential, production, consumption, recycling, disposal, and interaction with the environment. The MRP maps, studies, and analyzes the supply, demand, and trade of a wide variety of mineral resources that are critical to the economy and national security of the U.S. USGS researchers analyze and forecast domestic, foreign, and sectoral dependencies on mineral commodities, and develop methodologies to quantify the Nation's mineral resources both "still in the ground" and in mine wastes. The MRP also provides scientific data to support Federal and private sector decision-making; for example, informing Federal trade negotiations and investments in economically significant supply chains for critical minerals. The USGS also researches how minerals and mine wastes interact with the environment to identify potential mineral resources in wastes and to inform the management of wastes.

Critical Mineral Resources: The MRP has spent decades developing a focus on critical mineral resources that draws on data, science, and expertise from every component of the Program. Critical minerals, as defined by the Energy Act of 2020, are those mineral commodities which are essential to the economic or national security of the U.S. and which have a supply chain vulnerable to disruption. Critical minerals also serve an essential function in the manufacturing of a product, the absence of which would have significant consequences for the economic or national security of the United States. For example, minerals necessary to the rapidly growing high-tech and renewable energy sectors include the rare earth elements used in defense, medical and consumer electronics; wind turbines; and electric vehicles. Following the Energy Act of 2020, the USGS updated the methodology for determining mineral criticality and applied it to the 2022 Final List of Critical Minerals. The USGS is collecting public comments, collaborating with the interagency National Science and Technology Council, and refining this methodology to better identify emerging supply risks and evaluate the impact of commodity supply limitations and produce the next whole-of-government list of critical minerals in 2025, in accordance with the Energy Act of 2020.

Mineral Intelligence and Supply Chain Analysis: The USGS analyzes mineral production, consumption, sustainability, materials flow, availability, and the economic health of the U.S. minerals industry. The USGS collects data on about 100 mineral commodities for 180 countries, produces about 700 mineral reports annually (see *http://minerals.usgs.gov/minerals*), and answers more than 2,000 mineral resources inquiries monthly. These data provide decision makers information essential to anticipate supply chain disruptions and ensure dependable supplies of minerals to meet economic and defense needs. The public and private sectors use this information to understand the supply and use of minerals in the economy, and to inform investments in all aspects of supply chains. The USGS has unique

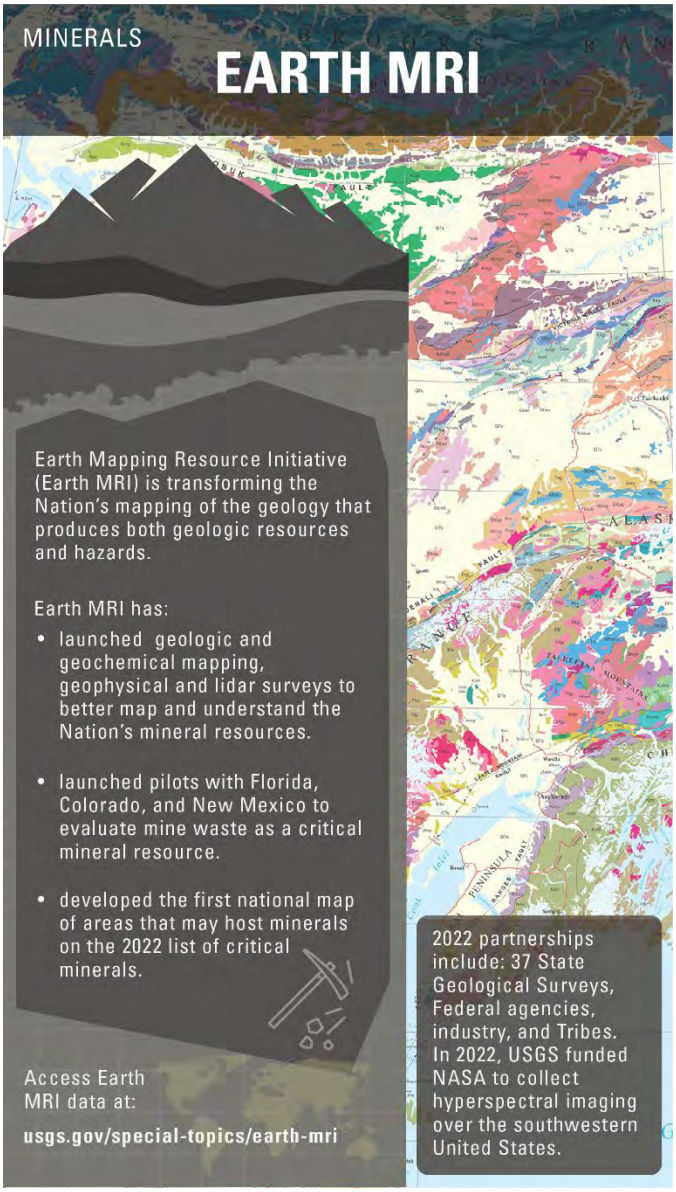
expertise in the flow of resources through the global economy and provides a cross-sectoral outlook that other agencies depend on to inform their investments. Agencies that rely on these analyses include the Departments of Commerce, Defense, Energy, and State, intelligence agencies, the Federal Reserve Board, foreign investment and credit agencies including the U.S. International Development Finance Corporation and Export-Import Bank, and the Office of the U.S. Trade Representative. State agencies, private sector minerals and manufacturing decision-makers, Wall Street market analysts, and foreign trade partners similarly rely on USGS data.

Mineral Resources Research and Assessments: The USGS conducts geologic research on how and where mineral deposits form and develops methods to detect potential mineral resources. This research has resulted in the recognition of new types of mineral deposits, new understanding of the mineral systems that form mineral deposits, and new methods to assess the Nation's undiscovered resources, which is essential to inform decision-making on both potential future domestic production and strategic trade relationships. The USGS also conducts innovative research on mine waste as a resource and the interactions of minerals with the environment. This work identifies the potential for reprocessing valuable minerals from mine wastes, provides science to inform the reclamation of previously mined lands, and identifies emerging challenges and opportunities for future mining. USGS mineral resources research enables mineral resource assessments and is used by Federal and State agencies, academia, and the private sector.

USGS mineral resource assessments evaluate the potential for domestic and global mineral resources ranging from major metals (e.g., copper) to industrial minerals (e.g., construction materials) to low-volume specialty minerals (e.g., rare earth elements). The Energy Act of 2020 directed the USGS to carry out comprehensive national assessments of critical mineral resources. In response, the USGS is focusing its next assessments on critical minerals needed for electric vehicle and grid energy storage applications. These assessments will help policymakers and land managers anticipate needs for increased investments in sustainable domestic production, mine waste reprocessing and other forms of secondary production, and new trade agreements with other nations.

As an initial step toward future mine waste resource assessments, the USGS and partners are creating a national mine waste inventory, leveraging USGS databases of historical mining information to prioritize both field data collection and remote sensing, and working through the interagency Federal Mining Dialogue and State partnerships to provide science on the benefits and risks of reprocessing, reclaiming, and restoring mine waste sites in light of environmental, community, and supply chain concerns. These efforts would be accelerated with additional funds requested in FY 2024.

Data Collection, Interpretation, and Delivery: The Nation is under-mapped relative to most other developed nations. In 2019, the USGS launched the Earth MRI to modernize mapping of the Nation's geologic framework and resources. Earth MRI collaborates with other USGS programs and Federal agencies, State agencies, tribal governments, and the private sector to plan, fund, acquire, and analyze foundational geoscience datasets. Earth MRI data are essential for understanding critical mineral potential, as well as for science and decisions on infrastructure, transportation, and land-use planning, hazard assessments for earthquakes, landslides, volcanoes, and floods, water resources management, geothermal resources and geologic carbon storage, and emergency response.



With the addition of $320 million over five years from the BIL, Earth MRI is significantly expanding and accelerating its collection of new airborne geophysical and lidar data, and on-the-ground geologic mapping and geochemistry. In addition, Earth MRI is conducting electromagnetic surveys that, in addition to helping to characterize subsurface mineral resources, also support analysis of groundwater resources; and hyperspectral surveys, which support characterizing shallow mineral resources as well as geologic acid mine drainage, debris flows, agriculture, and wildfires.

The USGS is also investing in data delivery to maximize the accessibility and utility of both new and historical datasets. This effort includes developing new tools for accessing and analyzing the vast amount of data collected by Earth MRI. The USGS is also partnering with other agencies and with technologists to increase access to legacy mining and minerals information.

One product from these partnerships is USMIN, a national geospatial database developed in collaboration with the BLM and State geological surveys, which is the authoritative data source on the most significant mines, mineral deposits, and mineral districts of the U.S. These datasets inform USGS assessments of domestic mineral resources and support Interior's BIL-funded efforts.

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Natural Hazards

Natural Hazards $ in thousands	2022 Actual	2023 Enacted	2024 Fixed Cost (+/-)	2024 Internal Transfers (+/-)	2024 Program Changes (+/-)	2024 Request	Change from 2023 Enacted (+/-)
Earthquake Hazards Program	**90,037**	**92,651**	**+2,541**	**0**	**+7,100**	**102,292**	**+9,641**
FTE	***267***	***268***	***0***	***0***	***+9***	***277***	***+9***
Volcano Hazards Program	**33,282**	**37,500**	**+1,426**	**0**	**-3,091**	**35,835**	**-1,665**
FTE	***150***	***160***	***0***	***0***	***-4***	***156***	***-4***
Landslide Hazards Program	**8,929**	**14,432**	**+356**	**0**	**-3,024**	**11,764**	**-2,668**
FTE	***35***	***45***	***0***	***0***	***-6***	***39***	***-6***
Global Seismographic Network Program	**7,212**	**7,273**	**+100**	**0**	**0**	**7,373**	**+100**
FTE	***11***	***11***	***0***	***0***	***0***	***11***	***0***
Geomagnetism Program	**4,673**	**5,251**	**+119**	**0**	**+500**	**5,870**	**+619**
FTE	***11***	***13***	***0***	***0***	***+1***	***14***	***+1***
Coastal/Marine Hazards and Resources Program	**41,865**	**43,149**	**+2,230**	**0**	**+17,650**	**63,029**	**+19,880**
FTE	***211***	***211***	***0***	***0***	***+33***	***244***	***+33***
Natural Hazards Total	**185,998**	**200,256**	**+6,772**	**0**	**+19,135**	**226,163**	**+25,907**
FTE	***685***	***708***	***0***	***0***	***+33***	***741***	***+33***

The 2024 budget request for the Natural Hazards Mission Area is $226,163,000 and 741 FTE, a program change of +$19,135,000 and +33 FTE from the 2023 Enacted.

Mission Area Overview

The USGS works to monitor, assess, and conduct targeted research on a wide range of natural hazards so that policymakers and the public have the understanding they need to enhance preparedness, response, and resilience. Every year in the U.S., natural hazards threaten lives and livelihoods and result in billions of dollars in damage to personal property and national infrastructure.

The Natural Hazards Mission Area (NHMA) provides scientific information to reduce losses from a wide array of natural hazards, including earthquakes, hurricanes, landslides, tsunamis, volcanic eruptions, and geomagnetic storms, as well as longer-term hazards such as sea level rise, coastal erosion, and wildfire

extent and severity. 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, landslides, and coastal change in the U.S. For many other hazards, the USGS directly supports the warning responsibility of the National Oceanic and Atmospheric Administration (NOAA), and other Federal or State agencies.

To achieve its primary mission, and to fulfill its responsibilities for loss and risk reduction, the USGS NHMA develops, delivers, and applies several components of hazard science: observations and targeted research, both of which 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 and environmental hazards, and enables science-based decisions that effectively enhance resilience and reduce impacts from those threats.

FY 2022 Selected Mission Area Accomplishments

- USGS research published in *Nature Reviews* in January 2022, "The Occurrence and Hazards of Great Subduction Zone Earthquakes," summarizes the latest scientific insights on the origin and nature of great subduction zone earthquakes and their cascading consequences. Understanding the likelihood of such earthquakes is crucial to improving hazard and risk assessments in subduction zones and to mitigate future associated impacts.
- The USGS Hawaiian Volcano Observatory (HVO) installed a temporary seismic and geodetic network in American Samoa in response to the seismic activity that began in late July 2022. This event accelerated plans of the USGS Volcano Science Center to develop volcano monitoring capability in American Samoa. HVO deployed personnel and equipment to American Samoa in early August 2022 in response to the earthquake swarm.
- The USGS delivered 31 post-fire debris-flow hazard assessments to meet requests from the Department of the Interior (Interior), U.S. Forest Service, State, and local emergency and land management agencies. In 2022, the USGS completed hazard assessments covering 4.2 million recently burned acres, providing information on the potential and size of debris flows. This information guides emergency preparedness and response, and hazard mitigation decisions, including those in New Mexico following a historic wildfire season, which burned an area nearly the size of the State of Rhode Island.
- The USGS supported preparation and response efforts for storms throughout 2022 with coastal storm inundation and erosion data collection and forecasts during Hurricanes Fiona, Ian, and Earl, and other extreme storms and hurricanes. The USGS additionally supported preparation and response with shoreline monitoring and modeling applications.
- The USGS installed 33 new Very Broadband (VBB) primary sensors in the Global Seismographic Network (GSN) and another 22 have been installed by the Incorporated Research Institutions for Seismology (IRIS) in the National Science Foundation component of the GSN. These instruments are producing superior data (lower noise and improved reliability) in comparison to the previous sensors, improving the ability of USGS to rapidly and accurately characterize global earthquakes, and support research (e.g., on Earth's Inner Core) critically dependent on high-fidelity data.
- Through a collaboration with the Albuquerque Seismological Laboratory (ASL), the USGS Geomagnetism Program continued expanding its magnetometer network and work towards

improved real-time magnetic data coverage across the contiguous U.S. A more dense magnetometer network will allow critical stakeholders provide more accurate and reliable space weather warnings, observations, and forecasts, and to better characterize space weather hazards.

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Natural Hazards
Earthquake Hazards Program

Natural Hazards $ in thousands	2022 Actual	2023 Enacted	2024 Fixed Costs (+/-)	2024 Internal Transfers (+/-)	2024 Program Changes (+/-)	2024 Request	Change from 2023 Enacted (+/-)
Earthquake Hazards Program	**90,037**	**92,651**	**+2,541**	**0**	**+7,100**	**102,292**	**+9,641**
National Seismic Hazard Model Improvements and Updates	[2,660]	[2,660]	0	0	-500	[2,160]	[-500]
Subduction Zone Science	[2,700]	[2,700]	0	0	+4,600	[7,300]	[+4,600]
Induced Seismicity	[1,100]	[1,100]	0	0	+2,000	[3,100]	[+2,000]
Modernization and Hardening of Infrastructure in Support of Earthquake Analysis	[2,000]	[3,000]	0	0	+1,000	[4,000]	[+1,000]
FTE	***267***	***268***	***0***	***0***	***+9***	***277***	***+9***

Justification of 2024 Program Changes

The 2024 budget request for the Earthquake Hazards Program (EHP) is $102,292,000 and 277 FTE, a program change of +$7,100,000 and +9 FTE from the 2023 Enacted.

National Seismic Hazard Model Improvements and Updates (-$500,000 / -3 FTE) – This funding level would allow the USGS to deliver a national seismic hazard model for Puerto Rico and the U.S. Virgin Islands (PRVI) at the end of 2026.

Subduction Zone Science (+$4,600,000 / +6 FTE) – The proposed increase supports work to: improve the understanding of risks posed to vulnerable communities in subduction zone environments; deliver scientific information and tools for disaster risk reduction; and expand support for subduction zone hazard characterization and risk reduction.

The USGS would accelerate the implementation of the USGS Subduction Zone Science Plan, *Reducing Risk Where Tectonic Plates Collide* (USGS Circular 1428; https://pubs.usgs.gov/circ/1428/cir1428.pdf). This plan describes work necessary to support targeted multi-hazards subduction zone science investment across USGS Mission Areas and Programs. Subduction zones, where one tectonic plate is thrust over another, generate the world's largest earthquakes, volcanic eruptions, landslides, and tsunamis. Subduction zones generate hazards onshore and offshore in the Pacific Northwest (Cascadia subduction zone), southern Alaska (Alaska-Aleutians subduction zone), the Caribbean, and Pacific Island Territories, and tsunami hazards extend to Hawaii, California, and East Coast States. Subduction zones remain poorly

understood because the processes that drive the hazard lie offshore. Future disastrous events in these regions are inevitable and require investment in subduction zone science that will inform decisions at all levels of society.

Requested funding would support targeted efforts, including seafloor geodetic monitoring aimed at improving our ability to detect the build-up of stresses leading to future earthquakes. Funding would also expand internal and external support for work focused on hazard and risk reduction, including research on subduction zone processes, improving onshore monitoring of major subduction zone hazards, and exploration of new technologies for monitoring and performing research in offshore environments, particularly in the Cascadia subduction zone. Efforts would be focused on minimizing community vulnerability via the delivery of data and products that improve understanding of hazard and risk, and making emergency response and recovery activities more effective, which would ultimately help citizens prepare for, react to, and recover from subduction zone hazards.

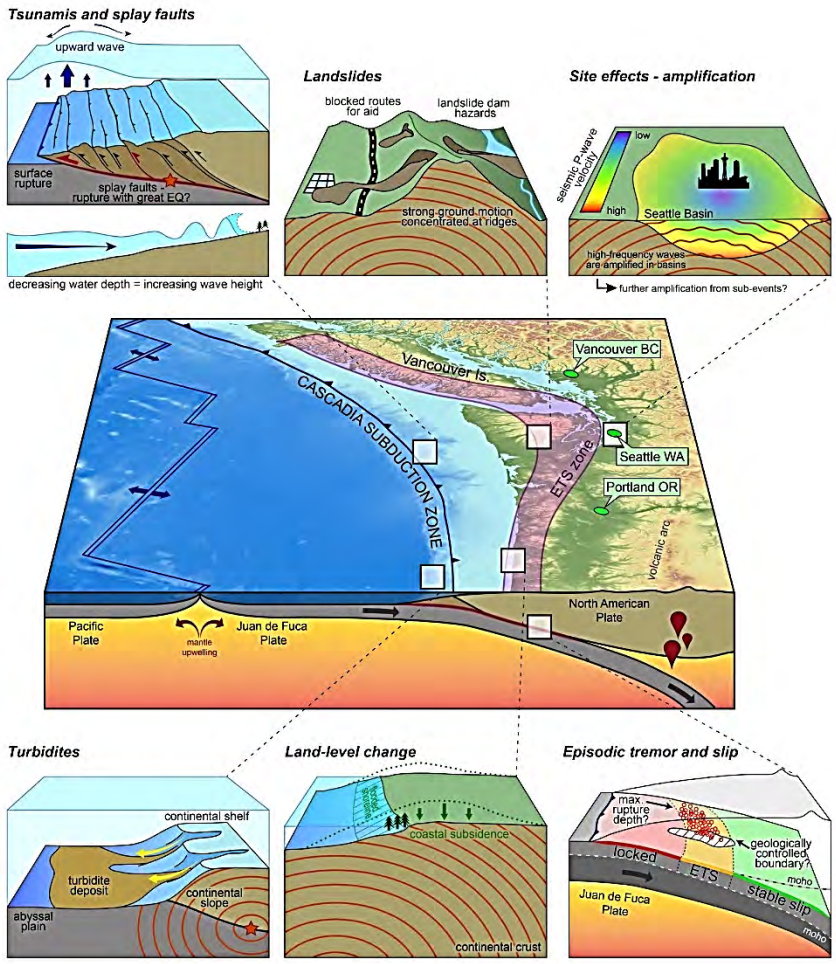
Induced Seismicity (+$2,000,000 / +4 FTE) – The USGS would expand its efforts to assess increased seismic hazard (earthquakes) associated with oil, gas, and geothermal energy production, as well as carbon sequestration. In addition to significantly expanding current induced seismicity projects, which are mostly focused on the impacts of oil and gas production, the USGS would invest in projects focused on other emerging geologic resources. New research would assess the effects of geothermal production and injection (including Enhanced Geothermal Systems) and carbon sequestration on induced earthquakes and Earth surface changes, and involves partnerships with the Department of Energy, State geological surveys, and universities. Funding would also support development of continuously refined hazard maps associated with induced seismicity, which would evolve with time as new geothermal energy facilities and carbon sequestration projects are developed, operated, and monitored over the long term.

Modernization and Hardening of IT Infrastructure in Support of Earthquake Analysis (+$1,000,000/ +2 FTE) – The USGS would expand efforts to modernize and harden the IT infrastructure that supports robust delivery of enhanced multi-hazards products such as ShakeMap and the Prompt Assessment of Global Earthquakes for Response (PAGER), to decision makers, emergency managers, and the public for risk mitigation, disaster planning, and situational awareness following major disasters. The USGS provides critical and rapid information to decision makers through some of the most heavily trafficked web pages in the Federal government. This funding would ensure national interests are supported by a robust, modern, cloud-based infrastructure.

Work begun in FY 2023 focuses on cloud-based infrastructure supporting data delivery, via reconfiguration of highly complex computational systems which manage data flow, processing, and product delivery. Work in FY 2024 would expand these efforts and begin streamlining national seismic monitoring systems to keep pace with modern research and innovation, including further incorporation of artificial intelligence and machine learning capabilities into earthquake detection, characterization, and alerting capacities. The effort associated with this funding supports the hardening and modernization of the USGS IT infrastructure which delivers enhanced multi-hazard products. While the funding for this effort is separate from *ShakeAlert*, the earthquake early warning system, it is a complementary effort given that hardened infrastructure is important to meet stakeholder needs for more comprehensive earthquake information following the issuance of a *ShakeAlert* earthquake early warning.

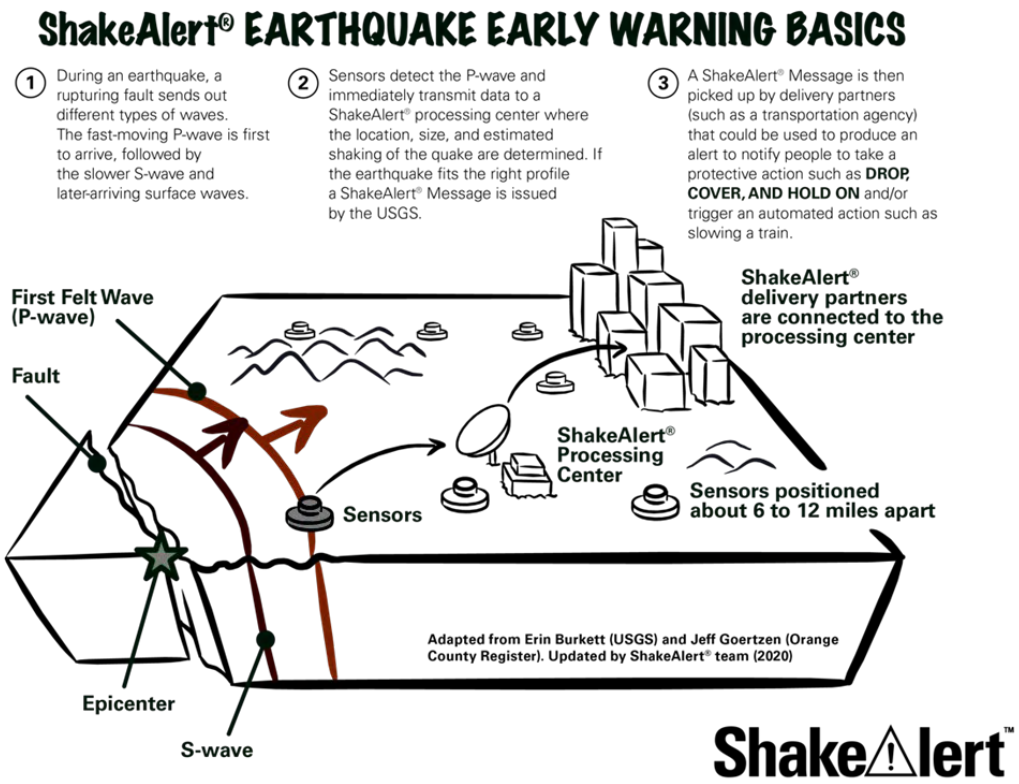
Program Overview

Nearly half of the U.S. population is at risk from earthquakes, and annualized earthquake losses infrastructure are estimated at $6.1 billion per year (source: P-366 - Hazus Estimated Annual Earthquake Losses for the United States (fema.gov)). The USGS 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 USGS EHP is the applied Earth science component of the four-Agency National Earthquake Hazards Reduction Program (NEHRP, reauthorized by the National Earthquake Hazards Reduction Program Reauthorization Act of 2018, P.L. 115-307). Through NEHRP, the USGS partners with the Federal Emergency Management Agency (FEMA), National Science Foundation (NSF), and National Institute of Standards and Technology (NIST) to reduce earthquake losses in the U.S. 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 (NEIC), the USGS is the only agency that 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. *ShakeAlert*, a west coast earthquake early warning system built upon ANSS, offers new capabilities for seconds of advanced warning to people and systems ahead of earthquake shaking. Through the USGS National Seismic Hazard Model, the EHP provides the basis for seismic provisions in the Nation's building codes, which affect 1.8 trillion dollars' worth of new construction annually in the U.S (source: Construction Spending (census.gov)). The USGS also issues timely aftershock forecasts following potentially damaging earthquakes within the U.S. and its Territories and provides aftershock forecasts following significant global earthquakes when called upon by other Federal agencies or international partners.

In FY 2024, the USGS will continue, in cooperation with States and other partners, to finalize build-out, operate, and maintain the *ShakeAlert* Earthquake Early Warning system based on the Technical Implementation Plan for the west coast, which was revised in 2018 (https://pubs.er.usgs.gov/publication/ofr20181155).



The graphic above describes the basics of how the *ShakeAlert* earthquake early warning system operates during an earthquake. Source: USGS.

In FY 2024 the EHP will continue to provide universities, State geological surveys, and private institutions with earthquake hazards applied research grants and cooperative agreements. Last year, more than 40 entities were the recipients of approximately $28 million of funding and equipment that supports earthquake research in high-risk areas nationwide, contributes to the maintenance and operation of the ANSS, and supports the *ShakeAlert* west coast earthquake early warning system.

Natural Hazards
Volcano Hazards Program

Natural Hazards $ in thousands	2022 Actual	2023 Enacted	2024 Fixed Costs (+/-)	2024 Internal Transfers (+/-)	2024 Program Changes (+/-)	2024 Request	Change from 2023 Enacted (+/-)
Volcano Hazards Program	**33,282**	**37,500**	**+1,426**	**0**	**-3,091**	**35,835**	**-1,665**
National Volcano Early Warning System (NVEWS)	[15,758]	[18,349]	0	0	-3,091	[15,258]	[-3,091]
FTE	***150***	***160***	***0***	***0***	***-4***	***156***	***-4***

Justification of 2024 Program Changes

The 2024 budget request for the Volcano Hazards Program (VHP) is $35,835,000 and 156 FTE, a program change of -$3,091,000 and -4 FTE from the 2023 Enacted.

National Volcano Early Warning System (NVEWS) (-$3,091,000 / -4 FTE) – At this funding level, the USGS would focus on maintenance and operation of current networks and present level of situational awareness provided by these networks. NVEWS activities initiated in FY 2022 and FY 2023 focused on closing monitoring gaps on very high-threat and high-threat volcanoes including enhancements to existing networks and installation of new digital networks on volcanoes lacking monitoring infrastructure would be reduced and implementation would halt on 12 very high-threat volcanoes in California, Oregon, Washington, and Hawaii, and 10 high-threat volcanoes in Alaska, California, Washington, Hawaii, and Wyoming. The establishment of the National Volcano Information Service with 24/7 operation for improved volcano situational awareness for all active U.S. volcanoes would be extended by at least two years.

Program Overview

There are more than 160 potentially active volcanoes in the U.S. Volcanic eruptions are among the most destructive natural phenomena and can have significant social and economic impacts. The mission of the USGS VHP is to enhance public safety and minimize social and economic disruption from volcanic unrest and eruption. This is accomplished by delivering effective forecasts, warnings, and information about volcano hazards. Through the VHP, USGS scientists monitor active and potentially active volcanoes, assess their hazards, and conduct targeted research to better understand volcanic processes. This work enables the USGS to provide assessments of volcano hazards, warnings of potential volcanic impacts, volcanic activity alerts, and other information to authorities and the public. These warnings and forecasts enable emergency responders, land managers and the public to mitigate the risk to life and property. The USGS has evaluated the Nation’s volcanoes to determine the monitoring levels needed commensurate with the threat they pose. This national threat level assessment was updated in 2018, and in

2019, a bill authorizing the USGS to establish a National Volcano Early Warning System (NVEWS) (Pub. L. 116-9, title V, §5001) was signed into law.

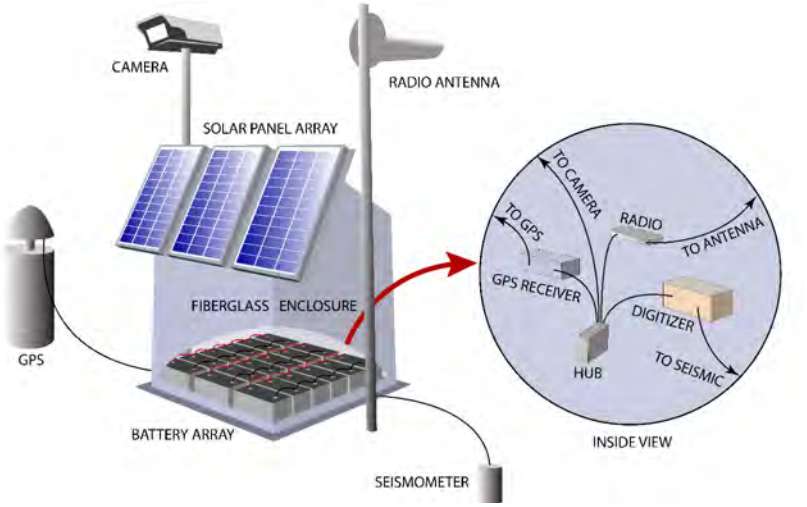
The goal of NVEWS is to ensure that the Nation's most hazardous volcanoes are adequately monitored enabling scientists to improve the timeliness and accuracy of hazard warnings and making it possible for citizens to take proper and timely action to reduce risk. NVEWS seeks to improve the capabilities of the U.S. volcanology community including: (1) increased partnerships with local governments and emergency responders; (2) additional staffing and automation to improve 24/7 monitoring of volcanoes; and (3) advanced and unified systems to distribute data to scientists, responding agencies, and the public.

Towards the goals of the NVEWS authorization, the USGS VHP intends to complete the next generation lahar detection system in all major drainages of Mount Rainier by October 2024. In FY 2024, USGS and will begin steps to apply this technology to other Cascades volcanoes in Washington such as Mt. Baker and Mt Adams, where lahars are a documented hazard.

The VHP is executed by the USGS Volcano Science Center (VSC), which operates five volcano observatories with State and academic partners. The observatories are organized into distinct geographic areas of responsibility:

- Hawaiian Volcano Observatory – Hawaii
- Cascades Volcano Observatory – Idaho, Oregon, and Washington
- Alaska Volcano Observatory – Alaska and the Commonwealth of the Northern Mariana Islands
- California Volcano Observatory – California and Nevada
- Yellowstone Volcano Observatory – Arizona, Colorado, Montana, New Mexico, Utah, and Wyoming

Under the leadership of the VSC, each observatory is responsible for volcano monitoring, community preparedness (including development and regular practice of volcano hazard emergency response plans), managing volcanic crises, and coordinating research in their areas of responsibility.



In Alaska, as of July 2022, the USGS completed the conversion of analog stations to digital. Conversion of analog radio telemetered monitoring stations is essential for NVEWS expansion because only stations with digital telemetry will have sufficient bandwidth to transmit data from additional ground-based sensor types. Conversion to all digital telemetry allows for NVEWS expansion of networks and augmenting what were previously largely seismic-only monitoring stations. Source: USGS.

Natural Hazards
Landslide Hazards Program

Natural Hazards $ in thousands	2022 Actual	2023 Enacted	2024 Fixed Costs (+/-)	2024 Internal Transfers (+/-)	2024 Program Changes (+/-)	2024 Request	Change from 2023 Enacted (+/-)
Landslide Hazards Program	**8,929**	**14,432**	**+356**	**0**	**-3,024**	**11,764**	**-2,668**
Actionable Landslide Hazard Data and Science	[750]	[4,524]	0	0	-1,524	[3,000]	[-1,524]
Cooperative Landslide Hazards and Assessment Competitive Grant Program	[0]	[1,000]	0	0	-1,000	[0]	[-1,000]
Landslide Hazard Assessments in Alaska	[4,000]	[4,500]	0	0	-500	[4,000]	[-500]
FTE	***35***	***45***	***0***	***0***	***-6***	***39***	***-6***

Justification of 2024 Program Changes

The 2024 budget request for the Landslide Hazards Program is $11,764,000 and 39 FTE, a program change of -$3,024,000 and -6 FTE from the 2023 Enacted.

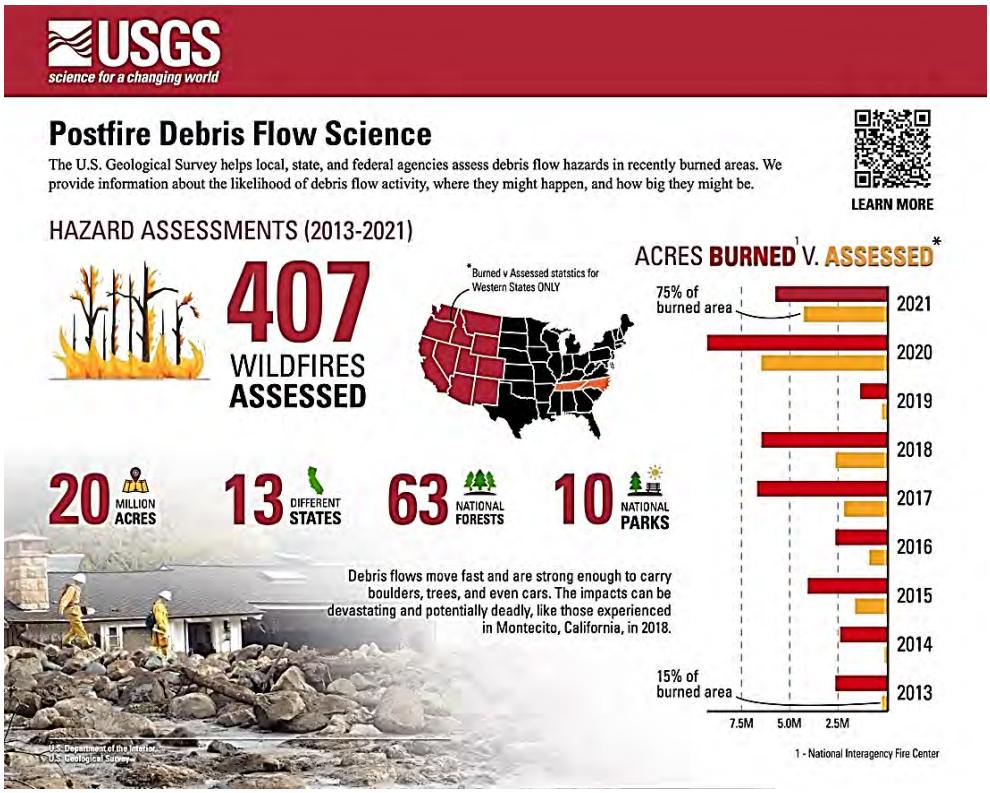
Actionable Landslide Hazard Data and Science (-$1,524,000 / -4 FTE) – Implementation of the National Landslide Preparedness Act (P.L. 116-323) would proceed at a slower pace and the addition of inundation models to post-fire debris-flow hazard assessments would be extended by two or more years. Inundation models are models which simulate water movement on post wildfire landscapes. Development of technical support capabilities for State, tribal, and local emergency management following damaging landslide events will be extended by two years.

Cooperative Landslide Hazards and Assessment Competitive Grant Program (-$1,000,000 / -1 FTE) – The budget does not request funds for this program.

Landslide Hazard Assessments in Alaska (-$500,000 / -1 FTE) – Collaborations with State, local, and regional entities to develop, support, and maintain landslide monitoring systems in Alaska would continue at the level currently provided. Cooperation with the State and National Tsunami Warning Center to surveil the Barry Arm landslide will continue. The unstable slope in the Barry Arm fjord of Prince William Sound in Alaska has the potential to generate a damaging local tsunami. Beginning in 2020 when the unstable slope was identified, the USGS has been working with an interagency science team to monitor landslide motion and assess the hazard. Results of this effort are informing National Tsunami Warning Center operations and emergency management planning activities.

Program Overview

Landslides occur in all 50 States and many Territories, and where landslides impact human activities, lives may be lost and property and infrastructure damaged. Widespread landslides can accompany big storms or earthquakes, impacting broad areas and hindering rescue and recovery efforts. For example, in 2017, Hurricane Maria generated more than 70,000 landslides across Puerto Rico, impacting transportation and other lifelines, hampering response, recovery, and rebuilding.



The USGS Landslide Hazards Program (LHP) is the only Federal program dedicated to landslide hazard science and conducts targeted studies to understand landslide initiation and mobility processes. This understanding is used to (1) develop methods and models for landslide hazard assessment, (2) develop and deploy systems to monitor threatening landslides, and (3) to develop methods and tools for landslide early warning and situational awareness. Program activities are targeted toward the types of landslides that result in human and economic losses in the U.S., such as those with long travel distances, those initiated by heavy rainfall, and those exacerbated by the effects of wildfire. The USGS assists Federal, State, and local agencies through landslide site evaluations and provides strategies for reducing ongoing and future impacts from landslides. The LHP 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 LHP began cooperative work with the National Weather Service in 2005 to deliver alerts for debris flows from recently burned areas in southern California. This limited-scale project has provided essential guidance to emergency, land, and transportation managers for many burned areas in the western U.S., including the 2020 Grizzly Creek Fire in central Colorado, and the 2021 Dixie and North Complex Fires in the central Sierra Nevada of California. In FY 2024, the Landslide Program and National Weather Service will continue to build on recent scientific advances to expand the project to other parts of California and the western U.S. to meet the intent of the National Landslide Preparedness Act.

In FY 2021, the National Landslide Hazard Preparedness Act (P.L. 116-323) was enacted and directs the Secretary of the Interior, acting through the Director of the USGS, to establish a program to identify risks and hazards from landslides, reduce losses, protect communities at risk, and improve communication and emergency preparedness. The USGS has published a National strategy for landslide loss reduction and formed an Interagency Coordinating Committee on Landslide Hazards. In FY 2024, the Committee will support the implementation of the National Landslide Hazard Preparedness Act.

The USGS is working with Federal and State partners to assess the risk of a catastrophic landslide and tsunami at the terminus of a retreating glacier in Prince William Sound, Alaska. This photo shows the Barry Arm Fjord of Prince William Sound, the area of potential landslides outlined, and the retreating Barry glacier in the middle foreground. Photo taken by Gabe Wolken, June 2020 Source: Public domain.

The USGS is working to develop and deliver actionable landslide hazard and risk modeling for vulnerable populations and high-risk settings with an emphasis on areas recently burned by wildfire. These activities are building on advances in landslide hazard assessment and data collection funded through recent appropriations. The USGS is also initiating efforts to meet requirements set out in the National Landslide Preparedness Act, developing a Federal capacity to deploy scientists and assets to assist emergency response to landslide events. Further, the USGS is expanding its capacity to deliver enhanced landslide hazard and risk assessments and provide situational awareness and technical assistance to emergency response in support of Interior, the U.S. Forest Service, the Federal Emergency Management Agency, State geological surveys, and State and emergency management. Work is being conducted in partnership with technical expertise from State, academic, and private sectors and data and products and will benefit land and emergency managers at all levels as well as the general public across the western U.S. and other States and Territories with landslide risk. In FY 2024, the USGS would scale back some of these efforts.

In FY 2024, the LHP is also leading efforts with Federal and State partners, to collect data and conduct analyses to assess the hazard from landslides with the potential to generate tsunami in Prince William Sound, AK. The LHP is surveilling landslide movement of the unstable slopes at the terminus of the Barry Glacier using satellite radar and other methods to inform the National Tsunami Warning Center and land and emergency managers of potential hazards.

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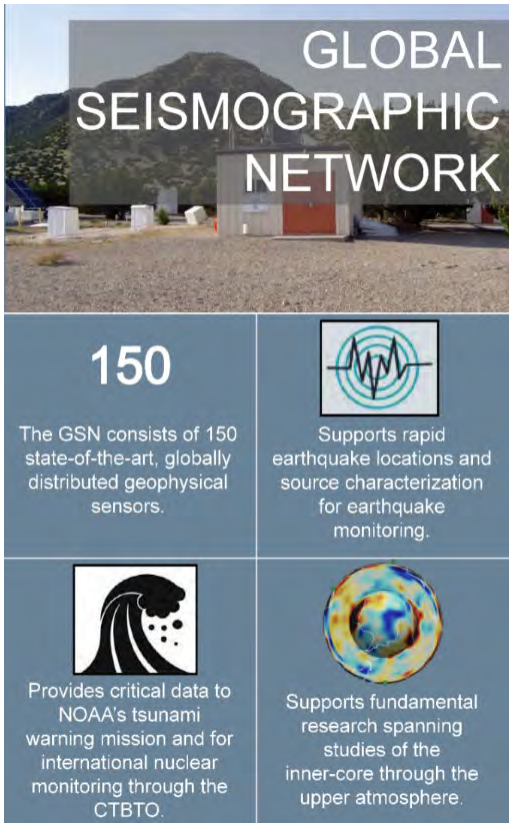
Natural Hazards
Global Seismographic Network

Natural Hazards $ in thousands	2022 Actual	2023 Enacted	2024 Fixed Costs (+/-)	2024 Internal Transfers (+/-)	2024 Program Changes (+/-)	2024 Request	Change from 2023 Enacted (+/-)
Global Seismographic Network Program	**7,212**	**7,273**	**+100**	**0**	**0**	**7,373**	**+100**
FTE	***11***	***11***	***0***	***0***	***0***	***11***	***0***

Justification of 2024 Program Changes

The 2024 budget request for the Global Seismographic Network (GSN) is $7,373,000 and 11 FTE. There are no program changes proposed in FY 2024 to the Global Seismographic Network.

Program Overview

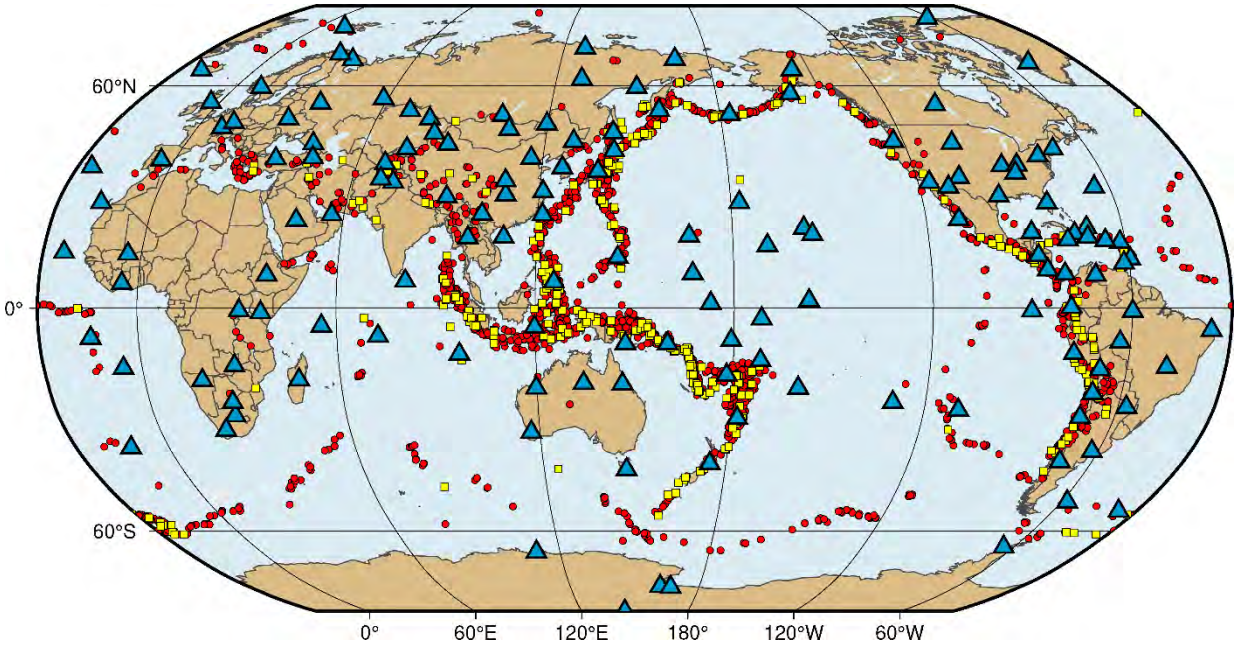


The GSN consists of more than 150 globally distributed stations, 100 of which are operated by the USGS. The GSN is a partnership between the USGS and the National Science Foundation (NSF) and is implemented in partnership with the Earthscope Consortium and many other entities. It provides the high-quality seismic data needed for global 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.

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 National Oceanic and Atmospheric Administration tsunami warnings; NSF basic research; and Department of Energy and Department of Defense nuclear test treaty monitoring and research. GSN stations transmit real-time data continuously to the USGS National Earthquake Information Center in Golden, CO, where they are used to rapidly 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 both 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.

GSN operation is accomplished in cooperation with international partners who, in most cases, provide facilities to shelter the instruments and personnel to oversee the security and operation of each station. USGS responsibilities include station maintenance and upgrades, overseeing telecommunications, troubleshooting problems and providing major repairs, conducting routine service visits, training station operators, providing limited financial aid in support of station operations at sites lacking a host organization, and ensuring data quality and completeness.



GSN stations (triangles) are shown against a backdrop of large earthquakes from 2000 to 2021 (red circles – magnitude 6-6.9, yellow squares – magnitude 7 and larger earthquakes). Source: USGS

In order to continue to receive high-quality seismic data needed, the USGS and the Earthscope Consortium have recently installed new high-quality Very Broadband (VBB) seismic sensors and have been improving the physical infrastructure of select GSN sites. These activities will continue in FY 2024.

Natural Hazards
Geomagnetism Program

Natural Hazards $ in thousands	2022 Actual	2023 Enacted	2024 Fixed Costs (+/-)	2024 Internal Transfers (+/-)	2024 Program Changes (+/-)	2024 Request	Change from 2023 Enacted (+/-)
Geomagnetism Program	**4,673**	**5,251**	**+119**	**0**	**+500**	**5,870**	**+619**
Expansion of Magnetometer Observatories	[500]	[1,000]	0	0	+500	[1,500]	[+500]
FTE	***11***	***13***	***0***	***0***	***+1***	***14***	***+1***

Justification of 2024 Program Changes

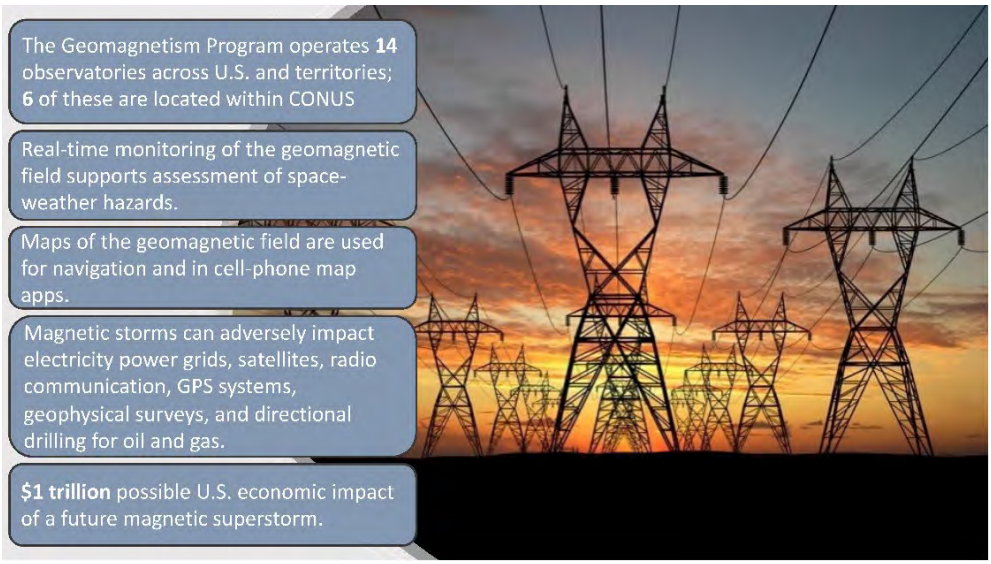
The 2024 budget request for the Geomagnetism Program is $5,870,000 and 14 FTE, with a program change of +$500,000 and +1 FTE from the 2023 Enacted.

Expansion of Magnetometer Observatories (+$500,000 / +1 FTE) - The USGS would continue to expand efforts to enhance monitoring and evaluation of space-weather hazards via expansion of operational ground-based magnetometer stations. In coordination with the NOAA Space Weather Prediction Center, this would enable delivery of more accurate geoelectric hazard maps by reducing uncertainties that are primarily associated with the limited number of existing observatories. This expansion, launched in FY 2022, supports the resilience of the national electrical power grid, which is susceptible to space weather, and is responsive to the interagency Space Weather Action Plan, involving numerous Federal agencies, which calls for an enhanced geomagnetic monitoring network to deliver data to operational centers in real time. The USGS would fully execute three planned observatory sites, adding to the six existing sites within the conterminous U.S. and facilitate additions of low-cost variometer stations in other strategic U.S. locations.

Program Overview

The Geomagnetism Program provides data and information on short-term and long-term variations in the strength and direction of the Earth's magnetic field, including the intensity of magnetic storms, through operation of a network of geomagnetic observatories and supporting research, and analyzes related geomagnetic hazards that threaten the economy and national security. Magnetic storms are caused by the dynamic interaction of the Earth's magnetic field with the Sun. While magnetic storms often produce beautiful aurora lights that can be seen at high latitude, they can also wreak havoc on the infrastructure and activities of our modern, technologically-based society. Large storms can induce voltage surges in electric-power grids, causing blackouts and the loss of radio communication, reduce GPS accuracy, damage satellite electronics and affect satellite operations, enhance radiation levels for astronauts and high-altitude pilots, and interfere with directional drilling for oil and gas.

The Geomagnetism Program is part of the U.S. National Space Weather Program (NSWP), an interagency collaboration that includes NASA, DOD, NOAA, the National Science Foundation (NSF), and DOE. The Geomagnetism Program provides data to the NSWP agencies, oil drilling services companies, geophysical surveying companies, and several international agencies, including INTERMAGNET, an organization with a worldwide membership drawn from institutes operating geomagnetic observatories who coordinate geomagnetic monitoring around the world. Data, products, and services from the USGS are also used by the electric-power industry to evaluate geomagnetic storm risk.



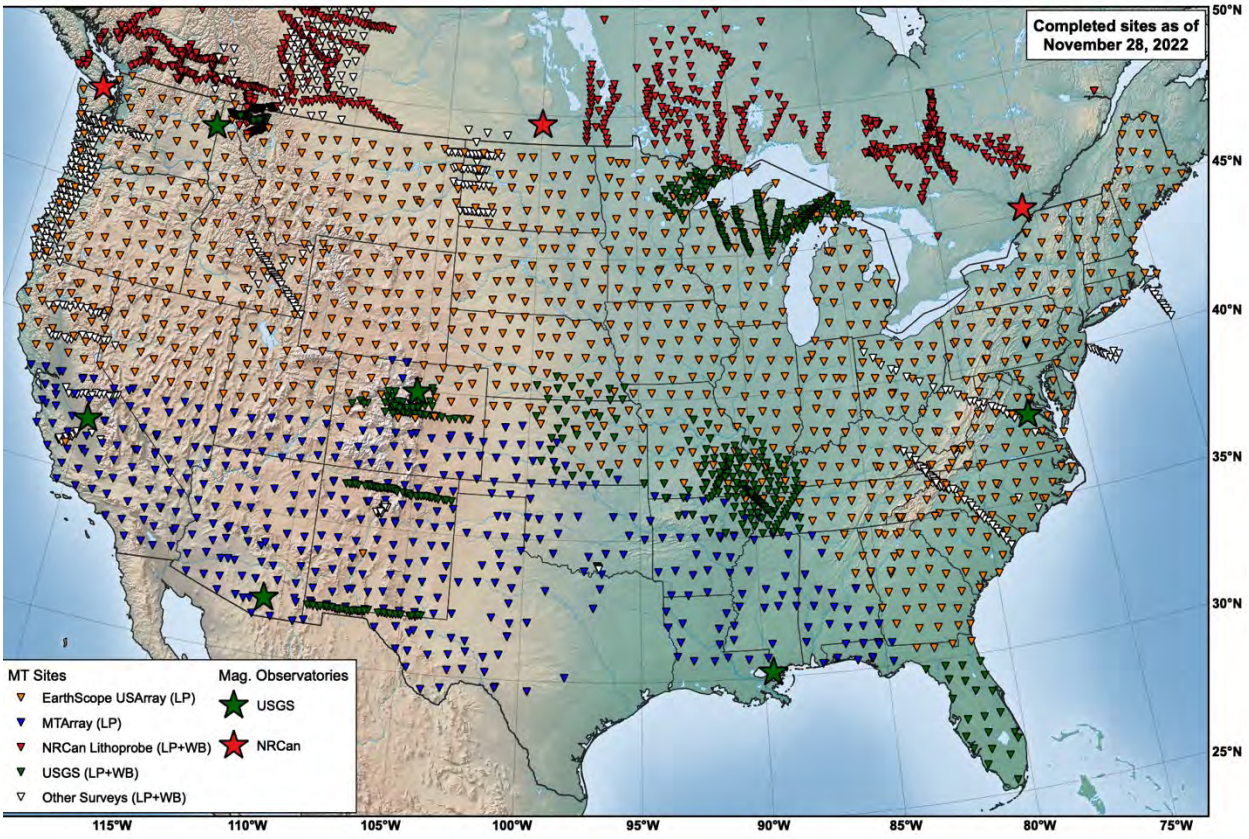
The graphic above describes the role of the Geomagnetism Program. The reference in the graphic above to "$1 trillion possible U.S. economic impact of a future superstorm" can be found at: https://nap.nationalacademies.org/catalog/12507/severe-space-weather-events-understanding-societal-and-economic-impacts-a Source: USGS.

Domestically, the USGS continues to operate 14 geomagnetic observatories, delivering data and working cooperatively with the NOAA Space Weather Prediction Center (SWPC), the U.S. Air Force 557th Weather Wing, and numerous other customers and Federal agencies. For example, USGS observatory data are used by NOAA's SWPC, and by the U.S. Air Force, for issuing geomagnetic warnings and forecasts. USGS geomagnetism research is conducted in collaboration with the Colorado School of Mines, the NOAA SWPC, and the NASA Community Coordinated Modeling Center.

Global USGS Magnetic Observatory locations. Source: USGS

The USGS also works with private entities that are affected by space weather and geomagnetic activity, including electric-power grid companies and the oil and gas drilling industries. In the oil and gas industry, for example, drill operators need to know the exact direction that their drill bits are going to maximize oil production and avoid collisions with other wells. One way to accomplish this is to install a magnetometer—a sort of modern-day "compass"—in a drill-string instrument package that follows the drill bit. Simultaneous measurements of the magnetic field in the drill hole are combined with those monitored by the USGS to produce a highly accurate estimate of the drill bit position and direction.

The USGS works with NOAA SWPC to produce hazard maps of the induced electric field in the Earth's crust due to geomagnetic storms. This work is part of a National Science and Technology Council's interagency working group for coordinating Space Weather Operations Research and Mitigation (SWORM). These results, now incorporated into a real time product, will help power-grid companies improve the resilience of their systems to magnetic storms, as required by the Federal Energy Regulatory Commission. Power grid operators will use these results to design mitigation strategies for geomagnetic storms, and the space weather alerting agencies will use the resulting electric field model to issue improved forecasts and nowcasts for space weather alerts.



The USGS Geomagnetism Program awarded a second Cooperative Agreement with Oregon State University (OSU) on June1, 2022, for a project to survey a large, contiguous sector of the southern conterminous U.S. This figure represents the status of the survey as of November 2022. Once finished, this project will complete the MT survey across the contiguous United States. Source: USGS

In FY 2024, the Geomagnetism Program will continue the magnetotelluric (MT) survey of the United States to improve U.S. electrical grid resilience, improve forecast models for geomagnetic storms, and aid in mineral resource assessments. Collection of MT data on a national scale is a basis for modeling the Earth's electric field, used to assess the impact of electrical storms. This survey is responsive to priorities established in the National Space Weather Strategy, as well as related international initiatives for pursuing induction hazard research. This broad collaboration includes scientists from NASA, NOAA, the Institute for Defense Analyses, the Federal Energy Regulatory Commission, the Federal Emergency Management Agency, and the NSF.

Natural Hazards
Coastal/Marine Hazards and Resources Program

Natural Hazards $ in thousands	2022 Actual	2023 Enacted	2024 Fixed Costs (+/-)	2024 Internal Transfers (+/-)	2024 Program Changes (+/-)	2024 Request	Change from 2023 Enacted (+/-)
Coastal/Marine Hazards and Resources Program	**41,865**	**43,149**	**+2,230**	**0**	**+17,650**	**63,029**	**+19,880**
Coastal Blue Carbon	[1,200]	[1,200]	0	0	+3,800	[5,000]	[+3,800]
Risk Reduction and Community Resilience	[950]	[950]	0	0	+3,850	[4,800]	[+3,850]
Modeling and Forecasting Coastal Change Hazards	[10,674]	[10,674]	0	0	+10,000	[20,674]	[+10,000]
FTE	***211***	***211***	***0***	***0***	***+33***	***244***	***+33***

Justification of 2024 Program Changes

The 2024 budget request for the Coastal/Marine Hazards and Resources Program (CMHRP) is $63,029,000 and 244 FTE, a program change of +$17,650,000 and +33 FTE from the 2023 Enacted.

Coastal Blue Carbon (+$3,800,000 / +8 FTE) – Coastal marshes and wetland sediments are a natural sink for atmospheric carbon, with the rates of carbon capture dependent on the extent, health, and expansion of the marsh complex. The USGS would increase evaluations of carbon sequestration potential in coastal salt marsh and associated environments. This includes field observations, development of new models leading to improved assessments and forecasts, and geospatial products to support decisions and policy within land management agencies at Federal, State and local levels. The USGS would quantify the consequences of management decisions in terms of enhanced carbon sequestration and reduced wetland methane emissions and integrate emissions benefits into tools to forecast the trajectories of natural, managed, and restored wetlands. This will allow marsh restoration and coastal ecosystem management decisions to include evaluation of carbon capture and emission reduction values in the prioritization and planning process. With an initial focus on the almost 1.2 million acres of wetlands and impoundments across the National Wildlife Refuge System, managed by the U.S. Fish and Wildlife Service, and approximately 3.2 million acres of wetlands managed by the National Park Service, the USGS and partners would develop and deliver tools that enable stakeholders to quantify and compare long-term benefits of alternative management strategies in terms of varied restoration, conservation, and risk reduction objectives, including reductions in greenhouse gas emissions.

Risk Reduction and Community Resilience (+$3,850,000 / +10 FTE) – The proposed increase would enhance USGS capacity to: (1) deliver accessible, timely, and actionable multi-hazards information to the public; (2) report on disaster losses related to natural hazards within the purview of the USGS; and (3)

identify communities, infrastructure, and demographic groups disproportionately exposed or vulnerable to natural hazards for improved outreach and targeted hazards research. Activities would build upon existing capabilities for advancing stakeholder communication, coordination, and engagement in the areas of risk reduction and community resilience.

In FY 2024, USGS would strengthen capacities in demography, sociology, and human geography, improve vulnerability risk communication and evaluation, and ultimately would support USGS scientists as they strategically prioritize areas for outreach and research. This capacity would also enable stakeholder engagement for equitable and effective delivery of information on hazards and disaster losses, building partner coalitions, and facilitating stakeholder collaboration. In addition, the USGS would develop mechanisms to share natural hazards risk information with relevant decision-makers, as well as record and share information on disaster losses.

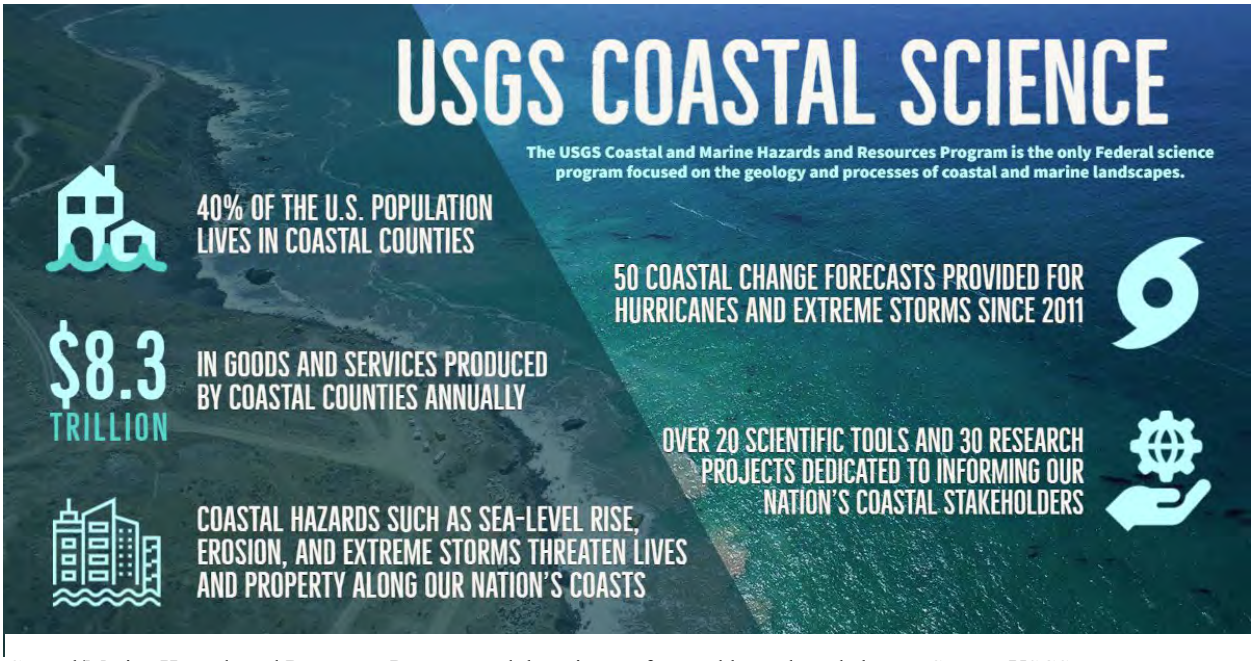
Modeling and Forecasting Coastal Hazards (+$10,000,000 / +15 FTE) – The USGS would improve models and forecasts of coastal response to natural process and deliver better information to resource managers across diverse landscapes and communities to advance the implementation of a national coastal change hazards framework. Models of the response of coastal landscapes, resources, and infrastructure to subsidence inundation and erosion from future storms and sea-level rise would enable coastal land and resource managers to evaluate the sustained benefits of alternative adaptation and restoration strategies to increase resilience and reduce risk. This would enable co-development of science and applications to meet site- and decision-specific requirements of resource managers (for example, U.S. Fish and Wildlife Service and National Park Service), installation operators (for example, Department of Defense), and developers of nature-based solutions (for example, U.S. Army Corps of Engineers, States) to reduce risk, enhance resilience, and pursue adaptation strategies in a variety of coastal settings.

The USGS would also support development and application of observational (land cover/elevation characterization and change) and modeling capacities required to deliver actionable hazards forecasts at regional and national scales. These would support stakeholder decisions to mitigate or adapt to coastal subsidence and other dynamic changes that place shorelines, barrier islands, and estuaries at increased risk. This would include maintaining the technical and operational capacities required to sustain rapid translation of new knowledge and methods to applications designed for a diverse group of stakeholders. The USGS also would begin implementing a strategy for multidisciplinary risk science and applications related to coastal change, including capacities to effectively engage stakeholders in coastal change hazards product design and evaluation. As a result of these investments, coastal resource and emergency managers would have the ability to anticipate the consequences of climate change, future storms, and coastal policies and projects on public safety, infrastructure performance, and community and ecosystem health and resilience.

Program Overview

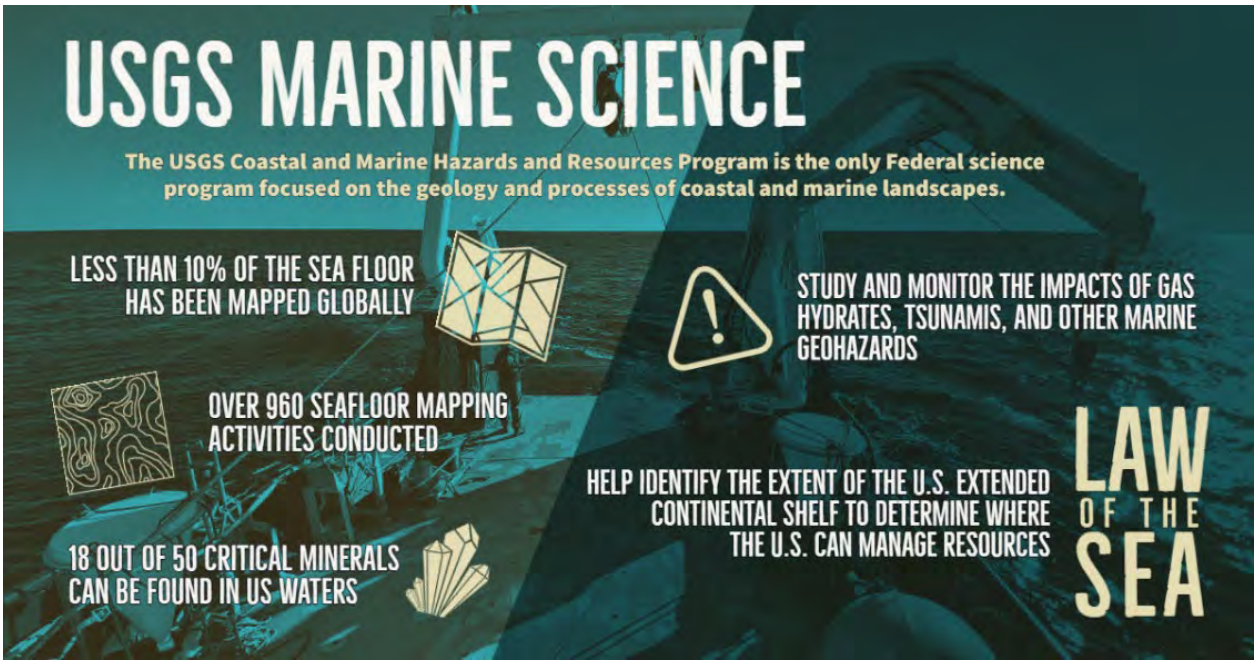
The CMHRP provides scientific information, applications, and tools to support evolving challenges related to public safety, development, economic growth, and resource management for both marine landscapes and coastal environments, where 40% of the Nation’s population lives and works. The USGS’s unique capabilities and expertise address the Nation’s needs for coastal and marine science-based products on a national scale and support the priorities and objectives of the Administration, Interior and other Federal agencies. The CMHRP, primarily through three science centers across the country, responds to the immediate and longer-term needs of local and regional groups, ensuring that products

serve the needs of the public. As the only Federal science program focused on the geology and processes of coastal and marine landscapes, the CMHRP investigates a wide range of issues, in locations ranging from shallow waters of estuaries to the deep sea. In FY 2024, the CMHRP projects will strategically focus on building capacity to more effectively deliver accessible and useful information to Federal partners, local officials, resource managers, emergency personnel, and other ocean and coastal stakeholders. These efforts will reduce risk, protect resources, restore habitats, and help managers plan responsibly for future change.



Coastal/Marine Hazards and Resources Program and the science of coastal hazards and change. Source: USGS

Coastal changes due to storms, changes in sediment supply, and human alterations pose substantial risk to communities across the Nation, especially when combined with threats induced by climate change, such as more intense hurricanes and rising sea levels. USGS is the recognized Federal provider of tools to anticipate and respond to physical change along our Nation's coasts and the consequences of climate and coastal change on communities, infrastructure, and resources. USGS operational, real-time forecasts of erosion and inundation for all weather conditions, including coastal storms and hurricanes, provide the public with reliable, nationally consistent guidance on pending threats to coastal communities. To address needs related to long-term planning for resilient coasts, USGS scientists assess past changes such as land loss, erosion, and flooding, and develop projections of future changes due to extreme storms and sea level rise, and the impacts on coastal environments and communities. In FY 2024, the CMHRP will expand national and regional forecasts for changes from near-term severe storm events that highlight challenges such as coastal subsidence, threatened natural resource areas, and health and safety for coastal communities. Through scientific studies and assessments that describe and quantify the value of natural capital in providing coastal protection – for example, the role of coral reefs in reducing risks to coastal communities and the capacity of coastal wetlands to serve as sinks for atmospheric carbon – the USGS supports efforts to protect the Nation's people, environment, and infrastructure from short- and long-term coastal hazards.



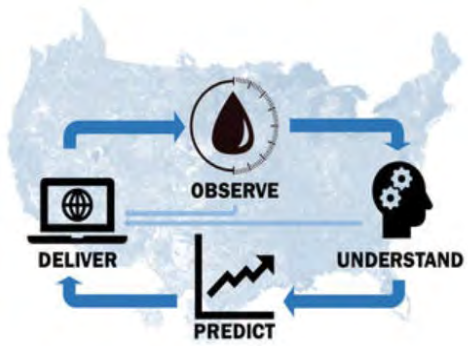
The graphic above describes the role of the Coastal/Marine Hazards and Resources Program as it relates to marine science. Program. Source: USGS.

USGS assessments of marine environments and potential geohazards – such as sub-marine earthquakes, landslides, and tsunamis – provide critical information that helps users identify and prepare for future hazards as well as reduce risk to offshore operations, coastal communities, and infrastructure. Surveys of geologic settings and processes increase scientific understanding used to inform development of offshore energy, critical mineral resources, and renewable energy efforts. This includes assessments of the distribution, composition, and environmental setting and resource potential of seafloor minerals, as well as associated environmental impacts of extraction. Additionally, the CMHRP supports the work to characterize marine methane systems and associated seabed processes to understand their energy resource potential, identify risks to offshore activities, and characterize their role in the global carbon system and marine ecological productivity.

Water Resources

Water Resources $ in thousands	2022 Actual	2023 Enacted	2024 Fixed Cost (+/-)	2024 Internal Transfers (+/-)	2024 Program Changes (+/-)	2024 Request	Change from 2023 Enacted (+/-)
Water Availability and Use Science Program	**64,501**	**74,296**	**+2,656**	**0**	**-2,250**	**74,702**	**+406**
FTE	***313***	***336***	***0***	***0***	***+39***	***375***	***+39***
Groundwater and Streamflow Information Program	**110,651**	**114,558**	**+3,499**	**0**	**+2,250**	**120,307**	**+5,749**
FTE	***484***	***489***	***0***	***0***	***+30***	***519***	***+30***
National Water Quality Program	**96,742**	**100,080**	**+3,264**	**0**	**0**	**103,344**	**+3,264**
FTE	***473***	***478***	***0***	***0***	***+6***	***484***	***+6***
Water Resources Research Act Program	**14,000**	**15,500**	**0**	**0**	**-500**	**15,000**	**-500**
FTE	***2***	***2***	***0***	***0***	***0***	***2***	***0***
Water Resources Total	**285,894**	**304,434**	**+9,419**	**0**	**-500**	**313,353**	**+8,919**
FTE	***1,272***	***1,305***	***0***	***0***	***+75***	***1,380***	***+75***

The 2024 budget request for the Water Resources Mission Area is $313,353,000 and 1,380 FTE, a program change of -$500,000 and +75 FTE from 2023 Enacted.



The above science processes (observe, understand, predict, and deliver) are necessary for acquiring reliable and actionable information about water availability. If one is overlooked, the others are limited. For example, if observing systems are not advanced, understanding is limited as is the ability to build better models for prediction. This is why science integration is critical and why it is a priority at the USGS.

Mission Area Overview

Beginning in 1888 with the National Streamgaging Program on the Rio Grande River under the direction of John Wesley Powell, the USGS has become one of the largest providers of in situ water data in the world. The Water Resources Mission Area (WMA) works with partners to monitor, assess, conduct targeted research, and deliver information on a wide range of water resources and conditions including streamflow, groundwater, water quality, and water use and availability. These activities support an overarching science strategy to observe, understand, predict, and deliver water science to the Nation.

Water information is fundamental to national and local economic well-being, protection of life and property, and effective management of the Nation's water resources. The

USGS works to monitor, assess, conduct targeted research, and deliver information on a wide range of water resources and conditions including streamflow, groundwater, water quality, and water use and availability.

As the Nation moves forward in the 21st Century, the USGS is integrating its water science activities to better address the greatest water resource challenges. In addition to maintaining longstanding nationwide monitoring systems , the USGS is working to intensively monitor and study select Integrated Water Science (IWS) basins. These IWS basins will focus multiple water science efforts, including the Next Generation Water Observing System (NGWOS), Integrated Water Prediction (IWP) and Integrated Water Availability Assessments (IWAAs), delivering a complete science capability. Five basins have been selected thus far – the Delaware River Basin (DRB), the Upper Colorado River Basin (UCRB), the Illinois River Basin (ILRB), the Willamette River Basin (WRB), and the Trinity-San Jacinto River Basin (TSJRB). A sixth basin will be selected in FY 2024.

IWS basins are medium-sized watersheds (10,000-20,000 square miles) that represent a wide range of environmental, hydrologic, and landscape settings and human stressors of water resources to improve understanding of water availability across the Nation. In each basin, the USGS will be developing assessment and predictive methodologies and tools that can be applied beyond the basin to the larger surrounding region and ultimately the Nation. The USGS will deploy water science efforts like the NGWOS, IWP, and IWAAs to better understand and predict water challenges. For example, in the DRB, the USGS is studying issues such as the impact of the drought of record under current water supply and demand restrictions. In the UCRB, cold-region processes of snow, ice and frozen soils are some of the priority issues being studied. In the ILRB, the relationship between an overabundance of nutrients (primarily nitrogen and phosphorus) and associated harmful algal blooms (HABs) is a focus of integrated water science efforts. In the WRB, USGS will focus on applied science that can help balance human need for water management (e.g., flood control, water supply, recreation) with the need to maintain ecological sustainability. In the TSJRB, USGS work will focus on impacts of flooding and large-scale urbanization on water availability and societal welfare. Through integrated activities funded through the four WMA budget programs, the USGS will continue to serve society by providing tools that managers and policymakers can use to manage water resources to meet both human and environmental needs.

The FY 2024 budget makes targeted investments in these integrated activities. The Water Resources Mission Area will focus on the following science priorities:

- ***Delivering IWAAs.*** These multi-extent, stakeholder-driven assessments support the delivery of the National Water Census (NWC), a near-real time census and prediction of water availability, integrating water quantity, quality, and use; indicators of socioeconomic demand; and impacts of climate-related stressors to forecast water availability for human and ecological needs. At the national scale, the USGS will improve predictions of water quantity and quality; enhance models of water use for all 8 categories of use reported by USGS; and work to integrate these components with indicators of socioeconomic demand and impacts of drought and wildfire to forecast water availability at various timeframes. Regionally, the USGS will continue IWAA activities in the DRB, UCRB, and ILRB with a focus on an improved understanding of impacts related to drought, wildfire, and overabundance of nutrients, respectively. Further, the USGS will begin assessment activities in the WRB in coordination with the NGWOS and IWP.

- ***Advancing USGS water observing systems.*** The USGS will continue to operate and maintain the fully implemented NGWOS monitoring infrastructure in the DRB, UCRB, and ILRB. In addition, the USGS will complete approximately 75 percent of initial implementation in the WRB and 30 percent in the TSJRB, and will begin planning for NGWOS implementation in a sixth basin (to be selected in FY 2024). In addition, the USGS will continue to operate its National Streamgaging Network in cooperation with over 1,400 partners. As part of the Streamgaging Network, the USGS will support approximately 3,490 locations in the Federal Priority Streamgage Network, which provide long-term, real-time data at locations that serve various Federal agencies. The USGS will advance its water observing systems with the construction of a new Hydrologic Instrumentation Facility (HIF) on the University of Alabama campus. The HIF is expected to be completed in FY 2024. Once constructed, USGS HIF functions will be relocated from the current location at NASA's Stennis Space Center in Mississippi to the University of Alabama - Tuscaloosa. All HIF employees located in Mississippi will be given the opportunity to relocate with their positions.
- ***Building integrated water prediction capabilities.*** The USGS is developing a new water prediction framework that, using advanced science and technology, will integrate state-of-the art climate, weather, water observations, and models to assess and simulate the underlying factors that limit water availability for both human and ecological uses. Using traditional observational networks, as well as targeted NGWOS data collection efforts, the USGS will evaluate and co-design data collection strategies to support model improvement and advance multi-scale modeling capabilities that support delivery of integrated water availability assessments. To ensure models effectively represent ecosystem demands, prediction capacity will be expanded to account for the impacts of hydrologic change on ecosystem vulnerability and resilience, including on culturally significant aquatic species that provide ecosystem services to underserved and vulnerable communities. Work will be accomplished through collaborations with Federal and local partners and academia.
- ***Modernizing USGS water data infrastructure***. The National Water Information System (NWIS) is the USGS enterprise system supporting the storage, processing, and delivery of real-time and historic water data. To ensure NWIS can manage current and new data produced by all WMA activities into the future, integrate water data from multiple agencies and sectors, and continue to deliver data and model results to the public, funding from across the WMA programs is used to support activities to modernize NWIS IT infrastructure and data systems. In 2024, efforts will be focused on completing a new delivery system for groundwater data; transmission, storage and processing of imagery and videos from monitoring stations; automated records processing; and enhancing user-centered data delivery.

Cooperative Matching Funds

Much of WMA work with partners is supported by a unique subset of funds referred to as Cooperative Matching Funds (CMF). Required by law to be matched at least 50:50 by State, local, or tribal partners, CMF is matched by over 1,600 of these partners to monitor and assess water resources in every State and U.S. protectorate and territory. CMF are found in three of the four budget programs: Water Availability and Use Science; Groundwater and Streamflow Information; and National Water Quality. The FY 2024 budget requests $66,529,000 for CMF across these three programs, continuing funding at the FY 2023 level.

FY 2022 Selected Mission Area Accomplishments

- USGS collected hydrologic data in partnership with over 1,400 Federal, State, tribal and local agencies at approximately 19,200 groundwater wells and 11,800 streamgages. Water-quality data were also collected at over 2,100 locations. These data are used for various activities, such as managing flood or water scarcity risk to humans, designing bridges and water-treatment plants, and supporting freshwater biodiversity conservation. USGS data are provided to the public via the National Water Information System: Web Interface. To improve the delivery of these data, the USGS released additional enhancements to its National Water Dashboard (NWD). The NWD provides an intuitive interface for the public to access USGS water data as well as water data from other government agencies (e.g., live weather radar) that helps the public understand the water situation in their area.
- USGS continued IWAAs at both regional and national scales to provide consistent assessments of water available for human and ecological needs. A regional IWAA in the DRB continued evaluation of water quality trends, development of machine learning approaches for water temperature modeling, and incorporation of groundwater modeling into water availability assessments. Similar regional activities in the ILRB and UCRB continued with a focus on data and model compilation and integration to efficiently identify water availability trends and additional data needs. A fourth regional IWAAs was initiated in the Willamette River Basin with a focus on water availability for ecosystem needs. Nationally, models, tools, and data collection strategies have been integrated to ingest the refined information compiled at the regional scale with focus on understanding factors that contribute to priority water availability concerns like groundwater and surface water interaction, salinity, harmful algal blooms, and the complexity of urban water supply and use.
- USGS continued to operate and maintain existing, new, and reactivated streamgages, water quality monitoring, water temperature sites, meteorological monitoring, water budget monitoring (evapotranspiration, water use, snow monitoring), cameras, and other technologies at fixed and mobile sites in the DRB. The USGS also completed the initial capital investment of new monitoring in the UCRB and expanded new monitoring investments into the ILRB. The NGWOS provides enhanced monitoring data to support integrated water availability assessments and predictions while also providing an innovation incubator for transitioning new monitoring instrumentation and methods from research to national operations in order to improve the spatial and temporal scales of data.

Water Resources
Water Availability and Use Science Program

Water Resources $ in thousands	2022 Actual	2023 Enacted	2024 Fixed Costs (+/-)	2024 Internal Transfers (+/-)	2024 Program Changes (+/-)	2024 Request	Change from 2023 Enacted (+/-)
Water Availability and Use Science Program	**64,501**	**74,296**	**+2,656**	**0**	**-2,250**	**74,702**	**+406**
Integrated Water Availability Assessments	[6,975]	[7,475]	0	0	+4,250	[11,725]	[+4,250]
Open ET	[1,500]	[3,500]	0	0	-3,000	[500]	[-3,000]
Hydrologic Science Talent Pipeline	[2,000]	[2,000]	0	0	-2,000	[0]	[-2,000]
Water Use Withdrawal Models	[2,000]	[2,000]	0	0	+1,500	[3,500]	[+1,500]
Transforming Fire and Drought Science Delivery for Natural Resource Managers	[0]	[0]	0	0	+3,000	[3,000]	[+3,000]
Water Cycle Center	[0]	[5,000]	0	0	-5,000	[0]	[-5,000]
Streamflow Permanence Modeling in Coordination with the Bureau of Land Management	[0]	[1,000]	0	0	-1,000	[0]	[-1,000]
FTE	***313***	***336***	***0***	***0***	***+39***	***375***	***+39***

Justification of 2024 Program Changes

The 2024 budget request for the Water Availability and Use Science Program is $74,702,000 and 375 FTE, a program change of -$2,250,000 and +39 FTE from 2023 Enacted.

Integrated Water Availability Assessments (IWAAs) (+$4,250,000 / +29 FTE) – The USGS would expand its capacity to conduct IWAA activities across the USGS IWS basins. Regional IWAAs are planned, coordinated, and conducted with Next Generation Water Observing System (NGWOS) and Integrated Water Prediction (IWP) activities in each basin and will provide enhanced assessments of the selected region's water availability that incorporate predictions and forecasts of water availability components, and the factors influencing both. Each Regional IWAA would provide a common set of products to give stakeholders a consistent set of information that integrates into National IWAA activities and products. Regional IWAAs would also have the flexibility to go beyond core requirements and prepare study designs that address regionally important science gaps, improving national assessment capacity and meeting stakeholder information needs. Assessment periods for Regional IWAAs may vary, but would generally consist of three phases totaling about 10 years of activity:

- Phase 1 – Discovery and Evaluation (1-2 years)
- Phase 2 – Availability Assessment (5-years)
- Phase 3 – Operational Linkages (3-4 years)

With additional funds, the USGS would advance phase 2 IWAAs activities in the Delaware River Basin (DRB) and initiate phase 2 activities in the Upper Colorado River Basin (UCRB). In addition, the USGS would begin phase 1 implementation in the Illinois River Basin (ILRB) and engage with stakeholders in the Willamette River Basin (WRB). In order to advance IWAAs being conducted in coordination with NGWOS and IWP activities across IWS basins, the USGS plans to redirect funding from an IWAA targeted at Saline Lakes toward these efforts.

Open ET (-$3,000,000 / -6 FTE) –At this funding level, USGS will continue to refine the Open ET approach in the existing footprint (the irrigated lands of the 17 western States) in support of water use irrigation withdrawal models but will not expand Open ET capabilities to the national-scale

Hydrologic Sciences Talent Pipeline (-$2,000,000 / -1 FTE) – The budget does not request funding for this program.

Water Use Withdrawal Models (+$1,500,000 / +10 FTE) – The USGS has been working to develop models that provide estimates for the eight major categories of water use at finer time scales and spatial resolution than has ever been available in the past. The USGS has developed operational models for the three primary categories that make up approximately 90 percent of annual water use in the U.S. (public supply, thermoelectric, and irrigation). With additional funds in 2024, the USGS would further refine these primary models using methods such as artificial intelligence and machine learning to drive predictions of water use based on changes in precipitation, temperature, land use, and populations. In addition, the USGS would accelerate the development of models for the remaining five water use categories (industrial, domestic self-supplied, mining, aquaculture, livestock). Once complete, the USGS will have operational models available to the public that account for all categories of use that USGS has historically reported.

Transforming Fire and Drought Science Delivery for Natural Resource Managers (+$3,000,000/ +20 FTE) – The USGS is proposing a $6.5 million total increase (including a $3.5 million increase in the Ecosystems Mission Area) to transform delivery of USGS science, information and tools to support decision making on wildfire and drought. This increase would allow the USGS to better align its science with the comprehensive decision support needs related to wildfire and drought with emphasis on Interior bureaus and their stakeholders. This initiative would build upon work that has taken place across the USGS, bringing a more integrated approach to science that can help Interior carry out its stewardship responsibilities. All Mission Areas will participate in providing the appropriate science and information as needed.

The effect of long-term drought and increased wildfires, particularly in the West, are increasingly detrimental to ecosystems and communities, threatening the ability of Interior natural resource managers and other USGS partners to meet their mission responsibilities. This initiative would prioritize decision-support development and delivery activities that would leverage and build on ecosystem restoration and Bipartisan Infrastructure Law wildfire investments, support water resource and ecosystem objectives sensitive to future drought and fire conditions and respond to the diverse stakeholder needs already identified through extensive stakeholder engagement. The USGS brings a wide range of relevant science

to bear on these issues, supporting Interior land management bureaus, the U.S. Forest Service, State natural resource agencies, and communities across the West, including Tribes. USGS partners currently lack science to assist in decision-making under future uncertainty, such as dam operation scenarios that reflect unprecedented low reservoir storage; projections of water availability for drinking water, irrigation, and ecological health; animal and habitat response to wildfire and vegetation change; forecasts of the onset, severity, and duration of droughts regionally; pre-fire estimates of potential vegetation and water quantity and quality impacts to evaluate effectiveness of fuel treatments and other mitigation actions; and state-of-the-art models to assess fire-ecosystem-water interdependencies and their cumulative impacts to the people, lands, and water of drought impacted areas.

With this funding, USGS would prioritize co-development and co-production of necessary and useful scientific products and tools with Federal, State, local, and tribal partners in a timely manner to support decision-making needs. Co-production would include partner-guided products, convening and engaging with our partners at all stages of the product life and reflecting the scale at which identified decisions are being made. The USGS would work with partners to develop decision support tools (such as advanced linked models, robust observation networks, integrated analyses, and forecasts at the scales relevant to natural resource decision making) that bring together projections on species vulnerability, drought, water availability, fire risk, and other drivers of ecological change. Advances in technology and advanced scientific computing are needed to deliver our science in new ways and at a scale appropriate for decision-making. The budget request also includes funding for advanced scientific computing (see Core Science Systems - Science Synthesis, Analysis, and Research).

Water Cycle Center (-$5,000,000 / -6 FTE) – The budget does not request funding for this program.

Streamflow Permanence Modeling in Coordination with the Bureau of Land Management (-$1,000,000 / -7 FTE) – The budget does not request funding for this program.

Program Overview

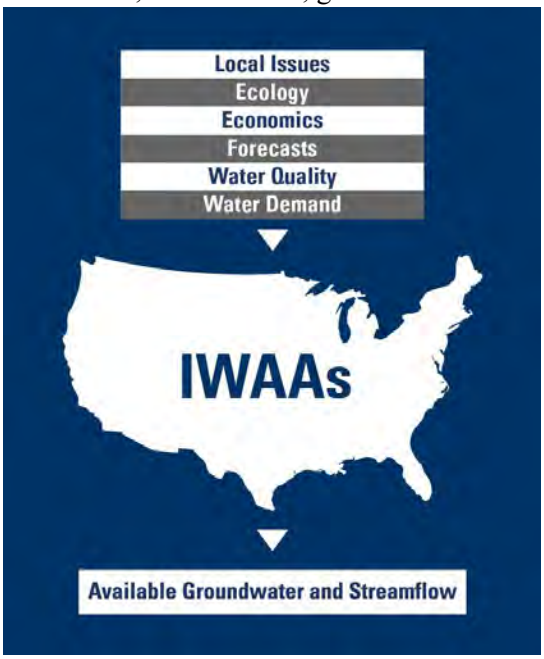
The Water Availability and Use Science Program (WAUSP) fulfills the goals established by Congress in the SECURE Water Act (Public Law 111-11, Section 9508) by investing in research and assessments that improve the Nation's understanding of water availability. Specifically, the WAUSP supports the National Water Census (NWC), a USGS activity designed to systematically provide information that will allow resource managers to assess the quantity, quality, and use of the Nation's water. The WAUSP focuses on conducting national and regional water availability assessments; developing methods to estimate water budgets; and evaluating trends in water availability. In addition, the WAUSP supports efforts to develop techniques to evaluate water availability, advance the models and infrastructure that support assessments, and deliver tools that resource managers can use to support resource planning.

The National Water Census (NWC)

The goal of the USGS NWC is to provide nationally consistent, well-documented information on water quantity, quality, and use that will allow resource managers to assess the Nation's water availability and inform decision-making. The USGS supports this goal by investing in efforts to assess and provide information on the inputs, the outputs, and changes in the water budget. Furthermore, the USGS is examining the dynamic interactions and complex roles that major factors (i.e., water quality, drought, ecological flows, and water use) can have in water availability. Estimates of water budget components, as

well as an understanding of how various factors can impact water availability, provide a means for the USGS to assess water availability.

Integrated Water Availability Assessments (IWAAs): Critical to the development and delivery of the NWC are multi-extent stakeholder-driven assessments, referred to as IWAAs, that will provide a near real-time census and seasonal prediction of water availability for both human and ecological uses. At a national scale, the USGS is working to deliver a web-based map that conveys daily snapshots of various water conditions and trends across the U.S. The WAUSP supports this effort by developing and refining models to simulate water budget components and factors that influence water availability. The USGS is currently providing daily estimates for a variety of water budget components, including precipitation, streamflow, soil moisture, groundwater recharge, evapotranspiration, snowpack, snowmelt, and total runoff. In addition, reporting for three major components related to water use will begin in FY 2023 when the USGS completes the final model development for thermoelectric, irrigation, and public supply water withdrawals. These water budget components will provide a foundation of data for the NWC.



When fully implemented, IWAAs will evaluate current water supply and demand, long-term trends in water availability, provide seasonal to decadal forecasts of availability, and inform water resource decisions through development of socioeconomic tools. The IWAAs are designed to meet the goals of the National Water Census as established through the SECURE Water Act. Source: USGS.

IWAA activities are also at work in each of the USGS IWS basins and in other targeted regions across the U.S. The USGS is developing Regional IWAAs in partnership with stakeholders to ensure they are timely and informative at the local and regional level but can also be assimilated into national-scale products. The USGS continues to work on a Regional IWAA through its Mississippi Alluvial Plain Assessment (MAP) project. Initiated in 2016 as a pilot for IWAAs, the project was developed and conducted in close cooperation with local, State, and regional stakeholders to ensure it met both USGS and stakeholder needs. While it has improved the data and developed key tools and information to support the MAP's water resource managers, it has also had national benefits by laying the groundwork for a unified approach for evaluating and predicting water availability in other regions across the U.S. From the foundation of work developed through the MAP, the USGS is planning to transition to IWAA activities in the Gulf of Mexico Coastal Plain (covering from Houston, TX, through Louisiana and Mississippi, to Mobile, AL) and the Klamath Basin in 2024.

In 2024, Regional IWAAs will be ongoing in the DRB, UCRB, ILRB, and WRB basins and will begin in the Trinity-San Jacinto River Basin (TSJRB). In the DRB, the USGS will continue phase 2 of the Regional IWAA with a focus on understanding the impacts of drought on water availability and issues related to water temperature, salinity, and coastal hydrology (including coastal inundation). The USGS will also continue full implementation of phase 2 in the UCRB and IRB with a focus on improving water resource planning with advancements to overall understanding and prediction of the processes that influence the magnitude and timing of snowmelt (in the UCRB) and HABs (in the ILRB). In the WRB,

the USGS will complete phase 1 of the Regional IWAAs with the design and implementation of projects aimed at better understanding how the timing, magnitude, and variation in water budget components influence water quantity and quality conditions, with a particular focus on ecosystem demand.

Water Use, Ecological Flows, and Drought: In order to fully deliver the NWC, the USGS must develop the capacity to assess and understand not only the traditional hydrologic components of the water budget but also human and ecological supply and demand. By incorporating research and technical evolution, the USGS is focused on model development that will improve water use reporting from 5-year annual reports (how USGS currently reports on water use) to daily estimates, including uncertainty, modeled on a national scale. The USGS will also identify, evaluate, and predict potential ecological responses to changes in water availability and forecast the onset, severity, and duration of hydrologic drought.

Better Tools for the Public
The USGS National Integrated Water Availability Assessment Report

The SECURE Water Act (P.L. 111-11) recognized the need to improve our understanding of water availability for both human and ecological needs, across multiple sectors critical for economic growth and ecosystem sustainability. The ability to understand past and current water availability, as well as predict future water demands compared to available supplies is critical in the identification of emerging water issues, understanding the causes, and preparing for the future water availability. Integrating human water use and decision-making into models of the natural hydrologic system increases the ability of USGS to provide science-based information, including forecasts of water supply and suitability for use, to water resource managers, allowing them to make more informed management decisions. In 2024, the USGS will finalize a draft of the first ever National Integrated Water Availability Assessment report, a periodic interpretive report on the state of the Nation's water resources—past, current, and future; quantity, quality, and use as well as the drivers of change including extreme events. This report will serve as a regular assessment of water availability for the Nation integrating the evaluation and prediction of water quantity, quality, and use, including ecosystem needs, into the assessment and communication of water availability.

In 2024, the USGS will continue developing water use withdrawal models for industrial, domestic self-supplied, mining, aquaculture, and livestock uses accounting for the remaining 10% of water use nationally not already covered by USGS models, which allows USGS to report water use for all 8 categories of use; conducting ecological flow assessments and model development in the UCRB and the WRB; and, finalizing data-driven methods to prototype early warning of drought conditions including potential impacts to different components of water availability, including agricultural areas and ecological flows most vulnerable to drought.

Model Development, Infrastructure, and Information Delivery

Integrated Water Prediction (IWP): The USGS is participating in an ambitious Federal partnership with agencies like the National Oceanic and Atmospheric Administration, Bureau of Reclamation, and the U.S. Army Corps of Engineers, to develop a new national, interagency capacity for water prediction. Working as part of this Federal community, the USGS is fostering a formalized, transparent, and adaptive governance process to integrate the modeling and computational strengths of multiple organizations.

Through identification of the science and technological needs that will serve the Nation's long-term hydrologic prediction capacity at the national, regional, watershed, and local scale, the USGS is developing the integrated modeling framework, software architecture, and standards needed to support the robust, efficient, and sustainable development of integrated water prediction capabilities. In 2024, the

USGS will continue working through an IWP program to develop nationally consistent approaches for predicting and forecasting water quantity and quality conditions, changes, and outcomes for water availability. Leveraging modeling approaches designed to consider water quantity, quality, and use together in an integrated water availability model framework, IWP tools will be used to support broader USGS goals such as delivery of the National Water Census and National Integrated Water Availability Assessment report.

High-Impact Hydrologic Research

Research and development are critical foundations to the effective management of the Nation's water challenges, providing a foundation for understanding how the hydrologic process works and impacts water availability. To this end, the WAUSP supports research to better understand how factors like socioeconomics and extreme events can impact water budgets, and at a broader level, water availability. Through these efforts, the USGS strives to provide water resource managers with high-impact data, tools, and information that support management decisions.

Social and Economic Drivers: The USGS is working to better understand the impacts of and interactions between socioeconomics and water availability. A comprehensive understanding of the social and economic factors that drive water demand and alter water supply is needed to assess water availability in a predictive framework. Assessments and model development will identify the economic sectors, ecosystem goods and services, and other social, cultural, and economic factors that affect, or are affected by, water availability. In 2024, the USGS is working to incorporate socioeconomic drivers into water prediction and assessment capacity to better incorporate the impact of water demand, water management, and ecosystem services into national assessments. These efforts will improve the ability of the NWC to forecast availability under a variety of conditions.

Water Budget Research: This research is focused on improving water availability prediction by better quantifying the hydrologic cycle. Activities at a range of spatial and temporal scales aim to improve the USGS's ability to evaluate all components of the water budget, including groundwater-surface water interactions, recharge, evapotranspiration, snowpack, soil moisture, and streamflow, and understand how changes to these components impact water availability. In 2024, the USGS will focus hydrologic process research on improving model representation of IWAAs core water budget components to reduce model uncertainty. This includes incorporation of process representation improvements based on assessment and prediction of snowpack as a driver of water availability in the UCRB and improved understanding of hydrologic influences on baseflow for improved representation of groundwater-surface water exchange.

Water Resources
Groundwater and Streamflow Information Program

Water Resources $ in thousands	2022 Actual	2023 Enacted	2024 Fixed Costs (+/-)	2024 Internal Transfers (+/-)	2024 Program Changes (+/-)	2024 Request	Change from 2023 Enacted (+/-)
Groundwater and Streamflow Information Program	**110,651**	**114,558**	**+3,499**	**0**	**+2,250**	**120,307**	**+5,749**
Next Generation Water Observing System	[29,000]	[29,500]	0	0	+1,400	[30,900]	[+1,400]
Federal Priority Streamgages	[25,215]	[25,715]	0	0	+4,600	[30,315]	[+4,600]
Klamath Basin Water Availability Activities	[1,214]	[1,214]	0	0	-1,000	[214]	[-1,000]
Hydrologic Science Talent Pipeline	[2,000]	[2,000]	0	0	-2,000	[0]	[-2,000]
Baseline Water-Quality Assessments of Transboundary Rivers	[1,500]	[2,250]	0	0	-750	[1,500]	[-750]
FTE	***484***	***489***	***0***	***0***	***+30***	***519***	***+30***

Justification of 2024 Program Changes

The 2024 budget request for the Groundwater and Streamflow Information Program is $120,307,000 and 519 FTE, a program change of +$2,250,000 and +30 FTE from the 2023 Enacted.

Next Generation Water Observing System (NGWOS) (+$1,400,000 / +21 FTE) – At this funding level, USGS would operate and maintain the fully-deployed NGWOS in the Delaware River Basin (DRB) and fully implement NGWOS in the Upper Colorado River Basin (UCRB) and Illinois River Basin (ILRB) and complete approximately one-quarter of the NGWOS the Willamette River Basin (WRB). The USGS would also begin initial implementation in the recently selected fifth basin, the Trinity-San Jacinto Basin (TSJRB). The USGS would also support hydrologic instrumentation research and development aimed at pushing the state of monitoring technology forward in each IWS basin, which would ultimately improve USGS national observing networks at large. As innovative data collection techniques and technologies are tested in each IWS basin, those that prove effective and beneficial could be rolled out to the national USGS observing networks. To accelerate NGWOS implementation in the WRB and TSJRB, the USGS proposes to redirect funding in base from external research and development with universities and other partners toward efforts to install new NGWOS monitoring infrastructure. Beyond these efforts, at the requested level, the USGS anticipates completing NWIS modernization efforts by the end of FY 2025.

Federal Priority Streamgages (FPS) (+$4,600,000 / +14 FTE) – Each year, floods, droughts, and water quality issues remind us of the vulnerability of our physical and socioeconomic well-being and the importance of monitoring our Nation's water. The FPS network was designed to support long-term

Federal information needs and operations, such as National Weather Service flood forecasting, reservoir management, and interstate and international compacts and decrees. In addition, the FPS network is intended to serve as a backbone within the USGS Streamgaging Network that is not vulnerable to changing local priorities and resources.

The proposed increase includes funding to support the continued operation of approximately 3,800 streamgages in the FPS Network. In addition, the USGS would be able to support an additional 30 flood-hardened streamgages that are fully funded by the USGS to the FPS network at key locations to fill gaps and support data needs of water model predictions. Furthermore, the USGS would implement enhancements that increase the resiliency of the FPS network (e.g., flood-hardening select existing sites) and ensure sites meet current requirements for successful data collection and transmission (e.g., cyclical equipment upgrades for monitoring, telecommunication, and data transmission).

Klamath Water Availability Activities (-$1,000,000 / -1 FTE) – USGS monitoring in the Klamath River watershed seeks to provide data necessary to better assess water availability and inflow to Upper Klamath Lake. In FY 2022, additional funding was provided to consult with state, federal, and tribal partners on monitoring gaps and install new sensors. At this funding level, the additional monitoring that began in FY 2022 and was augmented in FY 2023 would stop.

Hydrologic Sciences Talent Pipeline (-$2,000,000 / -1 FTE) – The budget does not request funding for this program.

Baseline Water-Quality Assessments of Transboundary Rivers (-$750,000 / -3 FTE) – With funding appropriated in FY 2023, the USGS is augmenting existing monitoring and assessment activities in the Kootenai watershed to further evaluate the impact of British Columbia mining operations on the health of U.S. transboundary rivers and lakes. This reduction would discontinue those new monitoring and assessment activities. Monitoring and assessment activities in the Kootenai watershed that have been ongoing since 2020 to evaluate the impacts of British Columbia mining operations would continue.

Program Overview

The Groundwater and Streamflow Information Program (GWSIP) collects, manages, and disseminates high-quality and reliable water information in real-time and over the long-term. The information is critical for managing the Nation's water resources and anticipating and responding to water hazards that can result in loss of life and property. Serving as one of the largest water data holders in the world, the USGS partners with more than 1,600 Federal, regional, State, tribal, and local agencies to maintain and manage its water monitoring networks. Furthermore, the GWSIP is increasingly monitoring both water-quality and quantity at a single location providing continuous real-time water data used for decisions such as emergency response, flood forecasting, reservoir management, water-use restrictions, drinking water deliveries, permit compliance, water-quality studies, and recreational safety. The long-term data supplied by the program are a critical component to sustaining the viability of industries such as agriculture, fishing, and outdoor recreation and are used for decisions related to water-supply planning, aquifer storage and recovery, infrastructure design, floodplain and ecosystem management, energy development, and resolution of water disputes.

National Water Census (NWC)

The goal of the USGS NWC is to provide nationally-consistent, well-documented information on water availability that will allow resource managers to assess the quantity, quality, and use of the Nation's water resources. The GWSIP is supporting this goal by collecting, analyzing, and assessing hydrologic data in transboundary rivers along the U.S-Canada border. Initiated in 2019, the USGS is currently supporting activities in Alaska, Washington, Idaho, and Montana that are aimed at documenting baseline conditions and assessing any potential impacts from mining activities in British Columbia. Work is being coordinated with various Federal, State, local, and tribal agencies to ensure that USGS efforts will serve their needs for data and scientific understanding.

Observing Systems

Water monitoring networks are foundational in understanding the Nation's hydrologic systems; they provide information that is critical for defining, using, and managing water resources. The USGS operates a suite of real-time surface water and groundwater networks that provide data on water levels, streamflow, and a variety of water-quality parameters. The GWSIP primarily supports the networks that provide data on water quantity (water levels and streamflow), while also investing in next-generation water observing systems designed to integrate monitoring for water quantity, quality, and use.

National Streamgaging Network: The GWSIP supports the collection and delivery of streamflow or water-level information at more than 11,800 sites for at least a portion of the year. More than 8,800 of these sites provide real-time streamflow information year-round and approximately 3,000 only record water level or operate less than year-round. The data are served online—most in near real-time—and form the basis for decisions related to protection of life and property from 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.

Improving Program Performance
Advancing USGS Monitoring Capabilities in Remote Areas through Satellite Remote Sensing

USGS is continuing to deliver historic and operational real-time discharge data at "virtual" stream monitoring stations on more than 12 rivers in Alaska, utilizing satellite remote sensing to measure river widths, slopes and altitudes at these locations and, using hydraulic equations, convert these to discharge measurements. These virtual streamgaging stations are demonstration and test sites for use of satellites to measure rivers in remote areas that are too difficult or expensive to measure with traditional methods.

The recent NASA launch of the Surface Water Ocean Topography (SWOT) satellite will soon provide data on 90% of water bodies (lakes, reservoirs, rivers, and wetlands) in the U.S. and globally, with repeat coverage about every 10 days. The SWOT satellite will measure water elevation, slope, and discharge of rivers whose widths exceeds 100m, which includes about 93,000 miles of rivers in the U.S. Through the initial pilot sites in Alaska, USGS has developed accurate and reliable methods that can expand coverage of the national stream monitoring network. USGS is now working with NASA to serve SWOT discharge data that have been improved, or unbiased, using USGS methods and station data. This work will improve safety by keeping technicians out of dangerous waters and will lead to less expensive stream monitoring methods that can be used to expand the coverage of monitoring across the Nation.

Federal Priority Streamgage (FPS) Network: The FPS Network (previously known as the National Streamflow Information Program) is a subset of the National Streamgaging Network and was conceived in 1999 to be a core, federally funded network. The original network design identified 4,300 sites that

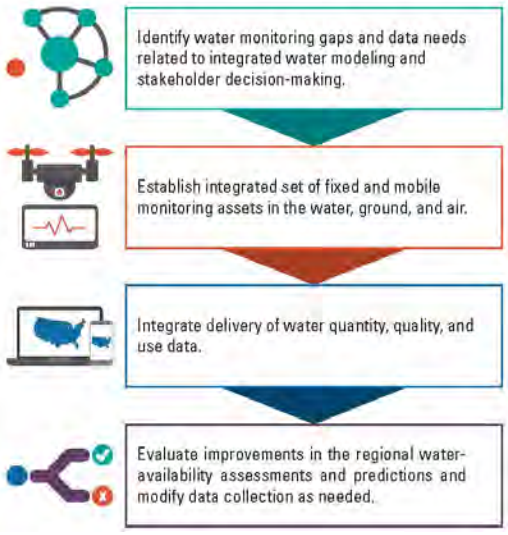
were strategically positioned across the country to address long-term Federal information needs, such as forecasting (primarily supporting National Weather Service flood forecasts and to trigger operational drought or emergency declarations), interstate and international water compacts and decrees, and tracking sentinel trends. These sites are supported through a combination of USGS and partner funding—approximately one-quarter are fully funded by the USGS.

Anticipating the evolution of Federal stakeholder water-data needs, and advances in monitoring and communication technologies in the 25 years since the network was initiated, USGS launched a re-evaluation of the fundamental priorities for the FPS network. In FY 2022, the USGS solicited feedback from Federal agency stakeholders that benefit from the FPS network to understand how it can better serve their needs in the next decade. Based on this feedback, the USGS will propose modifications to the original network priorities and eligibility criteria along with corresponding revisions to the list of eligible FPS locations in FY 2023.

National Groundwater Monitoring Network (NGWMN): The NGWMN was designed in 2009 in response to the SECURE Water Act (P.L. 111-11). Authorized as a collaborative groundwater network among intergovernmental agency data providers, the NGWMN provides access to water-level and/or water-quality data from nearly 20,000 groundwater wells that are supported by over 45 Federal, State, local, and tribal agencies. As part of the NGWMN, the USGS supports 695 Climate Response Network (CRN) sites, representing 292 of 370 Climate Divisions in the U.S. as outlined in P.L. 111-11. These sites are supported by a combination of USGS and partner funding. The primary purpose of these data is to track the response of groundwater systems to short- and long-term climate variations nationwide. It serves as a critical measure of groundwater conditions during drought and provides long-term groundwater level data. In 2024, the USGS will continue to support the CRN.

Next Generation Water Observing System (NGWOS): In efforts to modernize observing networks, the USGS has developed a strategy for implementing a NGWOS. The USGS has begun establishing advanced, intensive monitoring networks in medium-sized watersheds across the U.S. referred to as Integrated Water Science (IWS) basins. Selected watersheds are being instrumented to monitor water quantity, quality, and use with a mixture of monitoring equipment in the water, ground, and air. The goal of the system is to provide high temporal and spatial resolution data on streamflow, evapotranspiration, snowpack, soil moisture, water quality, groundwater/surface-water connections, stream velocity distribution, sediment transport, and water use. These data are intended to be coupled with advanced models, such as the National Water Model, and other modern modeling tools to lower prediction uncertainty as well as provide flood and drought forecasts; drive emergency- and water-management decision support systems; and address a variety of other water-resource questions in a given region. Further, the NGWOS will provide a foundational dataset as the USGS develops Integrated Water Availability Assessments.

Thus far, the USGS has selected five IWS basins (DRB, UCRB, ILRB, WRB, and TSJRB) and NGWOS implementation is ongoing in the first three basins. The initial investment of NGWOS instrumentation in the **DRB** is complete and has mainly focused on enhanced monitoring of streamflow, temperature and salinity to help address key water-resource issues such as: *interbasin transfers to New York City in the upper basin; maintaining ecological flows and stream temperatures adequate to support blue ribbon trout fisheries in the upper and middle part of the basin; and saltwater intrusion for cities like Philadelphia in the lower basin*. Full NGWOS implementation in the **UCRB** is complete as well and is focused on



Infographic of the NGWOS implementation process. The NGWOS is integrating fixed and mobile monitoring assets in the water, ground, and air, including innovative webcams and new ground- and space-based sensors. Partner and stakeholder needs are informing NGWOS design so that data helps them anticipate water shortages more accurately and react to water hazards more quickly. Source: USGS.

monitoring of snow to streamflow, groundwater to streams, and real-time water-quality and aims to help answer specific hydrologic questions important to stakeholders such as: *What are the near-term and long-term risks of floods and droughts, and what scenarios change these risks? How long will drought recovery take? How much water is stored in seasonal snowpacks, and how will changes affect water supplies? How much does groundwater contribute to streamflow, or vice-versa? What is the quality of water and how will it change during wet/dry periods?* In the **ILRB**, implementation is focused on real-time monitoring of nutrient and sediment delivery, factors leading to the formation of harmful algal blooms (HABs), and urban flood hydrology and helping to answer specific hydrologic questions important to stakeholders such as: *What are the near-term and long-term risks of floods and droughts, and what scenarios change these risks? What factors affect water availability in basins that possess a complex mixture of urban and agricultural land use? How do nutrient loads influence HABs? What are the best ways to monitor for water supply contaminants such as per- and poly-fluoroalkyl substances (PFAS)? What are the best practices to inform Federal State, local, and Tribal agencies about sediment loads in watersheds to facilitate planning of dredging operations that maintain navigable waters?*

In 2023, initial implementation in the **WRB** is underway with a focus on understanding the balance between human needs for water management (e.g., flood control, water supply, recreation) and the need to maintain ecological sustainability (particularly for salmon). In addition, planning for implementation in the recently selected **TSJRB** will commence. Selection of the sixth IWS basin will occur in 2024.

Improving Program Performance
Augmenting USGS Real-time Monitoring Capabilities with Cameras

Through support from NGWOS, the USGS is expanding the network of river monitoring stations equipped with optical cameras streaming live feed and displaying river conditions continuously. The network is hosted under the Hydrologic Imagery Visualization and Information System (HIVIS) that is available at https://apps.usgs.gov/hivis/. The images currently are being used for qualitative determination of hydraulic conditions through a visual analysis of the received frames. However, the network of cameras holds an immense untapped potential to measure key river conditions, such as water-level, velocity, and streamflow, cost-effectively, reliably, remotely, in real-time. The USGS is expanding the use of cameras at monitoring stations and working with academia to operationalize methods for optical measurement of hydrologic conditions, which could revolutionize the spatial and temporal resolution and manner by which water data is collected across the U.S. These data are useful to provide visual understanding of current conditions, particularly during flooding hazards and can provide quantitative data to help public officials assess flood damage, enhance flood forecasting models, and improve long-term planning for future water hazards.

At the foundation of USGS water observing systems is the Hydrologic Instrumentation Facility (HIF). The HIF provides quality-assured hydrologic instrumentation and data collection equipment, testing of in-

service instruments, and evaluation of new technology and instrumentation, which are foundational for a national, high quality water observing system. In 2020 and 2021, the USGS received appropriations to construct a new HIF co-located with complementary academic and federal partners. In 2023 and 2024, the USGS will be constructing a new HIF on the University of Alabama – Tuscaloosa campus. The HIF is expected to be completed in FY 2024. Once constructed, USGS HIF functions will be relocated from the current location at NASA's Stennis Space Center in Mississippi to the University of Alabama - Tuscaloosa. All HIF employees located in Mississippi will be given the opportunity to relocate with their positions.

Data Systems

National Water Information System (NWIS) Modernization: As the USGS moves its monitoring networks forward through initiatives like NGWOS, it is modernizing the enterprise system that supports water data transmission, storage, processing and delivery: NWIS. These efforts will ensure that NWIS can efficiently manage new data and data types, incorporate automated processing of hydrologic data, integrate water data from multiple agencies and sectors, and continue to deliver data to the public, but in new and more user-friendly formats. In 2024, the USGS will continue to modernize data telemetry and storage infrastructure, data processing and quality assurance processes, and data delivery components of NWIS. Data users will directly benefit from continued enhancement of the National Water Dashboard, adding new public search and data download functionality, and enhancing delivery of camera imagery and videos, geospatial information, and discrete groundwater data. In addition, the GWSIP is investing in activities to ensure that state-of-the-art tools are used to develop information and data visualizations that meet the decision-making needs of stakeholders.

Water Resources
National Water Quality Program

Water Resources $ in thousands	2022 Actual	2023 Enacted	2024 Fixed Costs (+/-)	2024 Internal Transfers (+/-)	2024 Program Changes (+/-)	2024 Request	Change from 2023 Enacted (+/-)
National Water Quality Program	**96,742**	**100,080**	**+3,264**	**0**	**0**	**103,344**	**3,264**
PFAS Methods and Sampling	[1,600]	[2,100]	0	0	-1,000	[1,100]	[-1,000]
Ecological Flows	[1,630]	[1,630]	0	0	+1,000	[2,630]	[+1,000]
FTE	***473***	***478***	***0***	***0***	***+6***	***484***	***+6***

Justification of 2024 Program Changes

The 2024 budget request for the National Water Quality Program is $103,344,000 and 484 FTE, a program change of $0 and +6 FTE from the 2023 Enacted.

PFAS Methods and Sampling (-$1,000,000 / -1 FTE) – Since FY 2022, the USGS has expanded sampling for PFAS in USGS national groundwater networks and initiated sampling in USGS national surface-water quality networks. With this reduction, USGS would no longer do PFAS sampling in the USGS surface-water quality network and would reduce sampling within the groundwater-quality networks. USGS would continue limited PFAS sampling nationwide.

Ecological Flows (+$1,000,000 / +7 FTE) – The USGS would support integrated, cross-mission area science that builds on recent advancements in monitoring, modeling, and multidisciplinary research to improve our capacity to forecast impacts of climate change and land management practices on water availability and ecosystem health. Working collaboratively in Integrated Water Science basins, the USGS Water Resources and Ecosystems Mission Areas would develop methods, including genetic and genomic capabilities, and models to study challenges related to water supply, infrastructure, land management, and aquatic ecosystems due to population growth, climate change, floods and droughts, and aging water delivery systems. Funding would support the integration of data from hydrologic, biogeochemical, and ecological studies to improve our capacity to model the impacts of hydrologic change on ecosystem vulnerability and resilience, including on culturally significant aquatic species that provide ecosystem services to disadvantaged and vulnerable communities.

Program Overview

To effectively manage the Nation's water resources, decisionmakers depend on information about what resources are available for various purposes, and whether the quality of those resources is sufficient. The National Water Quality Program (NWQP) supports the data collection, assessments, modeling, and research needed to assess the quality of freshwater resources. In particular, activities are focused on understanding the role that water quality plays in water availability. The long-term data, assessments, and models supported by the program are critical to sustaining the viability of industries such as agriculture,

fishing, and outdoor recreation, and are used for decisions related to water-supply planning, aquifer storage and recovery, infrastructure design, floodplain and ecosystem management, energy development, and water dispute resolutions. The multi-scale prediction of water quality and availability of freshwater resources is met through integrated capabilities across multiple programs. These programs include IWP to provide the computational framework for advanced models of quality and quantity, IWAAs to assess water availability within the context of competing demands, and research into water quality processes to identify and fill model gaps for more accurate predictions.

National Water Census (NWC)

The goal of the USGS NWC is to provide nationally consistent, well-documented information on water availability that will allow resource managers to assess the quantity, quality, and use of the Nation's water resources. The NWQP supports this goal by investing in efforts to evaluate the water-quality aspects of water availability. Given the cost of treating water for various uses (e.g. public supply, irrigation, energy development), water-quality is critical in understanding the availability of water for human and ecological purposes.

Water availability reflects the quantity, timing, quality, and use of water resources and is driven by the interactions of various factors. The primary factors that can drive water availability are climate change, economics, water quality, and human and ecological demand.

Integrated Water Availability Assessments (IWAAs): IWAAs will provide a near real-time census and seasonal prediction of water availability for both human and ecological uses at regional and national extents. As part of this effort, the NWQP is working to analyze trends and develop advanced techniques to account for water quality. At a national scale, efforts are focused on developing water availability indicators related to water quality that will convey periodic snapshots of current conditions and national trends. Water-quality indicators will show water availability based on suitable uses and untreated quality (e.g., water may be available but must be treated before use in an industrial setting yet could be used untreated for mining). In addition, the USGS supports efforts to evaluate water-quality trends on a national scale. At regional scales, the NWQP is working to integrate water-quality assessment and evaluation capabilities into Regional IWAAs. These Regional IWAAs are being developed in partnership with stakeholders to ensure they are informative at local and regional levels but can also be assimilated into national-scale products as part of the National IWAA. In 2024, regional IWAAs will be ongoing in the Delaware River (DRB), Upper Colorado River (UCRB), Illinois River (ILRB), Willamette River (WRB) basins and the recently-selected Trinity-San Jacinto Basin (TRJRB). The NWQP will assess water-quality factors such as salinity and temperature in the DRB, groundwater salinity and selenium in the UCRB, develop a framework for assessing the impacts of nutrients on water availability in the ILRB, and assess water-quality drivers impacting ecosystem needs in the WRB.

Ecological Flows: The USGS is working to develop the data, tools, and information water resource managers need to protect and restore stream health as it is affected by alteration of flows for human water use, climate change, and anthropogenic changes to water quality. The results will be used to identify, evaluate, and predict potential ecological responses to alteration of water availability. In 2023, the USGS

began to integrate data from hydrologic, biogeochemical, and ecological studies to improve USGS capacity to model the impacts of hydrologic change on ecosystem vulnerability and resilience, including on culturally significant aquatic species that provide ecosystem services to underserved and vulnerable communities. Leveraging the multi-disciplinary nature of the USGS, this work is being conducted in collaboration with the USGS Ecosystems Mission Area. The USGS is also applying new technologies in genomic analyses, bioinformatics, and machine learning to improve the accuracy and interpretability of indicators of ecological wellbeing. These efforts would be expanded in FY 2024.

Water Prediction and Information Delivery/Data Systems

Integrated Water Prediction (IWP): As part of an ambitious federal partnership, agencies such as the National Oceanic and Atmospheric Administration, Bureau of Reclamation, U.S. Army Corps of Engineers, and USGS are developing a new national, interagency capacity for water prediction. As part of this effort, the USGS is working to advance its water modeling capabilities through an IWP program that is focused on developing nationally-consistent approaches for predicting hydrologic conditions, changes, and outcomes for water availability. These approaches are being designed to consider water quantity, quality, and use together in an integrated water availability model. While these activities are supported by both the NWQP and the Water Availability and Use Science Program, NWQP funding supports activities that focus on incorporating water-quality processes into water prediction for a holistic view of water availability.

In 2024, the USGS will continue testing and evaluating methods to predict surface and groundwater quality nationally. NWQP efforts will focus on multi-scale testing and evaluation of this framework, specifically on improving the process representation and prediction of key water quality drivers such as surface water temperature, constituent transport, nutrients, and salinity. These activities will be coordinated with other integrated water science activities such as IWAAs and are major components of the National Water Availability Assessment.

High Impact Hydrologic Research

The USGS is investing in the research needed to better understand the water-quality factors that impact water availability. This work provides the foundation for providing models and tools for resource managers that can consider the quantity, quality, and use aspects of water availability as an interdependent system.

Water Quality Processes: These activities support the methods development and research that the USGS needs to quantify impacts of constituent fate and transport on changes in water-quality and how those changes impact water availability for both human and ecological uses. In 2024, the USGS is continuing efforts to understand the processes that influence both existing and emerging water-quality challenges such as harmful algal blooms (HABs) and per- and poly-fluorinated compounds (PFAS). Specifically, methods development activities will focus on the ability to detect and quantify contaminants of interest and to understand linkages between biogeochemistry and fate and transport. This is a critical foundation for understanding the potential impacts that contaminants like HABs and PFAS can have on water availability. Additional research will focus on developing proxy approaches for monitoring and detecting PFAS, HABs, and metal in surface water as well as improving prediction capabilities for the constituents identified as priority issues by stakeholders in IWS basins including sediment, salinity, selenium, carbon, and nutrient dynamics.

Social and Economic Drivers: These activities focus on better understanding the impacts of and interactions between socioeconomics and water availability. A comprehensive understanding of the social and economic factors that drive water demand and alter water supply is needed to assess water availability in a predictive framework. Assessment and model development will identify the economic sectors, ecosystem goods and services, and other social, cultural, and economic factors that affect, or are affected by, water availability. When considering these factors, water quality is an integral driver in socioeconomic decisions related to water availability given its role in the suitability of water resources for use. For example, under drought conditions, water resources managers must weigh water demand with the intended uses (e.g., irrigation vs. public supply vs. mining) and the costs for the required treatment of each use. In 2024, the USGS will continue studies aimed at understanding interactions such as how risk and vulnerability influence water demand, use, and movement regionally. These efforts will improve the ability of the National Water Census to forecast availability under a variety of conditions.

Water Availability Impacts of Extreme Events: The NWQP is working to understand how extreme events impact water availability through short-term changes in the quality of resources accessible for use. The initial focus of research activities will be on the impact of wildfire and hurricanes on water availability. In 2024, the USGS will continue developing the capacity to predict wildfire impacts on water availability using a strategic, nationally-consistent approach to quantify critical drivers of water-quality impairment. Improvements in measurement, assessment, and modeling techniques will allow USGS to produce near-real time predictions of wildfire impact for post-fire debris flows and water-availability impairment. These activities support the goals and strategies of the USGS Wildland Fire Strategic Plan released in February 2021. Additional efforts include developing a strategy for predicting short- and long-term water availability impacts of hurricanes.

Observing Systems

The USGS operates a suite of surface water and groundwater networks that provide real-time data on water levels, streamflow, and a variety of water-quality parameters such as dissolved oxygen, pH, specific conductance and temperature, as well as discrete water-quality data on contaminants. The NWQP primarily supports the networks that provide data on water quality, while also investing in next-generation water observing systems designed to enhance and integrate monitoring for water quantity, quality, and use. This integration is increasingly important as the WMA works to improve the prediction skill of complex hydrologic and water-quality models and ultimately improve understanding of water-availability and stakeholder decision-making.

National Water Quality Network (NWQN) for Streams and Rivers: The NWQN is the only nationally designed, long-term monitoring network for tracking the quality of rivers and streams with consistent, comparable data collection and analytical methods at all sites. NWQN data is primarily collected through discrete sampling at sites; however, a growing number of sites have sensors that provide continuous, real-time water-quality conditions. Through NGWOS, new sensors and instruments will be developed and implemented to measure more types of contaminants on a continuous basis and deliver information to users in real-time. In 2024, the USGS will continue monitoring at 100 sites in the NWQN covering important environmental settings (e.g., small agricultural and urban watersheds, large inland and coastal rivers, and minimally disturbed reference watersheds).

Improving Program Performance
Advancing USGS Monitoring Capabilities using Satellite Remote Sensing and Autonomous Underwater Vehicles (AUVs)

The USGS has begun combining traditional surface-water synoptic surveys with satellite remote sensing data and autonomous earth-based technology to produce integrated surveys of water quality, bottom shape, and velocity in rivers, lakes, and reservoirs. A synoptic survey produces a nearly instantaneous picture of a characteristic of interest over a broad area. Synoptic surveys of a water body often require many people and many hours to complete, depending on the extent of the survey and the purpose of the study. Typically, these surveys target a single characteristic, such as the extent of algal blooms. However, conducting these synoptic surveys simultaneously with a high-resolution three-dimensional survey of depth, water quality, velocity, and sonar imagery using an AUV and combining with satellite imagery can efficiently create an enhanced dataset that allows for a more holistic understanding and prediction of common environmental problems in both monitored and unmonitored locations across the country.

National Groundwater Quality Monitoring Networks (NGWQMN): The USGS monitors groundwater quality conditions through an enterprise of approximately 80 long-term networks across the U.S. These groundwater-quality monitoring networks track water quality conditions in principal aquifers across the U.S. Concentrations of constituents, such as arsenic, nitrate, metals, pesticides, volatile organic compounds, and per- and polyfluoroalkyl substances (PFAS) are compared to benchmarks established for the protection of human health. Users can access an online tool to see how concentrations of these constituents in groundwater are changing during decadal periods across the Nation. In 2024, the USGS will continue sampling through these networks.

National Atmospheric Deposition Program (NADP): The USGS monitors wet atmospheric deposition (chemical constituents deposited via snow, sleet, rain) in the U.S. through the interagency NADP. The USGS supports sites in the National Trends, Mercury Deposition, and Mercury Litterfall networks, which provide long-term, high-quality data to support decisions related to sources of water-quality impairment, and watershed studies. In 2024, the USGS will continue to support monitoring through the NADP.

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Water Resources
Water Resources Research Act Program

Water Resources $ in thousands	2022 Actual	2023 Enacted	2024 Fixed Costs (+/-)	2024 Internal Transfers (+/-)	2024 Program Changes (+/-)	2024 Request	Change from 2023 Enacted (+/-)
Water Resources Research Act Program	**14,000**	**15,500**	**0**	**0**	**-500**	**15,000**	**-500**
PFAS Research	[2,500]	[3,000]	0	+0	-500	[2,500]	[-500]
FTE	***2***	***2***	***0***	***0***	***0***	***2***	***0***

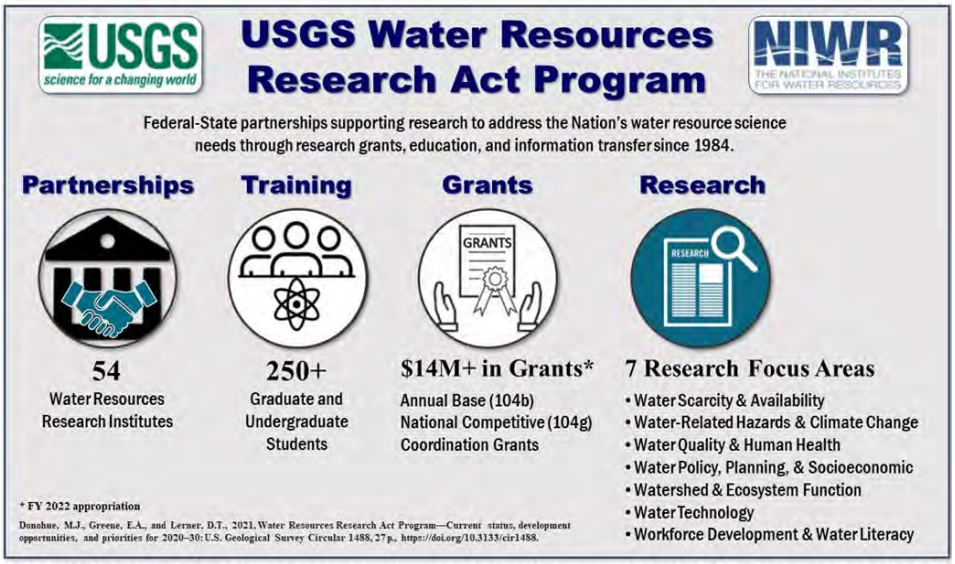
Justification of 2024 Program Changes

The 2024 budget request for the Water Resources Research Act Program (WRRA) is $15,000,000 and 2 FTE, program change of -$500,000 and 0 FTE from the 2023 Enacted.

Water Resources Research Institute Grants (-$500,000 / 0 FTE) – The USGS would continue to support competitive grants for research to improve understanding of the fate, persistence, and transport of PFAS, but at a reduced level.

Program Overview

The Water Resources Research Act, authorized by section 104 of the Water Resources Research Act (WRRA) of 1984, is a Federal–State partnership that plans, facilitates, and coordinates water resources research, education, and information transfer through a matching grant program.



FY 2022 Status of Water Resources Research Act Program. The WRRA Program provided over $14 million in grants to support water resources research within seven primary focus areas and promoted the education and training of students.

The WRRA authorized the establishment of State Water Resources Research Institutes (National Institutes for Water Resources; NIWR) at land grant universities across the Nation. There are currently 54 Institutes: one in each State, Puerto Rico, the District of Columbia, U.S. Virgin Islands, and Guam. The Institute in Guam serves the Federated States of Micronesia and the Commonwealth of the Northern Mariana Islands. The Institute in Hawaii also serves American Samoa.

Annual Base Grants

Under the provisions of section 104 of the Water Resources Research Act of 1984, annual base grants (104b) are awarded to the Institutes or Centers that have been established in each of the 50 States, the District of Columbia, Puerto Rico, the U.S. Virgin Islands, and Guam. Annual base grants are required to have a 1:1 match by the Institute and are used to fund projects that are selected at the Institute through a competitive selection process that is run by each Institute within their respective States. The annual base grants help each Institute or Center to plan and conduct applied and peer reviewed research on water resource issues that address State needs. Institutes also use their base grants to help train new scientists, disseminate research results to water managers and the public, and cooperate with other colleges and universities in their respective States and with other institutes and other organizations in their regions to promote regional coordination. Through research projects, the WRRA program directly supports more than 250 undergraduate and graduate students each year. In addition, USGS grants help to support information transfer activities including an annual conference at every institute to facilitate the transfer of research progress and findings to the hydrologic research community as well as the public at large. In FY 2024, the USGS will continue to support base grants to all 54 Institutes.

National Competitive Grants

The WRRA program, in cooperation with the Institutes, supports an annual call for proposals to focus on priority water issues that are of a regional or interstate importance or relate to a specific priority topic identified annually by USGS, the Department, and the Institutes. These competitive grants (104g) allow the WRRA Program to focus the collaborative research between USGS and university scientists on significant national and regional water resource issues while promoting the dissemination of results and supporting the training of scientists in water resources. Any investigator at an accredited institution of higher learning in the U.S. is eligible to apply for a grant through an Institute or Center established under the provisions of the Water Resources Research Act of 1984. However, these grants must be matched with non-federal dollars on a 1:1 basis. Successful research topics have included research on improving and enhancing the nation's water supply; developing innovative approaches to water treatment; evaluation of the dynamics of extreme hydrological events and associated costs; development of methods for better estimation of the physical and economic supply of water; developing approaches for integrated management of ground and surface waters; and the evaluation and assessment of conservation practices.

A subset of these competitive grants is offered for specific priority research areas. One of those is aquatic invasive species and grants are selected to improve our understanding of the impacts of aquatic invasive species on lakes and rivers in the Upper Mississippi River basin, including on changes to water quantity, quality and the connected ecosystem dynamics.

Coordination Grants

These grants allow Federal agencies, including those within the Department of the Interior, to use and take advantage of the expertise and capabilities that are available through the network of Institutes. The

USGS may accept funds from other Federal departments or agencies concerned with water resources problems and issues establish a grant with an Institute to conduct hydrologic research. Historically, these grants have been used by several agencies including the Environmental Protection Agency and U.S. Army Corps of Engineers. The USGS fully supports and encourages other Federal programs to develop grants with the Water Resources Research Institutes in cooperation with the USGS.

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Core Science Systems

Core Science Systems $ in thousands	2022 Actual	2023 Enacted	2024 Fixed Cost (+/-)	2024 Internal Transfers (+/-)	2024 Program Changes (+/-)	2024 Request	Change from 2023 Enacted (+/-)
National Geospatial Program	**87,526**	**93,650**	**+2,146**	**0**	**+1,722**	**97,518**	**+3,868**
FTE	***229***	***234***	***0***	***0***	***+7***	***241***	***+7***
National Cooperative Geologic Mapping Program	**42,431**	**44,556**	**+1,118**	**-350**	**-3,000**	**42,324**	**-2,232**
FTE	***123***	***123***	***0***	***0***	***0***	***123***	***0***
Science Synthesis, Analysis and Research Program	**26,353**	**30,480**	**+782**	**+350**	**+53,450**	**85,062**	**+54,582**
FTE	***77***	***82***	***0***	***0***	***+4***	***86***	***+4***
National Land Imaging Program	**107,492**	**115,921**	**+2,136**	**0**	**+25,650**	**143,707**	**+27,786**
FTE	***177***	***183***	***0***	***0***	***+42***	***225***	***+42***
Core Science Systems Total	**263,802**	**284,607**	**+6,182**	**0**	**+77,822**	**368,611**	**+84,004**
FTE	***606***	***622***	***0***	***0***	***+53***	***675***	***+53***

The 2024 budget request for the Core Science Systems Mission Area (CSS) is $368,611,000 and 675 FTE, a program change of +$77,822,000 and +53 FTE from the 2023 Enacted.

Mission Area Overview

The USGS is the Federal agency responsible for mapping the geologic, geographic, and land features of the United States. The USGS, through CSS, conducts detailed surveys and distributes high-quality and highly accurate topographic, geologic, hydrographic, and biogeographic maps and remotely sensed data to the public. Mapping accuracy enabled by cutting-edge technologies allows precise planning for: recreational use on public lands; collaborative conservation with Department of the Interior (Interior) partners; conservation and natural hazard resilience; critical mineral resource assessments; renewable energy development; transportation and pipeline infrastructure projects; urban planning and development;

land change and flood prediction at regional, local, and neighborhood scales; emergency response; and hazards mitigation.

The physical structure of the Earth underpins all life on it. The precise maps and data products the USGS delivers from our cutting-edge Earth surveys and explorations help us better understand the planet to aid in every aspect of human society, from economic planning to natural disaster prediction and response to natural resources management. The CSS fulfills the USGS' role as the primary national civilian mapping agency, including topographic and geologic mapping in support of Federal and State requirements, national geospatial coordination in support of Interior and the Federal Geographic Data Committee, geospatial mapping and applications through the Civil Applications Committee, and satellite operations and remote sensing. In addition, the CSS provides: research, modeling, and analysis of land change science, biological occurrence data acquisition, biological taxonomic analysis and interpretation, computational analytics and synthesis; integration of USGS national data sets, data management, storage, accessibility and policy; preservation of geological, geophysical, and paleontological data; management of the archive of geoscience samples, including rocks, fossils, sediments, and ice cores; and management of the network of libraries in support of USGS Earth science research.

The CSS manages the Nation's land imagery to support economic development, land use management, environmental protection, and climate change resilience. Additionally, the CSS houses the USGS Associate Chief Data Officer with delegated authority from the Interior Chief Data Officer to support the lifecycle and manage the portfolio of data assets from their respective bureau or office, champion data inventory and dissemination, and engage with data users and evaluation units within the organization.

The USGS, through CSS, is the Federal steward of high-quality geospatial data and provides access to the public through The National Map, the Federal Geospatial Platform, the National Land Cover Database, the National Geologic Map Database, USGS Earth Explorer, the National Biogeographic Map, and the Protected Areas Database of the United States. The CSS also operates Landsat satellites and data systems necessary to understand, monitor, and detect changes that affect the Nation's natural and agricultural resources, economy, public safety and national security, and historical heritage.

FY 2022 Selected Mission Area Accomplishments

- Completed the Landsat 9 satellite commissioning and its mission transition from the National Aeronautics and Space Administration (NASA) to the USGS, continuing the 50-plus year record of data availability used to monitor changes on the land surface of the Earth.
- Updated the Protected Areas Database of the United States (PAD-US) to include data updates from eight federal agencies and three states. Released two new interactive user-friendly tools– a new PAD-US Data Explorer that enables easy discovery, investigation, display and mapping of nearly 500,000 land and marine units and an interactive data dashboard enabling more-detailed spatial and analytic data summarization, which are already actively used in Wildland Fire emergency management systems, the Environmental Protection Agency's Environmental Atlas, and several U.S. and international protected areas research efforts.
- Achieved 89.5 percent coverage of the Nation with high-quality elevation data available or in progress by the USGS 3D Elevation Program (3DEP). Completed and released the 3D Nation Elevation Requirements and Benefits Study to help define the next generation of 3DEP data based on changing user needs for three-dimensional topographic and bathymetric mapping data.

- Awarded 87 cooperative agreements to external stakeholders at State geological surveys and universities in support of geologic mapping activities across the Nation. These cooperative agreements provided over $14.1 million to State Geological Surveys in support of STATEMAP, $1.1 million to universities in support of EDMAP, and $0.6 million to State Geological Surveys in the Great Lakes region in support of the Great Lakes Geologic Mapping Coalition. Over $15.8 million in USGS funding was distributed for a wide range of geoscience activities matched dollar-for-dollar by the recipient institutions.

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Core Science Systems
National Geospatial Program

Core Science Systems $ in thousands	2022 Actual	2023 Enacted	2024 Fixed Costs (+/-)	2024 Internal Transfers (+/-)	2024 Program Changes (+/-)	2024 Request	Change from 2023 Enacted (+/-)
National Geospatial Program	**87,526**	**93,650**	**+2,146**	**0**	**+1,722**	**97,518**	**+3,868**
Geospatial and Geologic Research and Collection on Tribal Lands	[230]	[330]	0	0	+3,670	[4,000]	[+3,670]
3D National Topography Model (3DNTM)	[0]	[500]	0	0	+1,000	[1,500]	[+1,000]
Federal Climate Data Portal	[0]	[0]	0	0	+10,000	[10,000]	[+10,000]
3D Elevation Program (3DEP)	[39,905]	[42,905]	0	0	-6,250	[36,655]	[-6,250]
Alaska Mapping and Map Modernization	[9,500]	[10,000]	0	0	-2,278	[7,722]	[-2,278]
National Digital Trails	[850]	[1,350]	0	0	-1,170	[180]	[-1,170]
USGS topoBuilder	[0]	[250]	0	0	-250	[0]	[-250]
Digital Surface Models	[3,000]	[3,000]	0	0	-3,000	[0]	[-3,000]
FTE	***229***	***234***	***0***	***0***	***+7***	***241***	***+7***

Justification of 2024 Program Changes

The 2024 budget request for the National Geospatial Program (NGP) is $97,518,000 and 241 FTE, a program change of +$1,722,000 and +7 FTE from the 2023 Enacted.

Geospatial and Geologic Research and Collection on Tribal Lands (+$3,670,000 / +1 FTE) – The USGS would significantly improve the amount of, and access to, geospatial data and mapping information for tribal communities with availability of data through The National Map and other existing data portals. In coordination with Tribes, the USGS would expand elevation and hydrography data collection over tribal lands, and geologic mapping information through detailed surveys of areas recognized to be vital to the economic, social, or scientific welfare of Tribes. Foundational elevation, hydrography, and geologic datasets, including acquisition of 3DEP high-resolution lidar data and curation

of data and maps, would support a broad range of critical conservation and land management needs of underserved tribal communities.

3D National Topography Model (3DNTM) (+$1,000,000 / +2 FTE) – The USGS and the National Oceanic and Atmospheric Administration (NOAA) are collaborating towards a "3D Nation vision" for a continuous three-dimensional (3D) elevation surface layer, from the peaks of our mountains to the depths of our waters. The 3DNTM is the terrestrial portion of the vision, which would integrate and model the Nation's elevation and hydrography in 3D. Combining the hydrography and elevation data would improve the accessibility of water related data, improve geospatial analysis, and support critical applications. The 3DNTM would continue the next phase of building a modern elevation foundation and would accelerate Federal, State, Tribal, and underserved community access to the next generation of topographic data, products, and services. The 3DNTM's state-of-the-art data and services would empower communities to plan for infrastructure projects and facilitate improvement of local economies. 3DNTM data would enable communities to effectively respond to fire and drought challenges and natural hazards by providing foundational data to analyze flood risk; manage land and water resources; locate potential areas for clean energy deployment; and support the mapping of broadband signal propagation to help improve access for underserved communities.

Federal Climate Data Portal (+$10,000,000 / +4 FTE) – The USGS would coordinate closely with other agencies and partners to improve Federal climate services and data delivery, providing accessible climate information to users to respond to climate risks and improve climate resilience. The funding would include support to accelerate development of an underpinning platform that serves climate information, model output and derivative datasets. This platform will enable the more efficient development of tools and applications that are tailored to specific agencies and groups of decision-makers, while enhancing coordination across the Federal government. The platform will enhance the new Climate Mapping for Resilience and Adaptation tool to help state, local, Tribal, and territorial governments and leaders better track real-time impacts, understand future impacts, and access Federal resources for long-term planning. Potential applications for this resource by decision makers and the public could include uses such as: exploring the potential impact of climate hazards on human populations, economies, and built and natural environments; assessing vulnerability and risk and determining which risks require actions; evaluating and evolving building standards and designs to help ensure that new infrastructure and capital improvement projects are climate resilient; and preparing climate impact assessments which are required in Federal grant applications. Funding would also expand the Federal Geographic Data Committee's (FGDC) capacity.

The FGDC would coordinate and collaborate across Federal agencies and with interagency groups to identify information gaps and needs and to recommend steps to better deliver that information to users. The FGDC would also assist in the development of geospatial standards and approaches for addressing Federal-wide data-service challenges such as metadata compatibility, data cataloging, and geospatial services delivery.

3DEP Elevation Program (-$6,250,000 / 0 FTE) – The 3D Elevation Program (3DEP) acquires light detection and ranging (lidar) data to enhance landscape-scale, three-dimensional maps for the Nation. At this level of funding, the USGS would complete 3DEP national coverage in 2027, two years slower than at the current funding level.

Alaska Mapping and Map Modernization (-$2,278,000 / 0 FTE) – The USGS would continue completion of the National Hydrography Dataset Plus High Resolution for Alaska but would not acquire targeted satellite imagery updates and high-resolution elevation data for landslide and flood-prone areas. Map modernizing efforts for the State of Alaska would be delayed.

National Digital Trails (NDT) (-$1,170,000 / 0 FTE) – The USGS would delay implementing improvements to trail planning tools relating to trail connectivity between Federal lands, public access for recreation, and new trail construction. Support for trail aggregation over State and local lands would end, impacting the USGS' ability to provide a nationwide public domain digital trail dataset.

USGS topoBuilder (-$250,000 / 0 FTE) – The USGS would reduce capabilities and total number of customized topo maps generated for this program.

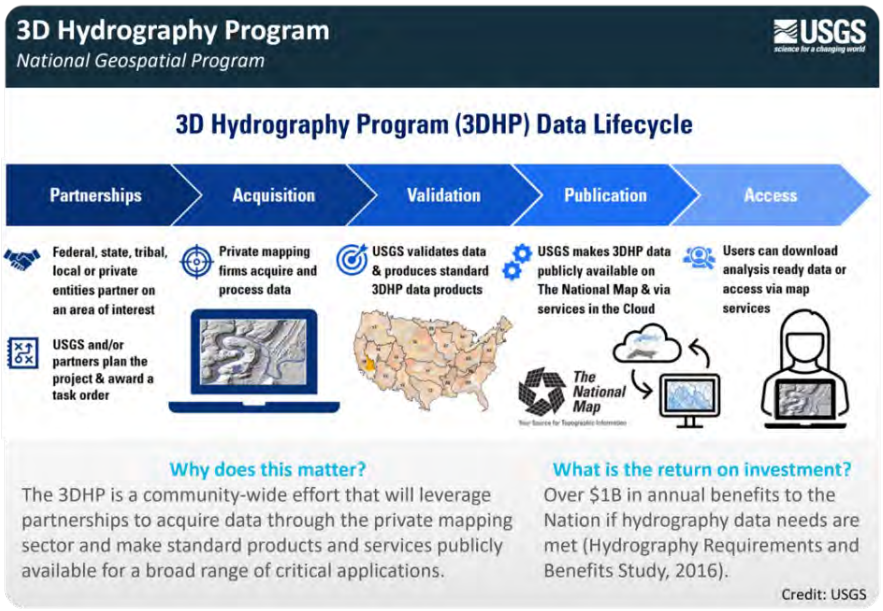
Digital Surface Models (-$3,000,000 / 0 FTE) – The USGS proposes to discontinue funding to produce digital surface models (DSM) in FY 2024. These funds were initially intended to produce an interim product for the USGS while 3DEP completed coverage in areas not covered by lidar acquisition. The interim products were of limited use for the 3DEP Program. By FY 2024, nearly all DSM source data for remaining areas not acquired by 3DEP will have been acquired or would be in process for production. This reduction would have minimal impact on completing acquisition of the national baseline of 3DEP or on USGS operations.

Program Overview

The NGP organizes, updates, and publishes the geospatial baseline of the Nation's topographic information, to advance science, enlighten citizens, and support decision-making through The National Map—a compilation of the foundational data layers for the entire Nation, maintained in the public domain. The USGS 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 online, as products and services, and as downloadable data allowing the public to enhance their recreational experiences, make life-saving decisions, and support scientific missions. The American people rely on the USGS's publicly available data and mapping to remain informed and to stay healthy and safe.

3DEP: The goal of the USGS 3DEP is to provide the first-ever national baseline of consistent high-resolution topographic elevation data, including both the bare Earth surface and 3D point clouds that map the Nation's natural and constructed features. The USGS 3DEP data directly support Departmental and Administration priorities, including clean energy deployment, infrastructure, and identification of undiscovered critical minerals, climate resilience, conservation, and Tribal programs. High accuracy 3DEP data are also used for determining broadband signal propagation routes to provide internet access to underserved communities, supporting racial and economic equity.

3D National Topography Model (3DNTM): The USGS produces and delivers the Nation's most comprehensive and up-to-date portfolio of surface waters datasets, including the National Hydrography Dataset, the Watershed Boundary Dataset, and the National Hydrography Dataset Plus High Resolution. With the FY 2024 proposal, the USGS would build on these baseline programs to develop the 3DNTM, which integrates USGS elevation and hydrography datasets to model the Nation's topography in three dimensions (3D). In the future, the 3DNTM would include next generation 3DEP data and modernized hydrography data, as the future of the 3D Elevation Program and the 3D Hydrography Program (3DHP) are defined.



The USGS is the lead domestic civilian mapping agency, producing topographic maps for the Nation for more than 140 years. In addition to the standard digital US Topo map product, the USGS Published Maps, Products, and Services (PMPS) component has embarked on a new paradigm of topographic mapping generation and delivery. PMPS has invested in a new cloud-based platform which enables users to request and receive custom, on-demand topographic maps.

The Federal Geographic Data Committee (FGDC) is an interagency coordinating committee, which acts as the lead entity in the Executive Branch for the development, implementation, and review of policies, practices, and standards related to geospatial data. The FGDC is responsible for implementing the Geospatial Data Act of 2018 (GDA; P.L. 115-254; 43 USC Ch. 46) and cross-government and national geospatial initiatives, including the Geospatial Platform (GeoPlatform), the National Spatial Data Infrastructure (NSDI), and Federal geospatial data portfolio management practices. The FGDC coordinates with other interagency working groups including the Chief Data Officers Council and is responsible for actions in the Federal Data Strategy. The FGDC Office of the Secretariat provides executive, administrative, planning, and technical support to the Committee, and to the National Geospatial Advisory Committee of non-Federal geospatial sector representatives, as directed by the GDA. The FGDC leads the development of the NSDI Strategic Plan, in accordance with OMB Circular A-16 and supplemental guidance (*Coordination of Geographic Information and Related Spatial Data Activities*).

The GDA directs covered agencies to include geospatial data in preparing the budget submission under sections 1105(a) and 1108 of Title 31 of the U.S. Code. The Department of the Interior is a covered agency under the GDA, and the Office of the Chief Information Officer (OCIO) provides vision and leadership to Departmental offices and bureaus in all areas of information management and technology.

The OCIO provides oversight and governance across Interior for geospatial programs and submits an annual Joint Certification Statement on geospatial data assets and major geospatial information technology investments, including the GeoPlatform, as a part of the Department of the Interior’s Federal IT Acquisition Reform Act Joint Certification Statement in the President's Budget Request.

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Core Science Systems
National Cooperative Geologic Mapping Program

Core Science Systems $ in thousands	2022 Actual	2023 Enacted	2024 Fixed Costs (+/-)	2024 Internal Transfers (+/-)	2024 Program Changes (+/-)	2024 Request	Change from 2023 Enacted (+/-)
National Cooperative Geologic Mapping Program	**42,431**	**44,556**	**+1,118**	**-350**	**-3,000**	**42,324**	**-2,232**
National Cooperative Geologic Mapping Program Projects and 3D Geologic Mapping	[41,897]	[43,397]	0	0	-3,000	[40,397]	[-3,000]
FTE	***123***	***123***	***0***	***0***	***0***	***123***	***0***

Justification of 2024 Program Changes

The 2024 budget request for the National Cooperative Geologic Mapping Program is (NCGMP) $42,324,000 and 123 FTE, a program change of -$3,000,000 and 0 FTE from the 2023 Enacted.

National Cooperative Geologic Mapping Program Projects and 3D Geologic Mapping (-$3,000,000 / 0 FTE) – This request would reduce funding for the Federal mapping component, STATEMAP, and EDMAP proportionately based on the algorithm defined by the National Geologic Mapping Act of 1992 (P.L. 102-285) and subsequent reauthorizations. Subsequently, the USGS would slow production of 3-D geologic maps for the Nation; reduce the number of STATEMAP grants to State Geological Surveys; and reduce the number of EDMAP grants to colleges and universities.

Program Overview

The USGS NCGMP conducts geologic investigations and produces geologic maps and three-dimensional geologic framework models in collaboration with State Geological Surveys and university partners. The national geologic framework model is a three-dimensional visualization of surface and subsurface rock, soil, and sediment layers. This model is used to inform the responsible use of land, water, energy, and mineral resources and address the Nation's rapidly changing natural resource needs. Federal and State decision-makers use the digital geologic maps and three-dimensional geologic framework models and visualizations to help mitigate natural hazards; conduct energy and mineral resource assessments at county and regional scales; and assess hydrogeology and groundwater availability—all of which sustain and improve the quality of life and economic vitality of the Nation.

The Federal mapping component, or FEDMAP, supports research on the Earth's surface and subsurface geologic framework to solve critical societal and scientific problems.

The State mapping component, or STATEMAP, funds the geologic mapping studies conducted by approximately 44 State Geological Surveys through a competitive cooperative agreement program that matches every Federally-provided dollar with a State-provided dollar.

The educational component, or EDMAP, funds competitive grants to universities and colleges for undergraduate and graduate students to conduct geologic mapping across the Nation in support of the Administration's priority for educating and training a 21st century workforce.

The National Geologic Map Database (NGMDB) serves as the authoritative, comprehensive, and publicly-available repository for the geologic maps and data produced by the NCGMP mapping components. The USGS manages the NGMDB in partnership with State Geological Surveys.

The USGS' substantial engagement with State governments supports mapping regions with high potential for strategic materials for the supply chain.

Core Science Systems
Science Synthesis, Analysis and Research Program

Core Science Systems $ in thousands	2022 Actual	2023 Enacted	2024 Fixed Costs (+/-)	2024 Internal Transfers (+/-)	2024 Program Changes (+/-)	2024 Request	Change from 2023 Enacted (+/-)
Science Synthesis, Analysis and Research Program	**26,353**	**30,480**	**+782**	**+350**	**+53,450**	**85,062**	**+54,582**
Advanced Research Computing Environment	[0]	[3,650]	0	0	+26,350	[30,000]	[+26,350]
The American Conservation and Stewardship Atlas	[900]	[900]	0	0	+24,600	[25,500]	[+24,600]
Assessment of Biodiversity	[0]	[0]	0	0	+2,500	[2,500]	[+2,500]
FTE	***77***	***82***	***0***	***0***	***+4***	***86***	***+4***

Justification of 2024 Program Changes

The 2024 budget request for the Science Synthesis, Analysis, and Research Program (SSAR) is $85,062,000 and 86 FTE, a program change of +$53,450,000 and +4 FTE from the 2023 Enacted.

Advanced Research Computing Environment (+$26,350,000 / 0 FTE) – This request supports a high-performance computing (HPC) initiative that would transform USGS science data delivery. Advanced Scientific Computing will help USGS transform fire and drought science delivery for resource managers, as described in the Ecosystems and Water Resources Mission Areas chapters. The USGS proposes to invest in scalable, on-demand operational HPC systems, including HPC cloud integration, large-scale integrated observational data storage and discovery platforms, edge computing, and modern artificial intelligence/machine learning (AI/ML) architectures that would begin to provide timely, accurate Earth systems forecasting (drought, weather, land management, wildland fires, landslides, volcanos). For example, during the 2018 Kilauea eruption, USGS scientists used the HPC resources to reduce lava flow modeling time from 27 hours to 30 seconds for analysis, allowing emergency responders to provide more timely evacuation routes. The additional computational capacity would also reduce barriers between science production and user application. Several studies within the USGS and the Department of the Interior (Interior) have shown the tremendous benefits through increased scale and scope of research that can be undertaken and decreased computational time achieved through broader implementation of these scientific computing capabilities. The USGS would also invest in additional computer and data scientists, known as research facilitators, to educate and collaborate with researchers on the effective use of HPC

systems, tools, and related AI/ML technologies for Earth systems weather and hazards forecasting and landscape-scale planning for land management.

America the Beautiful and American Conservation and Stewardship Atlas (+$24,600,000 / +4 FTE) – This request would fund the American Conservation and Stewardship Atlas (Atlas), a platform that would bring together communities across America, deliver evidence-based information, and support planning for and assessment of land and natural resources. Conserving and restoring the lands, waters, and nature requires locally-led, nationally-scaled efforts and high-quality information to strengthen decisions on prioritizing, implementing, and assessing land management outcomes. The Atlas would be a visual, interactive way to tell the story of land and nature in America. Through the Atlas, Americans would see where activities occur, where natural resources and societal interests intersect, and where additional effort could make the greatest impact for local communities and conditions.

The Atlas has extensive information technology and data curation requirements identified by Federal, State, Tribes, and non-governmental organizations (NGOs) to support conservation progress in several settings, from protected lands to working lands. The proposed increase includes funding for completing and modernizing the Protected Areas Database of the United States (PAD-US), America's official national inventory of U.S. terrestrial and marine protected areas. The USGS would modernize the PAD-US technology infrastructure to automate integration of partner data and provide national-scale analytics and data delivery in support of the Atlas. When complete, the Atlas would provide information needed to assess the state of conservation nationally. The Atlas would also provide integrated scenario analyses and visualization tools that allow Interior and the broader land management community to co-produce approaches specific to the issues of concern using the best available science.

This request is responsive to the outcomes of three national listening sessions with a variety of stakeholders, interest groups across the landscape, and the public accentuating the significant need for this Atlas. This funding would enable the USGS to fully establish an open and automated Atlas infrastructure using state-of-the-art technology solutions to integrate current data from a variety of sources, develop map and analytical capabilities, partner with State, local, and Tribal organizations as well as NGOs to meet these requirements, and accelerate the delivery of the Atlas by 2026. The USGS would provide direct funding to tribal Nation organizations, State organizations, NGOs, and other Federal agency data partners to update and collect data on land status; develop user-interactive analytics to evaluate various land management strategies and potential outcomes; and implement automated data workflows to improve access, use, and availability of authoritative data for science-based conservation actions.

Assessment of Biodiversity (+$2,500,000 / 0 FTE) – The USGS proposes to deliver a National Biodiversity Assessment Dashboard to conduct an initial assessment that identifies nationwide biodiversity metrics; evaluates the role of protected areas; and projects vulnerabilities under future climate conditions. This assessment would allow the USGS to provide vital information to help communities and Tribes to implement climate adaptation, resilience, and clean energy strategies and assist in providing equitable access to managed lands for underserved communities. The National Biodiversity Assessment Dashboard would be integrated with PAD-US to facilitate on-demand biodiversity assessments and analysis on protected area lands.

Program Overview

The SSAR provides analysis and synthesis of scientific data and information, interdisciplinary research to improve understanding of Earth system changes, and preservation of scientific data and samples and

library collections. This program strives to accelerate research and decision-making through data science, information delivery, advanced computing, biodiversity analytics, multi-hazard risk assessments, and preservation of geoscientific assets for reuse. SSAR ensures that data are strategically managed, integrated, and easily available to decision makers and others as they focus on issues associated with Earth and life science processes.

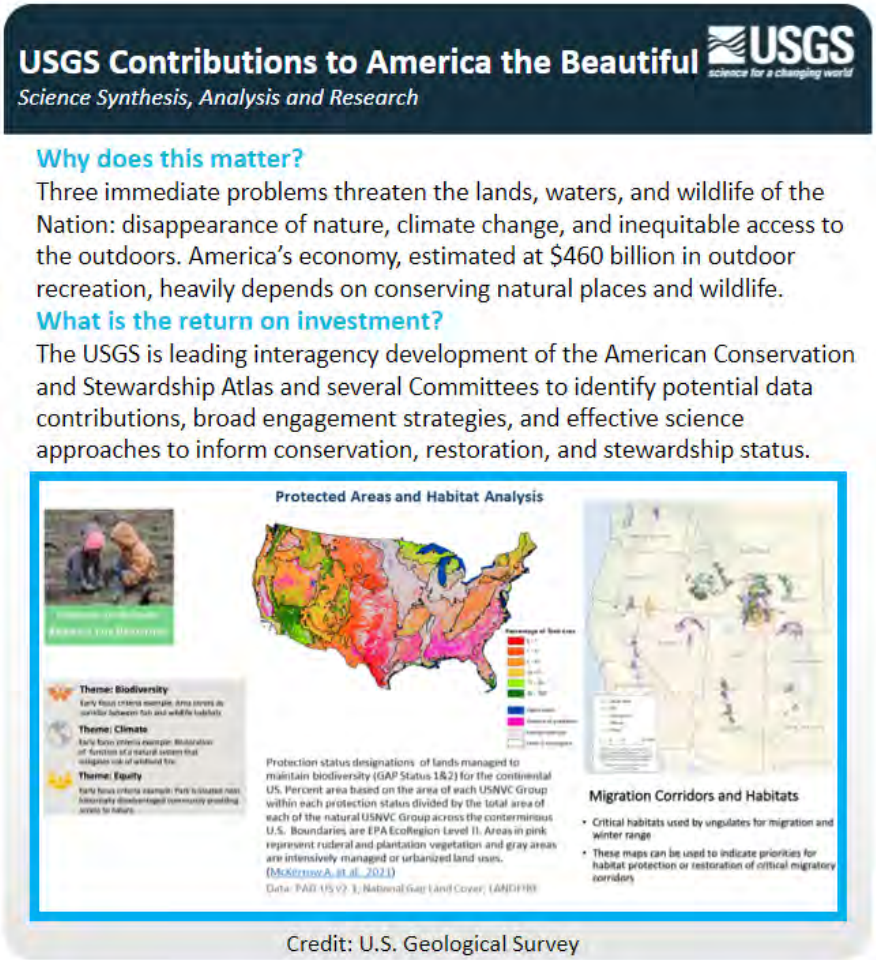
The program includes the Science Analytics and Synthesis Program; National Geological and Geophysical Data Preservation Program; Geologic Materials Repository; J.W. Powell Center for Analysis and Synthesis; and USGS Library. Answers to today's science challenges are complex, multidisciplinary, and global in scope. Access to scientific data, samples, and literary resources is the foundation of scientific discovery. These assets require preservation, modernization, and documentation so that they are available for future research. The Nation has invested heavily in the initial acquisition of these scientific resources and the USGS is making these data and unique historical assets Findable, Accessible, Interoperable, and Reusable (FAIR).

The SSAR program, through interdisciplinary approaches, tools, and expertise, and strategic partnerships with the Earth science community, provides the long-term management and public distribution of scientific resources that are collected, processed, analyzed, and reused by researchers who conduct broad, complex analyses using the program's high-performance computing, enterprise data management, and historical research assets contained in the vast USGS scientific collections. USGS publications and science data are distributed and managed through a suite of enterprise data management applications such as the USGS Publications Warehouse and ScienceBase, a trusted digital repository. Scientists conduct complex analyses using advanced research computing capacity including powerful supercomputers, large data transfer and storage, training, and expert consulting. Scientists, policymakers, and land conservation and resource management decision-makers rely on immediate access to this timely, well-curated, high-quality science to make well-informed decisions.

The USGS, other Interior bureaus, and State geological surveys manage a wealth of geological data and physical samples. The National Geological and Geophysical Data Preservation Program provides grants to State geological surveys, and funds projects in Interior's bureaus, to document, modernize and archive these valuable assets and make them available to the public. The USGS Geological Materials Repository provides bureau-wide consultation, training, and repository services for USGS scientific working collections management. The USGS Library, authorized by Congress in 1879, is recognized as one of the world's largest Earth and natural science libraries. Each year, the USGS Library fills more than 2.5 million electronic information requests (journal subscriptions, website content, USGS Publications Warehouse visitors) and an estimated 10,000 service requests from USGS scientists and the public.

There is an imminent need to mitigate threats and foster resiliency to support conservation of America's lands, waters, and biodiversity. SSAR is engaged in interagency efforts, like those called for in a recent Administration report on "Conserving and Restoring America the Beautiful," to accelerate the application of scientific information in planning and decision-making. SSAR partners with natural resource managers to co-produce purpose-built tools such as the Atlas, PAD-US, National Fish Habitat Partnership, the Global Biodiversity Information Facility – US Node, and the Species of Greatest Conservation Need national database.

The SSAR program also provides biogeographic data and science products, ensuring usefulness for science-based management decisions. By employing expertise and resources in data management, high-performance computing, and visualization, the SSAR is working within the USGS, Interior, and with external partners to compile, synthesize, and analyze data representing species, their habitats, threats, and protections. Integration of these data provides the foundation for multi-hazard risk and vulnerability assessments and forecasting of ecological change.



Credit: U.S. Geological Survey

Core Science Systems
National Land Imaging Program

Core Science Systems $ in thousands	2022 Actual	2023 Enacted	2024 Fixed Costs (+/-)	2024 Internal Transfers (+/-)	2024 Program Changes (+/-)	2024 Request	Change from 2023 Enacted (+/-)
National Land Imaging Program	**107,492**	**115,921**	**+2,136**	**0**	**+25,650**	**143,707**	**+27,786**
Science Research and Investigations	**22,704**	**23,737**	**[+1,068]**	**0**	**[+8,650]**	**33,455**	**[+9,718]**
Land Change Monitoring, Assessment, and Projection	[3,858]	[3,893]	0	0	+5,365	[9,258]	[+5,365]
Biologic Carbon Sequestration	[0]	[500]	0	0	+3,500	[4,000]	[+3,500]
Remote Sensing State Grants	[1,250]	[1,465]	0	0	-215	[1,250]	[-215]
Satellite Operations	**84,788**	**92,184**	**[+1,068]**	**0**	**[+17,000]**	**110,252**	**[+18,068]**
Sustainable Land Imaging Development-Landsat Next	[84,788]	[91,334]	0	0	+12,000	[103,334]	[+12,000]
Commercial Satellite Data Pilot	[0]	[0]	0	0	+5,000	[5,000]	[+5,000]
FTE	***177***	***183***	***0***	***0***	***+42***	***225***	***+42***

Justification of 2024 Program Changes

The 2024 budget request for the National Land Imaging Program is $143,707,000 and 225 FTE, a program change of +$25,650,000 and +42 FTE from the 2023 Enacted.

Land Change Monitoring, Assessment, and Projection (+$5,365,000 / +20 FTE) – The USGS proposes to accelerate and augment the delivery of land change monitoring assessment and projection (LCMAP) activities including improving land cover classification, characterizing land use, and expanding to Alaska, Hawaii, and U.S. Territories. This would allow the USGS to analyze rates and trends in land cover and condition change from the past to the present (the current LCMAP collection covers 1985 to 2021); link the analyses to protection status and land ownership; and include an assessment of causes of landscape change, including land use, natural disturbance, and climatic factors. This information is important because monitoring and assessing changes in historic and current land cover and use—and their

subsequent impacts on human and biological communities—help scientists better understand the drivers and impacts of these changes, including those from drought, wildland fire, disasters, land use, water use and availability. The delivery would include modeling of short-term weather patterns, long-term climate scenarios, land management practices, carbon and hydrological cycles, with national-scale maps of past, present, and future landscape conditions to support the Administration's America the Beautiful, Natural Capital Accounting, Nature-Based Solutions, and the Nature Assessment initiatives.

Biologic Carbon Sequestration (+$3,500,000 / +9 FTE) – The USGS proposes to enhance, streamline, and deliver regular assessments of carbon stocks, fluxes, sequestration, and emissions for landscapes across the Nation. The USGS continues to develop integrated land cover land use change, climate, hydrologic and economic scenarios of enhanced carbon management and avoided emissions in the public land management portfolio. The USGS would produce a baseline assessment of current carbon stocks and fluxes in various terrestrial ecosystems throughout the country for modeling of future ability for carbon sequestration and emissions. The USGS would work with land management agencies to identify methods that could optimize the protection of carbon resources, adaptation to future change and mitigation strategies to serve stakeholders (e.g., forestry, biodiversity, water resources). The USGS would initiate studies on the feedback between climate change, wildland fire, permafrost thaw, hydrologic change, greenhouse gas emissions, infrastructure, and vulnerability of landscapes in Alaska, an area with rapid climate change.

Sustainable Land Imaging Development-Landsat Next (+$12,000,000 / +10 FTE) – This request ensures the USGS has sufficient funding for the joint agency DOI/National Aeronautics and Space Administration (NASA) Sustainable Land Imaging (SLI) program, including ground system development to support the launch and operation of Landsat Next to stay on track with NASA in the Landsat Next joint mission and achieve the goals of the Sustainable Land Imaging Program. To ensure that sufficient funding is available to fund the peak development, a $12.0 million increase is needed in FY 2024. Without this increase, the USGS would not be able to keep pace with Landsat Next development timelines while simultaneously operating the Landsat 8 and 9 satellites, collecting, archiving, and processing their data, and providing access to the users.

Landsat Next would deliver far more capability than Landsat 8 and 9, meeting more agency and partner needs across the DOI and Federal agencies with twice the number of spectral bands, better than twice the spatial resolution, and better repeat coverage than Landsat 8 and 9 combined. The new Landsat Next capabilities would dramatically improve Landsat data to make it more useful for science and operational applications across the Federal government including monitoring fast-moving events such as crop growth and coastal change; natural hazards including wildfire; water use and water quality, and mineral mapping. With the aging Landsat 8 satellite in orbit, it is critical to support the development of Landsat Next now to ensure that no break occurs in the (by then) nearly 60-year Landsat data record. Continuous Landsat measurements ensure a consistent record of Earth surface changes envisioned for future decades.

Commercial Satellite Data Pilot (+$5,000,000 / +3 FTE) – This request would fund a pilot to better understand how acquiring commercial satellite data can help provide higher-resolution, full-spectral coverage, time-sensitive land imaging data and derivative products. The initiative would pilot various methods for acquiring products from commercial optical and radar satellites and upgrade the USGS infrastructure for accessing these data. Commercial optical satellite data can augment Landsat capabilities with nimble, high-resolution, targeted area data collection to monitor rapidly changing land conditions

caused by floods, volcanic eruptions, and landslides. Commercial radar data could also enable improved monitoring of land subsidence, forest structure, and infrastructure changes.

With this increase, the USGS would acquire data and products that are not readily available from existing mechanisms. Agency operational needs would be identified through a periodic request for information to Federal users. The USGS would follow NASA and the National Reconnaissance Office's best practices on purchasing commercial satellite data while evaluating commercial satellite vendors. This proposal ensures the USGS could successfully identify, evaluate, and access suitable commercial satellite data to augment the SLI program's products and services that need high-resolution optical, radar, and hyperspectral data. Advancing the use of commercial satellite data supports U.S. remote sensing space policies that seek to promote the use of U.S. commercial remote sensing satellite systems to the maximum practical extent.

Remote Sensing State Grants (-$215,000 / 0 FTE) – This request would reduce funding for the National Land Remote Sensing Education Outreach and Research Activity, a grant program focused on promoting the uses of space-based land remote sensing data with qualified educational institutions.

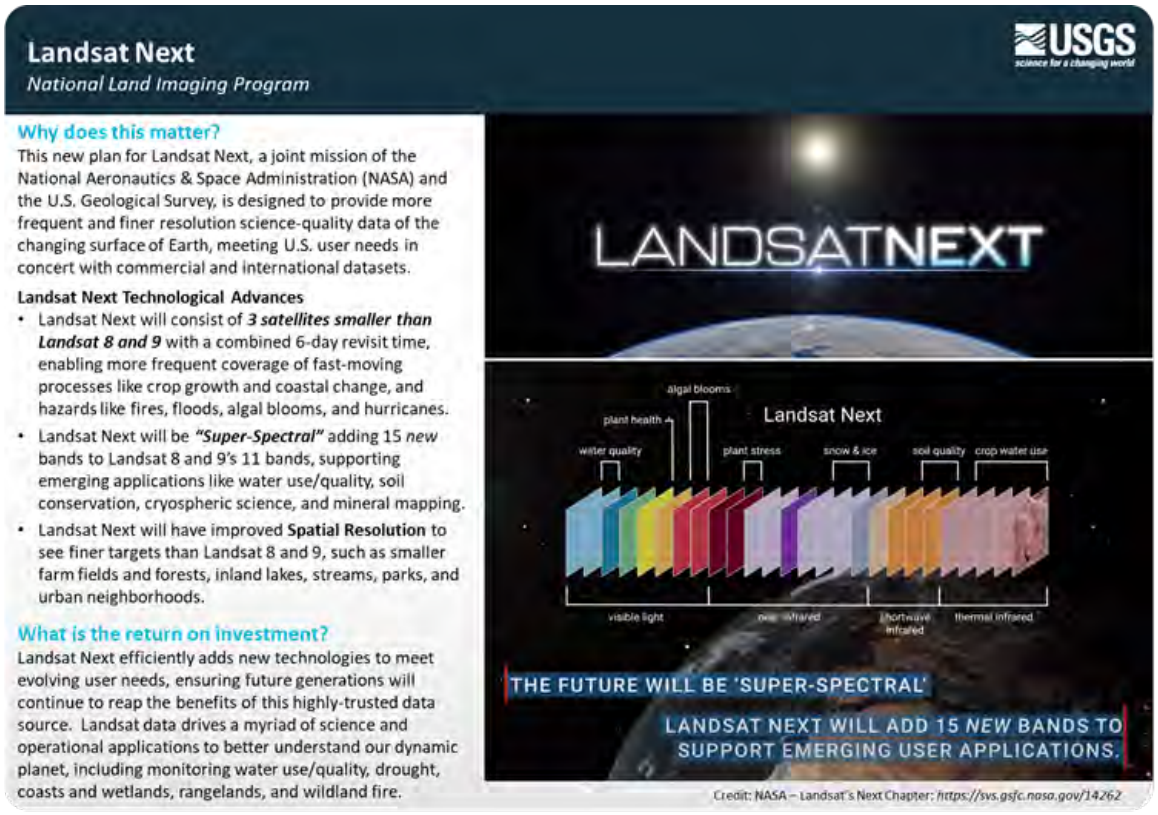
Program Overview

Our Nation's economic security, environmental vitality, and climate resiliency rely on the USGS's continuous monitoring of the Earth's continents, islands, and coastal regions. The USGS, through the Earth Resources Observation and Science (EROS) Center in Sioux Falls, South Dakota, provides the world's largest civilian archive of remotely sensed digital land-surface images for land, inland water, and coastal resource management. This information empowers research and decision-making by land resource and environmental managers in all 50 States, Tribal lands, U.S. territories, and 185 countries.

The USGS plays a leading role in land surface observations through its Landsat satellite missions that are designed, launched, and operated in collaboration with NASA under both agencies' SLI partnership. This partnership ensures continued long-term operational provision of land remote sensing data to U.S. citizens on a full, free, and open basis. Through EROS, the USGS operates the Landsat 7, Landsat 8, and Landsat 9 satellites, the world's only operational civil satellites with both thermal and short-wave infrared sensors. These satellites provide near-weekly Landsat observations, supporting hundreds of thousands of government, commercial, and academic users across the Nation. Landsat's unique 50-plus year data record enables the Nation's users to record, study, understand, and better manage landscape change at local, regional, and global scales. The USGS processes and distributes Landsat data and maintains the long-term Landsat data archive. Through its use of commercial cloud data services, the USGS is exponentially increasing the amount of Landsat data products accessed by users at no cost: from tens of millions to billions of accesses each year.

Under the SLI partnership, NASA and the USGS have begun work on the follow-on mission to Landsat 9, called Landsat Next. Landsat Next is the result of several years of joint planning by NASA and the USGS, resulting in a system of three smaller satellites, launched into a lower orbit, and providing twice the number of spectral bands of today's Landsat satellites. Landsat Next will also provide better spatial and temporal resolution than previous Landsat satellites while sustaining continuity with the 50-year Landsat data record. These technological enhancements will provide users with improved performance to meet their evolving needs for detecting and characterizing land surface change across the Earth, including

an improved ability to respond to increasing wildfire events, drought, harmful algal blooms, and other effects of the changing climate across the U.S. and around the world in the coming decades.



In addition to Landsat data, the USGS collects, processes, archives, and provides the Nation with digital land-surface image data acquired by numerous other satellite and airborne sensors, including uncrewed aircraft systems (UAS). In the case of UAS, the National Land Imaging (NLI) Program provides funding to the USGS National Uncrewed Systems Office in Denver, Colorado, which facilitates the use of UAS technology across the USGS, supporting a range of science applications including ecosystems monitoring and hazards assessments. These data complement the Landsat data collection to maximize user need satisfaction across the community.

Through the NLI Program, the USGS supports world-class remote sensing research and development, land change science, land cover monitoring and assessments, and provides land and natural resource managers, policy makers, and other users with related data, tools, and information products. These activities include the innovative LCMAP and authoritative National Land Cover Database. These and other USGS products are fundamental to well-informed local, Tribal, State, and Federal land use and management decisions that empower community safety, economic prosperity, sustainable development, and climate change adaptation. They also provide crucial support to the America the Beautiful initiative and related Interior land conservation activities.

The USGS National Civil Applications Center (Center) uses Earth observations from military and U.S. Intelligence Community sensors to detect wildland fires, compile Incident Commanders' wildfire response maps, and to monitor global volcanos for aviation safety and local government information. The Center also manages the interagency Civil Applications Committee to oversee and facilitate appropriate

Federal civil agency access to, and use of, military, intelligence, and commercial Earth observations. These observations are used extensively by Interior, the USGS, and numerous agencies for disaster response, environmental monitoring, and scientific research.

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Science Support

Science Support $ in thousands	2022 Actual	2023 Enacted	2024 Fixed Cost (+/-)	2024 Internal Transfers (+/-)	2024 Program Changes (+/-)	2024 Request	Change from 2023 Enacted (+/-)
Administration and Management Program	**77,520**	**82,179**	**+6,070**	**0**	**+11,139**	**99,388**	**+17,209**
FTE	***354***	***358***	***0***	***0***	***+30***	***388***	***+30***
Information Services Program	**22,216**	**24,125**	**+795**	**0**	**+9,864**	**34,784**	**+10,659**
FTE	***61***	***64***	***0***	***0***	***+15***	***79***	***+15***
Science Support Total	**99,736**	**106,304**	**+6,865**	**0**	**+21,003**	**134,172**	**+27,868**
FTE	***415***	***422***	***0***	***0***	***+45***	***467***	***+45***

The 2024 budget request for Science Support is $134,172,000 and 467 FTE, a program change of +$21,003,000 and +45 FTE from the 2023 Enacted.

Mission Area Overview

The USGS Science Support activity provides business and information services that are crucial to conducting quality science including acquisition and grants; finance; financial reporting; internal controls; communications; budget and performance; monitoring and evaluation of science quality and integrity; information assurance; information management and technology services; strategic planning; international program activities; Freedom of Information Act (FOIA); and human capital. Science Support also provides policy and analysis services related to technology transfer, intellectual property, agreement reviews, and directive management. Included under the Science Support umbrella are the offices of the Director; Administration; Budget, Planning, and Integration; Communications and Publishing; Diversity and Equal Opportunity; the FOIA Officer; International Programs; Science Quality and Integrity; and the Associate Chief Information Officer (ACIO).

Science Support also includes the executive leadership and management that provide guidance, direction, and oversight for all USGS science activities. The Science Support team aids USGS science by providing science and operational leadership and oversight, including ensuring fiduciary responsibility, communicating the value and relevance of USGS science to the public and Congress, and verifying the validity and quality of USGS science.

FY 2022 Selected Mission Area Accomplishments

- Achieved all acquisition socio-economic goals – including those for small, disadvantaged businesses; small disabled veteran-owned small businesses; and women-owned small businesses.

- USGS put a contract in place for the construction of the new Hawaii Volcano Observatory laboratory, office space and field station in Hilo, Hawaii that replaces the facility destroyed in the 2018 Kilauea eruption. These facilities are critical in investigating and assessing hazards from active volcanoes and earthquakes in Hawai'i.
- The USGS established a new internship program to enhance diversity; piloted Virtual Classroom Visits with USGS scientists with a focus on underserved schools; and maintained the Secondary Transition to Employment Program for 18–22 year-old students with cognitive and other disabilities.
- Processed 130 FOIA requests in FY 2022 resulting in a 36% reduction of backlogged requests.
- Coordinated with DOI and the Department of Homeland Security's Continuous Diagnostics and Mitigation Program to implement the Department-wide Enterprise Security Event Information Management System, supporting the identification of security events that require further analysis to determine if an incident has occurred. This initiative along with USGS ACIO Software Asset Management system which provides an authoritative list of acceptable software enhancing best practices.

Science Support
Administration and Management

Science Support $ in thousands	2022 Actual	2023 Enacted	2024 Fixed Costs	2024 Internal Transfers	2024 Program Changes	2024 Request	Change from 2023 Enacted
Administration and Management Program	**77,520**	**82,179**	**+6,070**	**0**	**+11,139**	**99,388**	**+17,209**
Scientific Integrity and Diversity and Support for Enterprise Science	[1,943]	[2,667]	0	0	+7,761	[10,428]	+7,761
Federal Electric Fleet, Vehicle AFE Premium	[150]	[250]	0	0	+3,378	[3,628]	+3,378
FTE	***354***	***358***	***0***	***0***	***+30***	***388***	***+30***

Justification of 2024 Program Changes

The 2024 budget request for the Administration and Management Program is $99,388,000 and 388 FTE, a program change of +$11,139,000 and +30 FTE from the 2023 Enacted.

Scientific Integrity and Diversity and Support for Enterprise Science (+$7,761,000 / +30 FTE) – The USGS would create effective equity measures to better identify and address inequities. USGS would also promote innovative partnerships to ensure that all communities can benefit from and participate in all aspects of USGS science.

The USGS would build scientific capacity in Tribal communities through enhancements to the USGS Technical Training in Support of Native American Relations program, which supports USGS employees to design and conduct technical training for staff of Tribal governments or organizations. The USGS would aid in building scientific capacity in Native communities by leveraging USGS expertise across the bureau to grow the most needed scientific skills. Work would be done exclusively in collaboration with a Tribal entity to ensure that training successfully meets their needs. The USGS would also create science partnerships and internships for Tribal youth through work with Tribes and Native American organizations, emphasizing traditional ecological knowledge to acknowledge the understanding and wisdom of Tribal elders and respect Tribal teachings. This initiative will support a team of Tribal youth at the Native Youth Community Adaptation Leadership Congress and provide USGS internships for college students on the team.

The USGS would also develop a plan to build and sustain human capital pipelines for underserved communities and continue to develop the skilled and high-performing workforce needed to meet the USGS 21st Century Science Strategy, serving the Nation. These opportunities include engaging Tribal youth in USGS science to support scientific diversity in STEM education and underserved communities; financial assistance (grants and cooperative agreements), research, internships, scholarships, and fellowships to the Nation's Historically Black Colleges and Universities, Minority Serving Institutions,

and eligible community colleges to encourage students to continue studies and pursue advanced degrees in natural science fields that are critical to the USGS.

Additionally, the USGS would enhance the core functions that make it possible to produce world-class science, including scientific integrity, diversity, and business services. The USGS would protect and enhance scientific integrity for Interior and within the USGS by implementing and maintaining key recommendations from a staff survey about scientific integrity, through the use of best practices from the Interior Scientific Integrity Officers Council, and the Presidential Memorandum on Restoring Trust in Government Through Scientific Integrity and Evidence-Based Policymaking. The recommendations include strengthening USGS scientific integrity policies, safeguarding protections against political interference, enhancing the culture of science quality and integrity, and providing opportunities for the professional development and advancement of USGS scientists.

Federal Electric Fleet, Vehicle AFE Premium (+$3,378,000 / +0 FTE) – The request includes $3.4 million to fully transition the Department's light duty fleet acquisitions to zero emission vehicles. This funding will provide critical planning and coordination capabilities, utility build-out and charging infrastructure, and zero emission vehicles. The planning includes prioritizing locations for deployment, determining infrastructure needs such as electrical upgrades and access for electric vehicle supply equipment, and coordinating installation to ensure Interior can maximize the use of these charging stations. By leveraging the buying power of the Federal government and transforming its fleet of more than 600,000 cars and trucks to an all-electric fleet, the Administration can both save money for American taxpayers and accelerate the Nation's industrial capacity to supply domestically produced zero emission vehicles and electric batteries to create new good-paying jobs.

Program Overview

The Administration and Management Program provides business and information services that are crucial to conducting quality science including acquisition and grants; finance; financial reporting; internal controls; communications; budget and performance; monitoring and evaluation of science quality and integrity; information assurance; information management and technology services; strategic planning; international program activities; and human capital.

PROMOTING DIVERSITY IN THE FEDERAL WORKFORCE
Science Support
USGS

WHAT ARE WE DOING?
USGS recognizes its talented and diverse workforce as a key asset. Our success as an agency reflects the quality and skill of our people. The USGS is committed to seeking out and retaining a highly skilled and diverse workforce to ensure we accomplish our mission in the most effective, efficient, and robust way possible.

WHY DOES THIS MATTER?
One of the core values of the USGS is the importance of diversity in our science and our workforce. The USGS is committed to creating opportunities for all.

The GeoGirls Visit a Volcano Monitoring Station at Mount St. Helens
Source: USGS

The Administration and Management Program 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; communicates the USGS mission and science to Congress and the public; and supports Interior's centralized administrative and business services through the Working Capital Fund.

Scientific Integrity and Fundamental Science Practices

Science Support

USGS

What Are We Doing?

The USGS is dedicated to preserving the integrity of the scientific activities it conducts and that are conducted on its behalf. The USGS will not tolerate loss of integrity in the performance, use, or communication of scientific activities and their results.

Why Does This Matter?

The responsible planning, conduct, and communication of research is the bedrock of USGS science. Sustaining and fostering a culture of scientific integrity means conducting our work free from falsification, fabrication, plagiarism, and censorship, as well as adhering to the Code of Scientific and Scholarly Conduct.

Dr. Carol Meteyer at the National Wildlife Health Center applying knowledge and expertise in diverse scientific areas to study the most critically important diseases occurring in wildlife populations. Source: USGS

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Science Support
Information Services

Science Support $ in thousands	2022 Actual	2023 Enacted	2024 Fixed Costs	2024 Internal Transfers	2024 Program Changes	2024 Request	Change from 2023 Enacted
Information Services Program	**22,216**	**24,125**	**+795**	**0**	**+9,864**	**34,784**	**+10,659**
Integration of Standard Cybersecurity Architecture	0	0	0	0	+2,492	[2,492]	+2,492
IT Support for R&D, Including Cloud and High-Performance Computing	[2,500]	[4,000]	0	0	+6,500	[10,500]	+6,500
IT Enhancements	0	0	0	0	+872	[872]	+872
FTE	***61***	***64***	***0***	***0***	***+15***	***79***	***+15***

Justification of 2024 Program Changes

The 2024 budget request for the Information Services Program is $34,784,000 and 79 FTE, a program change of +$9,864,000 and +15 FTE from the 2023 Enacted.

Integration of Standard Cybersecurity Architecture (+$2,492,000 / +5 FTE) – The Federal Information Security Modernization Act (FISMA) requires a comprehensive framework for ensuring the effectiveness of cybersecurity controls over information resources that support Federal operations and assets, as well as effective management and oversight of cybersecurity risks and Agency cybersecurity programs. Funding is requested to address critical gaps and requirements in accordance with Administration cybersecurity requirements to keep the USGS systems secure and strengthen our security posture as we evolve to meet new challenges. Funding will support transition to Internet Protocol version 6 (IPv6) in accordance with OMB M-21-07; planning and architecture support to migrate to a Zero-Trust Architecture Model in accordance with NIST Special Publication 800-207; and improved cybersecurity assessment requirements for High Value Assets (HVA's) such as Security Architecture Reviews and Penetration Testing.

IT Support for R&D, Including Cloud and High-Performance Computing (+$6,500,000 / +10 FTE) – Rapid advancements in technology and an explosion of scientific data from sources require the bureau to make substantial IT upgrades for increased capacity across approximately 400 locations. Modernizing USGS IT capabilities will strengthen mission essential functions and support forecasting and foundational predictive science. USGS' complex network infrastructure raises challenges with replacing, retiring, and migrating systems to these new technologies. Funding will focus on infrastructure, security, and application components to a Cloud Smart (fully actualizing the promise and potential of cloud-based technologies while ensuring thoughtful execution that incorporates practical realities) architecture. The USGS would invest in infrastructure, security, and application components to a Cloud Smart architecture, which will support the achievement of goals related to the USGS's 21st Century Science Mission and Vision, alongside 21st Century IT. The goal of these activities would be to create an integrated, agile, and

secure hosting environment that advances analytical and visualization capabilities, artificial intelligence, emerging machine-assisted processes, and service delivery models supporting mission requirements.

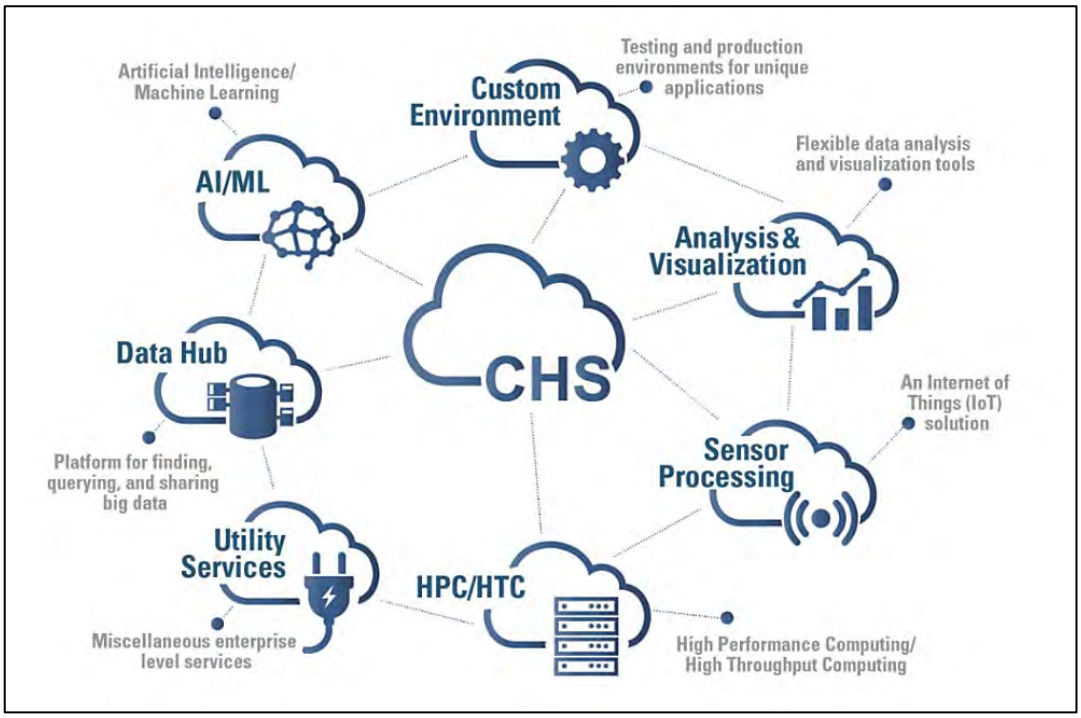
IT Enhancements (+$872,000 / +0 FTE) – The USGS proposes to invest $872,000 in IT modernization, IT workforce, and critical IT infrastructure needs. This funding would support key Department and Bureau-specific cybersecurity requirements and priorities such as Zero-Trust implementation, FISMA compliance, and effective oversight.

Program Overview

Information Services (IS) includes the Office of the ACIO. The components within ACIO include the Office of the Chief, Information Security, Enterprise Infrastructure, Integrated Science Solutions, Freedom of Information Act (FOIA), and End User Services.

The ACIO provides enterprise services to the bureau's mission and regional offices that support the USGS Science Strategy. These service offerings enhance computing capacity and foundational predictive science capabilities.

IS provides the critical Information Management & Technology (IMT) foundation for the USGS science mission by implementing advances in IMT and using them to facilitate research, data gathering, analysis, modeling, scientific collaboration, knowledge management, and efficiencies in both business and administrative processes. IS supports numerous IMT services, such as the USGS information assurance program; network capacity and cloud services; telecommunications and customer support; portfolio management; application development and delivery programs; and supports the Interior IMT activities through the Interior's Working Capital Fund.



ACIO's Cloud Hosting Service (CHS) provides cloud hosting services through a virtual data center. In addition to the virtually unlimited storage and computing capabilities of the Cloud, CHS has a cloud-based ecosystem of services including high-performance computing, data visualization, sensor processing, artificial intelligence/machine learning, analytics, data storage, and more.

Facilities

Facilities $ in thousands	2022 Actual	2023 Enacted	2024 Fixed Cost (+/-)	2024 Internal Transfers (+/-)	2024 Program Changes (+/-)	2024 Request	Change from 2023 Enacted (+/-)
Rental Payments and Operations & Maintenance Program	**110,146**	**113,211**	**+5,203**	**0**	**0**	**118,414**	**+5,203**
FTE	***73***	***73***	***0***	***0***	***0***	***73***	***0***
Facilities Maintenance, Modernization, and Restoration	**74,664**	**74,840**	**+14**	**0**	**+4,203**	**79,057**	**+4,217**
FTE	***2***	***2***	***0***	***0***	***+1***	***3***	***+1***
Facilities Total	**184,810**	**188,051**	**+5,217**	**0**	**+4,203**	**197,471**	**+9,420**
FTE	***75***	***75***	***0***	***0***	***+1***	***76***	***+1***

The 2024 budget request for the Facilities Mission Area is $197,471,000 and 76 FTE, a program change of +$4,203,000 and +1 FTE from the 2023 Enacted.

Mission Area Overview

The USGS Facilities activity provides safe, functional workspace to accomplish the bureau's scientific mission, with an emphasis on the USGS mission driving facility needs. The goal of Facilities is to meet bureau science needs while optimizing facility locations, functionality of workspace, and reducing costs. The USGS defines facilities to include all sites where USGS activities are housed and mission-related work is conducted. Facilities typically provide space for offices, laboratories, storage, and parking, as well as shared support for cafeterias, conference rooms, and other common space uses. USGS research vessels are also considered facilities for funding purposes. Rent costs, basic facility operations and security are funded and performed through this program, as is facility maintenance which, in compliance with Federal, State, and local standards, provides a safe, sustainable working environment for employees, visiting partners, and customers.

USGS Facilities partners with other Federal agencies, State and local governments, universities, and the private sector to provide appropriate space for USGS scientists and other staff. Collaboration with these partners supports the USGS's scientific work and facilitates communication of the results of this work to the public, emergency managers, and the scientific community. Partners generally have a mission similar to that of the USGS. In these instances, the USGS occupies space in return for science-related services or space is acquired as part of a larger cooperative agreement. Typically, the USGS pays a reduced rent rate or the cost of operations and maintenance when in partner space. Co-locations with other bureaus,

agencies, or universities is a space management strategy that advances science, creates partnerships, and facilitates recruitment of new talent.

FY 2022 Selected Mission Area Accomplishments

- **Hydrologic Instrumentation Facility (HIF) Building:** The HIF was built by the National Aeronautics and Space Administration (NASA) for the USGS in the early 1970s and is located at the NASA Stennis Space Center in Bay St. Louis, MS. It is foundational for national, high quality water observing systems, providing quality-assured hydrologic instrumentation and data collection equipment, testing of in-service instruments, and evaluation of new technology and instrumentation. NASA informed the USGS that the buildings occupied by USGS on the Stennis Space Center campus were scheduled for demolition. In FY 2020, the USGS received funding to build a new facility which will be co-located with complementary academic and Federal partners. The new facility will include new capabilities that will meet the hydrologic equipment needs of the USGS Next Generation Water Observing System. The construction contract was awarded in December 2021 with construction initiated in January 2022 to build the new HIF at the University of Alabama in Tuscaloose, AL. Construction is proceeding on schedule and completion is currently scheduled in FY 2024.
- **Moffett Field Laboratory, Warehouse, and Office Space:** This is the final phase of a project to relocate USGS employees and capabilities in Menlo Park, CA to co-located space on the campus of NASA Ames Research Park at Moffett Field in Mountain View, CA. The new design at Moffett Field will include warehouse and office space while also consolidating the numerous individual labs currently at Menlo Park into modern, shared, and more space-efficient multifunctional labs. In FY 2022, all required land use and construction permits were obtained for the new laboratory building and construction began in November 2021. In addition, the warehouse design was completed, and the construction contract was awarded for both the warehouse and Building 19 renovations. Construction is scheduled to begin in FY 2023 with completion planned for FY 2025.
- **Hawaiian Volcano Observatory (HVO) & Pacific Island Ecosystem Research Center (PIERC) Facilities:** The mission of the HVO is to monitor, investigate, and assess hazards from active volcanoes and earthquakes in Hawaii, and communicate the results of this work to the public, emergency managers, and the scientific community. The HVO facility, perched on the rim of Kilauea Volcano's summit caldera in the Hawaii Volcanoes National Park, was evacuated on May 16, 2018 in response to eruptive activity. During the 2018 eruption, the facility sustained irreparable damage from the ground deformation and repeated earthquakes associated with the collapse of the summit crater. In response, the USGS is constructing a new field station in the Park and working with the University of Hilo to build a new observatory and science center for all USGS employees on the island of Hawaii (both HVO and PIERC) in Hilo. Pre-construction requirements were completed in FY 2022 with the construction contract awarded in September 2022. Construction on the new facilities is scheduled to begin in FY 2023 and is planned to be completed in FY 2026.
- Consolidated field offices for the Washington Water Science Center, Idaho Water Science Center, and Geology, Minerals, Energy, and Geophysics Science Center into one facility in Spokane, WA, which reduced space by 2,255 rentable square feet.

Facilities
Rental Payments and Operations and Maintenance

Facilities $ in thousands	2022 Actual	2023 Enacted	2024 Fixed Costs	2024 Internal Transfers	2024 Program Changes	2024 Request	Change from 2023 Enacted
Rental Payments and Operations & Maintenance Program	**110,146**	**113,211**	**+5,203**	**0**	**0**	**118,414**	**+5,203**
FTE	***73***	***73***	***0***	***0***	***0***	***73***	***0***

Justifications of 2024 Program Changes

The 2024 budget request for Rental Payments and Operations and Maintenance Program is $118,414,000 and 73 FTE. There are no program changes proposed in 2024.

Program Overview

The Rental Payments and Operations and Maintenance Program provides the USGS with funding needed to pay for annual rent and operations and maintenance costs. Rental payments are made to the GSA, other Federal sources, private lessors, and cooperators for space occupied by the USGS. The USGS is continually working to enhance facilities efficiencies, in terms of both costs and mission needs. For example, the consolidation of USGS employees into the Bureau of Reclamation facility in Boulder City, NV, provides both enhanced collaboration opportunities between the two Interior bureaus as well as lower and more stable facilities costs for the foreseeable future.

The USGS is located at a number of rented facilities across the U.S. and will be renewing agreements for space over the next 18 months for many of them. There is a potential for relocations in 14 States based on lease expirations, lease negotiations, and market availability. The initial plan is that if a move is necessary, the new location would remain within the same commuting area. The following table details these current locations:

City	State	Street
Guaynabo	PR	GSA Center, 651 Federal Drive
Charlotte	NC	810 Tyvola Road
Lutz	FL	4446 Pet Lane
Charleston	SC	219 Fort Johnson Road
Mounds View	MN	2270 Woodale Drive
Oklahoma City	OK	Broadway Executive Park
Bismarck	ND	821 E. Interstate Avenue
Las Cruces	NM	4611 Research Park Circle
Fort Worth	TX	501 West Felix Street
Wichita	KS	7920 West Kellogg

City	State	Street
Ft Myers	FL	1400 Colonial Blvd
East Hartford	CT	101 Pitkin Street
Shenadoah	TX	19241 David Memorial Drive
Buffalo	NY	1000 Putnam Way

The USGS has unique facility requirements to support science functions and relies on a mix of owned, leased and other agency provided space to meet those needs, including modern laboratory space.

The 2024 budget will allow the USGS to:

- Continue the USGS move from Menlo Park, CA, to NASA Ames Research Park, Moffett Field, Mountain View, CA.
- Coordinate facility planning with science planning to provide safe, high-quality workspace aligned with science needs.
- Continue supporting the USGS scientific mission by providing facilities with unique space requirements.
- Reduce energy intensity by 30 percent compared to FY 2003.
- Implement cost savings initiatives through space consolidations.

PROPERTY AND LABORATORY MANAGEMENT

Facilities

USGS

WHAT ARE WE DOING?

The USGS has more than 400 locations across the United States. Its mission is to collect, monitor, analyze, and provide scientific understanding about natural resource conditions, issues, and problems. To support these mission areas, the USGS occupies nearly 1,200 assets, including buildings, land, structures, and vessels.

WHY DOES THIS MATTER?

Priority of the program is to continue the important work of the Department of the Interior and the USGS, while also maintaining the health and safety of our employees and community.

The USGS National Center (105 acres) located in Reston, Virginia provides for the agency's widespread activities for the Survey employees located in the Washington, D.C, metropolitan area. The site also provides habitat for many native and migratory birds, insects, and large and small mammals.
Source: USGS.

Facilities
Facilities Maintenance, Modernization, and Restoration

Facilities $ in thousands	2022 Actual	2023 Enacted	2024 Fixed Costs (+/-)	2024 Internal Transfers (+/-)	2024 Program Changes (+/-)	2024 Request	Change from 2023 Enacted (+/-)
Facilities Maintenance, Modernization, and Restoration	**74,664**	**74,840**	**+14**	**0**	**+4,203**	**79,057**	**+4,217**
Department of the Interior Field Communications Modernization (DIFCOM)	[0]	[176]	0	0	+176	[352]	[+176]
Charging Infrastructure	[0]	[0]	0	0	+1,425	[1,425]	[+1,425]
Priority Facility Projects	[0]	[0]	0	0	+2,602	[2,602]	[+2,602]
FTE	***2***	***2***	***0***	***0***	***+1***	***3***	***+1***

Justification of 2024 Program Changes

The 2024 budget request for Facilities Maintenance, Modernization, and Restoration (FMMR) is $79,057,000 and 3 FTE, a program change of +$4,203,000 and +1 FTE from the 2023 Enacted.

Technical Adjustment: Facilities Maintenance, Modernization, and Restoration (FMMR) Proposal: The USGS proposes a technical adjustment to meet new policy requirements according to the Office of Acquisition and Property Management's (OS-PAM) AAAP 0176 - Department of the Interior Standard Infrastructure Investment Categories, issued August 10, 2021. This policy directs bureaus to draft an implementation plan for aligning their investment needs according to standard investment categories. In response to this directive and to align infrastructure investment more effectively, the USGS proposes to change the name for the subactivity "Deferred Maintenance and Capital Improvement" to "Facilities Maintenance, Modernization, and Restoration". This name change supports Interior's efforts to standardize terms and clarify definitions and asset management concepts around a common asset management framework.

This proposal would continue to strengthen the USGS' role as the premier science agency by equipping USGS science centers with the infrastructure needed to meet the challenges of the 21st century. Realigning the Facilities - Deferred Maintenance and Capital Improvement (DMCI) to the Facilities - Facilities Maintenance, Modernization, and Restoration (FMMR) would:

- Improve coordination with the OS-PAM, other bureau asset managers, and stakeholders using standard infrastructure investment terms.

- Support standard investment terms used across Interior that are integrated into USGS investment planning in the areas of budget formulation, Five Year Capital Improvement and Deferred Maintenance Plan development, and the systems that support them (e.g., the Facilities Maintenance Management System (FMMS).
- Integrate large infrastructure investment and modernization projects into the Bureau's Lifecycle Investment Five-Year Plan that expand beyond a standard deferred maintenance and capital improvement project.

Department of the Interior Field Communications Modernization (DIFCOM) (+$176,000 / +0 FTE) – This coordinated request across multiple bureaus includes $176,000 for USGS and builds on funding included in the 2023 appropriation for DOI. With the 2024 requested funding, USGS will participate in communications modernization in Alaska, Hawaii and the insular areas, and the Southeastern contiguous United States. Modernization enhances capabilities being implemented across DOI communities of practice. Across the geography targeted for modernization in 2024, initial planning and design work will identify solutions that are standardized and consistent by leveraging existing systems such as the FirstNet network, including identification of potential sites for infrastructure-sharing with commercial entities and partners where it would be beneficial to all parties. The assessments will identify where Interior can consolidate sites or replace obsolete land mobile radio sites with lower cost options where it makes sense.

Charging Infrastructure (+$1,425,000 / +1 FTE) – The request includes $1.4 million to fully transition the Department's light duty fleet acquisitions to zero emission vehicles. This funding will provide critical planning and coordination capabilities, utility build-out and charging infrastructure, and zero emission vehicles. The planning includes prioritizing locations for deployment, determining infrastructure needs such as upgraded electrical infrastructure and access for electric vehicle supply equipment, and coordinating installation to ensure Interior can maximize the use of these charging stations. By leveraging the buying power of the Federal government and transforming its fleet of more than 600,000 cars and trucks to an all-electric fleet, the Administration can both save money for American taxpayers and accelerate the Nation's industrial capacity to supply domestically produced zero emission vehicles and electric batteries to create new good-paying jobs.

Priority Facility Projects (+$2,602,000 / +0 FTE) – USGS is currently experiencing increased costs in facilities construction projects due to a variety of market factors outside of the bureau's control. USGS is managing acquisition needs and schedules on these projects to complete everything in as timely a manner as possible through 2028. This increase would allow the USGS to fund some of these additional costs and better meet construction schedules on some projects.

Program Overview

FMMR funding provides for construction, modernization, and maintenance/repair projects on USGS-owned and maintained assets and infrastructure. Funding is provided to the highest-priority facility requirements in support of USGS mission needs. Prioritization follows annual Interior budget guidelines and funding is primarily directed toward projects that stabilize, restore, replace, or improve life-cycle performance of assets that are mission critical or mission dependent. Projects that facilitate space consolidation, improve utilization, promote energy efficiency and sustainability, and reduce the bureau space footprint also receive FMMR funding as do other facilities maintenance and management activities that identify, document, track, and remediate maintenance needs. In 2023, about 80 percent of funding is dedicated to on-going major construction projects funded through specific Congressional appropriations. As a variety of market factors outside the bureau's control continue to increase costs, the USGS estimates that these construction projects will continue to require about 80 percent of program funding through at least 2027.

The FY 2024 budget requests just over $79 million to complete FMMR projects. The following table provides a description of how those funds will be used, followed by project descriptions for major infrastructure projects. This allocation is subject to change based on factors outside the bureau's control.

Project Title	Description	FY 2024 Request ($000)
National Wildlife Health Center	NWHC Phase II and III Modernization	$25,200
Construct Energy and Minerals Research Facility	Construction of laboratory at the Colorado School of Mines to replace facilities at the Denver Federal Center	$38,602
Maintenance Projects	Upper Midwest Environmental Sciences Center – Facility Wide Water Conservation and Infrastructure Improvements (PFAS Remediation)	$9,000
Space Consolidation and Reduction	Consolidate staff from the New York Water Science Center, Ithica Project Office into new facilities at the Tunison Lab of Aquatic Science in nearby Cortland, NY.	$2,000
Other Deferred Maintenance Projects	Renovation, maintenance and repair projects to address deferred maintenance needs and energy efficiency.	$661
DIFCOM	Department of the Interior Field Communications Modernization (DIFCOM) Project	$352
Charging Infrastructure	The necessary infrastructure for charging stations for the electric vehicles acquired by the bureau.	$1,425
Bureau Lifecycle Investment Funded Programs	Programs supporting facilities condition assessments, maintenance management system, and project planning and support.	$1,817
Total		**$79,057**

Infrastructure Project Descriptions

National Wildlife Health Center (NWHC)

The NWHC was established in 1975 to serve the nation and its natural resources by providing sound science and technical support regarding wildlife disease, and to disseminate information to promote science-based decisions affecting wildlife and ecosystem health. NWHC personnel study emerging and resurging diseases, wildlife and ecosystem health, zoonotic diseases, and environmental health and degradation. The NWHC is located on 24 acres and maintains offices and high security disease laboratories in the Main Building (MB) and the Tight Isolation Building (TIB).

The NWHC is the only Federal Bio Safety Level (BSL) 3 facility dedicated exclusively to scientific investigation and research on wildlife diseases that threaten human, animal, and environmental health. It is designated by Interior as a USGS "mission essential" facility, the only facility in Interior with this designation, and is also registered with and inspected by the Centers for Disease Control and Prevention and the U.S. Department of Agriculture's Federal Select Agent Program.

The current enhanced BSL-3 laboratories are at risk of no longer meeting biosecurity requirements for certain diseases and the original design of the building does not meet best practices for a modern high-level biocontainment facility. If not replaced within the next 5 to10 years, the laboratory may lose its FSAP registration, and Interior will lose the ability to conduct nationally and internationally important work on detecting, characterizing, monitoring, preventing, and controlling some of the most harmful wildlife diseases, many of which can jump to livestock or humans. This project will reduce deferred maintenance, address major infrastructure needs, and enhance Interior's capability to address safety and security concerns related to infectious wildlife diseases and their possible use as bioterrorism agents.

When implemented, the project will address one of the highest USGS facility needs. The goal is to modernize the NWHC through the construction of replacement facilities. The modernized facility will include start-of-the-art BSL-3 laboratories that support USGS and the NWHC's mission of research and surveillance on economically and ecologically harmful wildlife diseases. The planned timeline for the completion of design and construction is the 4th quarter FY 2024 and FY 2027 respectively.

Energy and Minerals Research Facility

The USGS Geology, Geophysics, and Geochemistry (G3) and Central Energy Resources (CER) Science Centers provide unique research and operational capabilities related to critical minerals, energy resource evaluation, and other essential energy and mineral program priorities for the USGS and Interior. Currently located on the Denver Federal Center (DFC), the science activities of G3 and CER are increasingly hindered by the state of the facility. A new facility will enable cooperative scientific research, educational development, and technological collaboration to maximize contributions to basic and applied Earth Sciences for the purpose of solving natural resource and environmental problems, and benefitting local communities, governmental agencies, and the public. The requested funding will supplement funding already provided by the Bipartisan Infrastructure Law (BIL) for the construction of a new facility. The planned timeline for the completion of construction is the 2nd quarter FY 2026.

Special Initiatives

Special Initiatives $ in thousands	2022 Actual	2023 Enacted	2024 Fixed Costs (+/-)	2024 Internal Transfers (+/-)	2024 Program Changes (+/-)	2024 Request	Change from 2023 Enacted (+/-)
2023 Special Initiatives	**0**	**2,130**	**0**	**0**	**-2,130**	**0**	**-2,130**
Harney Watershed Council for Harney Basin Water Resource Planning Support	[0]	[250]	0	0	-250	[0]	[-250]
Kuskokwim River Intertribal Fish Commission for Implementation of Intertribal Federal Subsistence Cooperative Management Program	[0]	[880]	0	0	-880	[0]	[-880]
University of Illinois Aquifer Mapping	[0]	[1,000]	0	0	-1,000	[0]	[-1,000]
FTE	***0***	***0***	***0***	***0***	***0***	***0***	***0***

Justification of 2024 Program Changes

The 2024 budget request for Special Initiatives is $0 and 0 FTE, a program change of -$2,130,000 and 0 FTE from the 2023 Enacted. The budget request does not include funding for Congressionally Directed Spending and Community Project Funding (Special Initiatives) included in the 2023 enacted bill.

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Working Capital Fund

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

The WCF consists of the following components:

- **The WCF Investment Component** provides a mechanism to assist the 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 established by designated USGS officials. 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, energy management and security. 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.

WORKING CAPITAL FUND

Employment Summary

Identification Code 14-4556-0-4-306		2022 Actual	2023 Estimate	2024 Estimate
	Reimbursable:			
2001	Civilian full-time equivalent employment	96	96	96

USGS Accounts

Appropriations Language

SURVEYS, INVESTIGATIONS, AND RESEARCH

(INCLUDING TRANSFER OF FUNDS)

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(a)(1)) and related purposes as authorized by law; and to publish and disseminate data relative to the foregoing activities; [$1,497,178,000] *$1,785,509,000*, to remain available until September 30, [2024] *2025;* of which [$92,184,000] *$110,252,000* shall remain available until expended for satellite operations; and of which [$74,840,000] *$79,057,000* 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: *[Provided further,* That of the amount appropriated under this heading, $2,130,000 shall be for projects specified for Special Initiatives in the table titled "Interior and Environment Incorporation of Community Project Funding Items/Congressionally Directed Spending Items" included for this division in the explanatory statement described in section 4 (in the matter preceding division A) of this Consolidated Act: Provided further, That amounts in the preceding proviso may be transferred to the appropriate program, project, or activity under this heading and shall continue to only be available for the purposes and in such amounts as such funds were originally appropriated]*: Provided further, That of the amount appropriated under this heading not to exceed $15,000 may be for official reception and representation expenses.*

(Department of the Interior, Environment, and Related Agencies Appropriations Act, [2023] *2024*.)

SURVEYS, INVESTIGATIONS, AND RESEARCH

[For an additional amount for "Surveys, Investigations, and Research", $41,040,000, to remain available until expended, for necessary expenses related to the consequences of wildfires, hurricanes, and other natural disasters occurring in and prior to calendar year 2023.]

(Disaster Relief Supplemental Appropriations Act, 2023.)

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 gauging stations, observation wells, and seismic equipment; 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 *(including noncompetitive cooperative agreements with Tribes)* as defined in section 6302 of title 31, United States Code, including noncompetitive cooperative agreement with Tribes: *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.

(Department of the Interior, Environment, and Related Agencies Appropriations Act, [2023] *2024*.)

Appropriations Language Change:

The 2024 budget proposes appropriations language to enable USGS to use up to $15,000 of appropriated amounts for courtesy and social responsibilities associated with official duties, primarily for outreach, engagement, and consultation with Tribal partners to honor traditions. This request would provide the Bureau similar authority provided to other agencies to extend hospitality to official visitors without bureau employees bearing expenses from their own personal funds.

The budget also proposes appropriations language that will improve the USGS' ability to offer grants and cooperative agreements to Tribes. By addressing barriers to applying for and accessing DOI discretionary grants, the USGS can better support Tribes in improving long-term sustainable development and quality of life for their members.

Authorizations

A full listing of USGS authorizations is available at the USGS Office of Budget, Planning, and Integration website.

Website: https://www.usgs.gov/about/organization/science-support/budget/authorizations

Expiring Authorizations

P.L. 111-11

- National Streamflow Information Program - Base Program (no specific dollar amount)
- National Groundwater Resources Monitoring (no specific dollar amount)
- Secure Water Act - Water Availability and Use Assessment Program - $300 million

P.L. 115-307

- National Earthquake Hazards Reduction Program (NEHRP) ($83,403,000)

P.L. 116-9 Dingell Act

- National Cooperative Geologic Mapping Program - $64,000,000
- NVEWS – Part of total above.

Summary of Requirements for USGS *(Dollars in Thousands)*												
Surveys, Investigations, and Research	**2022 Amount**	**2022 FTE**	**2023 Amount**	**2023 FTE**	**2024 Fixed Costs (+/-)**	**2024 Internal Transfers (+/-)**	**2024 Program Changes FTE (+/-) Amount**	**2024 Program Changes $ (+/-) Amount**	**2024 Amount**	**2024 FTE**	**Change from 2023 (+/-) FTE**	**Change from 2023 $ (+/-)**
Ecosystems												
Environmental Health Program	26,489	120	30,457	128	+984	-	-	-	31,441	128	-	+984
Species Management Research Program	55,418	240	63,904	322	+2,474	-	-	+11,000	77,378	322	-	+13,474
Land Management Research Program	58,103	227	54,806	165	+1,546	-	+40	+23,200	79,552	205	+40	+24,746
Biological Threats and Invasive Species Research Program	40,431	199	46,622	236	+1,607	-	-7	+1,170	49,399	229	-7	+2,777
Cooperative Research Units Program	26,006	146	28,206	152	+1,168	-	-3	-117	29,257	149	-3	+1,051
Climate Adaptation Science Center and Land Change Science Program	71,450	204	83,181	216	+2,430	-	+106	+42,350	127,961	322	+106	+44,780
Total, Ecosystems	**277,897**	**1,136**	**307,176**	**1,219**	**+10,209**	**-**	**+136**	**+77,603**	**394,988**	**1,355**	**+136**	**+87,812**
Energy and Mineral Resources												
Energy Resources Program	31,486	132	33,365	133	+1,497	-	+22	+22,529	57,391	155	+22	+24,026
Mineral Resources Program	63,737	268	70,855	278	+3,005	-	+41	+19,500	93,360	319	+41	+22,505
Total, Energy and Minerals Resources	**95,223**	**400**	**104,220**	**411**	**+4,502**	**-**	**+63**	**+42,029**	**150,751**	**474**	**+63**	**+46,531**
Natural Hazards												
Earthquake Hazards Program	90,037	267	92,651	268	+2,541	-	+9	+7,100	102,292	277	+9	-92,651
Volcano Hazards Program	33,282	150	37,500	160	+1,426	-	-4	-3,091	35,835	156	-4	-37,500
Landslide Hazards Program	8,929	35	14,432	45	+356	-	-6	-3,024	11,764	39	-6	-14,432
Global Seismographic Network Program	7,212	11	7,273	11	+100	-	-	-	7,373	11	-	-7,273
Geomagnetism Program	4,673	11	5,251	13	+119	-	+1	+500	5,870	14	+1	-5,251
Coastal/Marine Hazards and Resources Program	41,865	211	43,149	211	+2,230	-	+33	+17,650	63,029	244	+33	-43,149
Total, Natural Hazards	**185,998**	**685**	**200,256**	**708**	**+6,772**	**-**	**+33**	**+19,135**	**226,163**	**741**	**+33**	**-200,256**
Water Resources												
Water Availability and Use Science Program	64,501	313	74,296	336	+2,656	-	+39	-2,250	74,702	375	+39	+406
Groundwater and Streamflow Information Program	110,651	484	114,558	489	+3,499	-	+30	+2,250	120,307	519	+30	+5,749
National Water Quality Program	96,742	473	100,080	478	+3,264	-	+6	-	103,344	484	+6	+3,264
Water Resources Research Act Program	14,000	2	15,500	2	-	-	-	-500	15,000	2	-	-500
Total, Water Resources	**285,894**	**1,272**	**304,434**	**1,305**	**+9,419**	**-**	**+75**	**-500**	**313,353**	**1,380**	**+75**	**+8,919**
Core Science Systems												
National Geospatial Program	87,526	229	93,650	234	+2,146	-	+7	+1,722	97,518	241	+7	+3,868
National Cooperative Geologic Mapping Program	42,431	123	44,556	123	+1,118	-350	-	-3,000	42,324	123	-	-2,232
Science Synthesis, Analysis and Research Program	26,353	77	30,480	82	+782	+350	+4	+53,450	85,062	86	+4	+54,582
National Land Imaging Program	107,492	177	115,921	183	+2,136	-	+42	+25,650	143,707	225	+42	+27,786
Total, Core Science Systems	**263,802**	**606**	**284,607**	**622**	**+6,182**	**-**	**+53**	**+77,822**	**368,611**	**675**	**+53**	**+84,004**
Science Support												
Administration and Management Program	77,520	354	82,179	358	+6,070	-	+30	+11,139	99,388	388	+30	+17,209
Information Services Program	22,216	61	24,125	64	+795	-	+15	+9,864	34,784	79	+15	+10,659
Total, Science Support	**99,736**	**415**	**106,304**	**422**	**+6,865**	**-**	**+45**	**+21,003**	**134,172**	**467**	**+45**	**+27,868**
Facilities												
Rental Payments and Operations & Maintenance Program	110,146	73	113,211	73	+5,203	-	-	-	118,414	73	-	+5,203
Facilities Maintenance, Modernization, and Restoration	74,664	2	74,840	2	+14	-	+1	+4,203	79,057	3	+1	+4,217
Total, Facilities	**184,810**	**75**	**188,051**	**75**	**+5,217**	**-**	**+1**	**+4,203**	**197,471**	**76**	**+1**	**+9,420**
Special Initiative - 2022 -EEW Alaska	**1,000**	**-**	**-**	**-**	-	-	**-**	**-**				
Special Initiative - 2023	**-**	**-**	**2,130**	**-**	-	-	**-**	**-2,130**	-			
Total without Supplementals	**1,394,360**	**4,589**	**1,497,178**	**4,762**	**+49,166**	**-**	**+406**	**+239,165**	**1,785,509**	**5,168**	**+406**	**+64,298**
Supplementals (BIL and Disaster - 2022)	**264,754**	**-**	**68,655**	**44**	-	-	**-14**	**-**	**68,655**	**30**	**-14**	**-**
Inflation Reduction Act - 2022	**23,500**	**-**	**-**	**-**	-	-						
Supplementals (Emergency - 2023)	**-**	**-**	**41,040**	**-**	-	-	**-**	**-41,040**	**-**	**-**	-	**-41,040**
TOTAL, ACCOUNT	**1,682,614**	**4,589**	**1,606,873**	**4,806**	**+49,166**	**-**	**+392**	**+198,125**	**1,854,164**	**5,198**	**+392**	**+198,125**

United States Geological Survey
SIR
Justification of Fixed Costs Changes
(Dollars In Thousands)

Fixed Cost Element	2023 Enacted Total or Change	2023 Enacted to 2024 Request Change	Description
Change in Number of Paid Days	-2,636	+3,110	This column reflects changes in pay associated with the change in the number of paid days between 2023 and 2024. 2024 has one day more than 2023.
Pay Raise	+27,395	+39,210	The President's Budget for 2024 includes one quarter of the 4.6% pay raise for 2023 and three quarters of a planned 5.2% pay raise for 2024.
Employer Share of Federal Employee Retirement System (FERS)	0	0	This column reflects no budgeted increase to the employer contribution to the Federal Employee Retirement System and a 0.6% increase to the employer contribution for the Law Enforcement Federal Employees Retirement System.
Departmental Working Capital Fund (WCF)	+1,187	+2,269	The change reflects the final 2024 Central Bill approved by the Working Capital Fund Consortium.
Workers' Compensation Payments	+184	-122	The amounts reflect final chargeback costs of compensating injured employees and dependents of employees who suffer accidental deaths while on duty. Costs for 2024 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.
Unemployment Compensation Payments	0	+4	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.
Rental Payments	+2,795	+934	The amounts reflect changes in the costs payable to 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. 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.
Baseline Adjustments for O&M Increases	0	+3,761	In accordance with space maximization efforts across the Federal Government, this adjustment captures the associated increase to baseline operations and maintenance 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 an increase 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.
Account Total Fixed Cost	+28,925	+49,166	

United States Geological Survey
SIR
Justification of Internal Realignments

(Dollars In Thousands)

Internal Realignments and Non-Policy/Program Changes (Net-Zero)	BY (+/-)	Description
Water Resources Research Institutes - Annual Base Grants	-1,000	The USGS is proposing to transfer $1,000,000 within the Water Resources Research Act (WRRA) Program to support national competitive grants targeted at priority water issues that are of regional or interstate importance or that relate to a specific priority topic identified by USGS, the Department, and the Institutes. Funding would come from the annual base grants component of the WRRA Program.
Water Resources Research Institutes - General National Competitive Grants	+1,000	
NGGDPP Transfer from National Cooperative Geologic Mapping Program	-350	The USGS proposes to transfer funds to the National Geological and Geophysical Data Preservation Program to support operational efficiencies and promote geoscience discovery for Administration priorities including critical mineral potential and energy security. The funds would support USGS scientific collections management to facilitate and promote the discovery and reuse of high-value physical samples and associated materials for new scientific discovery, model validation, data recovery and development of new technologies. This proposal would not affect distribution of National Geological Cooperative Mapping Program funds to the States and follows the intent of the National Geologic Mapping Act of 1992.
NGGDPP Transfer to Science Synthesis, Analysis and Research Program	+350	
Net Account Total, Internal Transfers	0	

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Account and Sundry Exhibits

Employment Summary

SURVEYS, INVESTIGATIONS, AND RESEARCH

Identification Code 14-0804-0-1-306		2022 Actual	2023 Estimate	2024 Estimate
	Direct:			
1001	Civilian full-time equivalent employment	4,589	4,806	5,198
	Reimbursable:			
2001	Civilian full-time equivalent employment	3,059	3,059	3,059
	Allocation account:			
3001	Civilian full-time equivalent employment	45	45	45

CONTRIBUTED FUNDS

Identification Code 14-8562-0-7-306		2022 Actual	2023 Estimate	2024 Estimate
	Direct:			
1001	Civilian full-time equivalent employment	3	3	3

Employee Count by Grade

(Total Employment)

		2022 Actual	2023 Estimate	2024 Estimate
Executive Level V		1	1	1
SES		16	16	17
	Subtotal	17	17	18
SL – 00		9	9	12
ST – 00		29	34	39
	Subtotal	38	43	51
GS/GM – 15		415	408	442
GS/GM – 14		745	733	793
GS/GM – 13		1,071	1,054	1,140
GS – 12		1,594	1,569	1,696
GS – 11		1,335	1,314	1,420
GS – 10		127	125	135
GS – 9		926	911	985
GS – 8		237	234	253
GS – 7		657	647	700
GS – 6		235	232	251
GS – 5		311	306	331
GS – 4		85	83	90
GS – 3		40	39	42
GS – 2		7	7	7
GS – 1		1	1	1
Subtotal		7,787	7,664	8,287
Other Pay Schedule Systems		294	294	294
Total employment (actual/estimate)		**8,136**	**8,026**	**8,653**

Section 403 Compliance

This section describes details related to any assessments to, or within, the USGS to support bureau-wide services and functions to support governmentwide, DOI-wide, bureau-wide and regional administrative functions, headquarters, and central operations.

External Administrative Costs	2024 Estimate ($000)
Department of the Interior Working Capital Fund and Payments to Other Federal Agencies	
WCF Centralized Billings	*$20,758*
WCF Direct Billings	*$16,412*
Worker's Compensation Payments	*$1,867*
Unemployment Compensation Payments	*$1,096*
GSA Rental Payments	*$83,900*
Bureau Administrative Costs	
Shared Program Costs	*$46,000*
Bureau-Level Costs	*$39,000*
Reimbursable Overhead	*$53,000*

Department of the Interior Working Capital Fund and Payments to Other Federal Agencies

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 using 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 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 and 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.

Direct billing is used whenever the product or service provided is severable but is executed through a time and materials reimbursable support agreement or similar contractual arrangement.

More information related to payments to other Federal agencies can be found in the USGS Account chapter under the fixed cost exhibit.

Bureau Administrative Costs

Shared Program Costs

The USGS maintains an estimated (up to) five percent of its budget submission for other bureau-wide support and science-related activities. These costs are in addition to what may be needed to adequately pay for science support. These funds are used for initiatives which may be unfunded mandates, are crosscutting in nature, or respond to new bureau priorities 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. 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 information technology compliance or 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.

Bureau-Level Costs

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 bureau-wide systems. Funding appropriated to the Science Support budget subactivities pays much of the bureau-level costs. For this reason, bureau-level costs collected on reimbursable support agreements are deposited within Science Support program areas as well. Additionally, the USGS may allocate costs for these activities typically funded out of the Science Support program to the direct appropriation for those programs when those costs exceed amounts allocated to Science Support subactivities in the appropriation. At the 2023 enacted level, these costs are approximately three and a half percent of the science program appropriations. Taken as a whole, costs to support science mission areas is estimated at about 12 percent of the USGS operating budget and up to 12 percent of appropriated programmatic funding could be used to adequately pay for science support costs. These costs may be considered shared program costs.

At the science center level, as 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 to cover 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. During 2022, the cost for the local overhead totaled $201 million; however, these costs are not included in Section 403 estimates. We expect approximately the same levels for 2023 and 2024.

Reimbursable Overhead

The USGS also 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

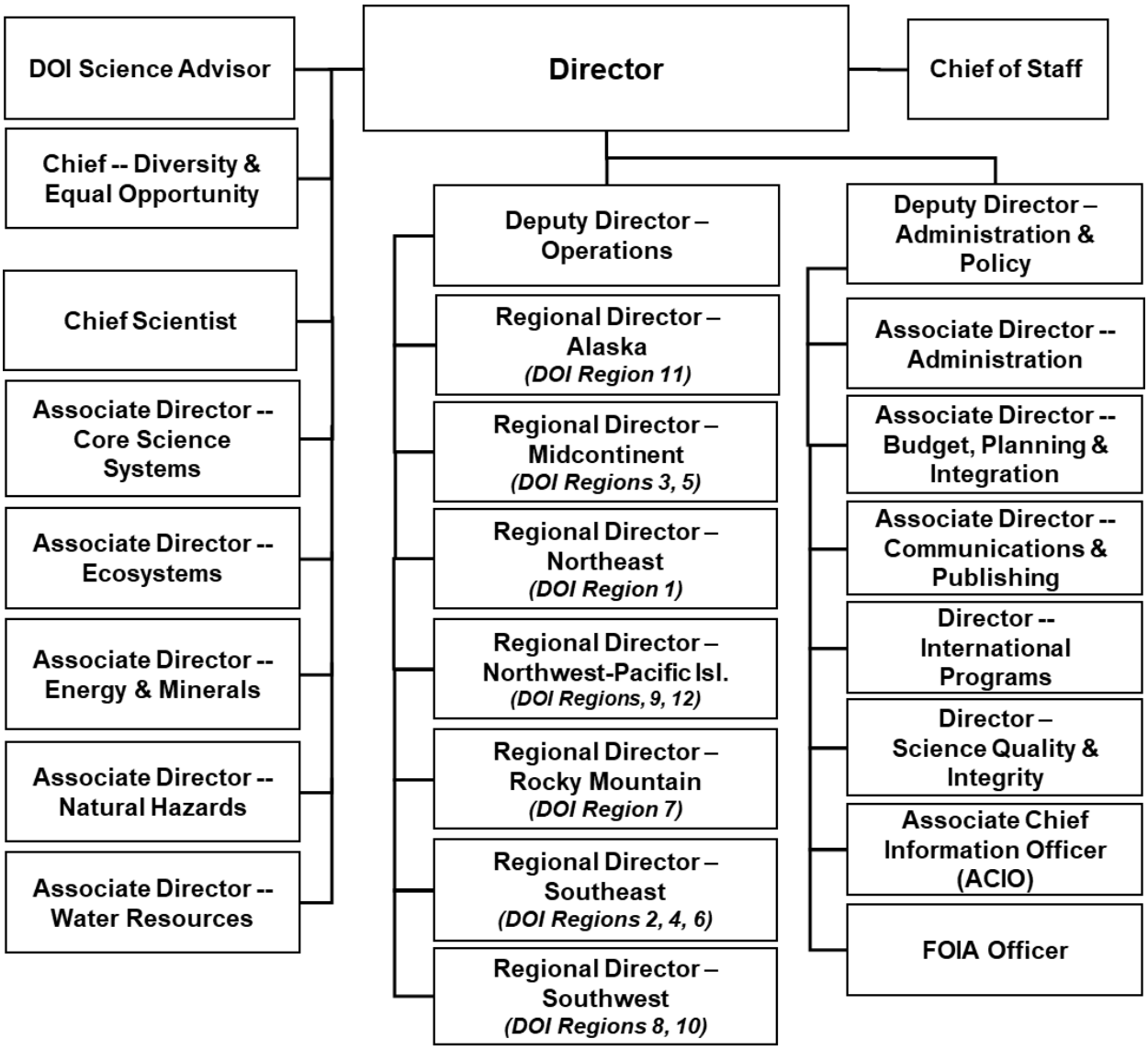
assesses a special or reduced rate when it can be demonstrated that indirect costs are substantially and consistently less than the norm and the amount collected covers the full costs, such as with pass-through funding where the USGS does not perform any of the actual work.

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 cost share funds are available within the USGS budget to cover the uncovered overhead costs. Cost Centers may charge up to 22 percent for the preferred rate in FY 2024, which will cover both bureau and center-level common services costs. This is an increase from the 15 percent that USGS has had in place for the past 20 years. In the intervening years, the gap between the preferred rate and actual center-level common services costs has grown, requiring an increasing diversion of directly appropriated funding even as funds identified for such cost share have dwindled. Of the 22 percent, 7 percent will be applied to bureau costs (the same as in previous years), and the remaining 15 percent is applied to common services costs. USGS is communicating this change with the other DOI bureaus and will continue to coordinate additional changes that may be necessary in future years.

The Associate Director for Administration establishes the USGS bureau special rate for each fiscal year. The special rate for 2023 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 using common service providers.
- Equipment purchase required for new project; cost of the equipment is a major portion of the total agreement funds; and equipment will be USGS property.
- Interagency detail work assignments of a USGS employee to a non-USGS agency when space and administrative support are provided at no charge.
- Funds received with specific legal authority to award a grant which will be transferred to a third-party entity.

USGS Organizational Chart



Bipartisan Infrastructure Law (BIL) FY 2024 Spend Plan

Introduction

President Biden signed the Bipartisan Infrastructure Law on November 15, 2021, making this once-in-a-generation investment in the Nation's infrastructure and economic competitiveness a reality. This landmark investment will rebuild America's critical infrastructure, tackle the climate crisis, advance environmental justice, and drive the creation of good-paying union jobs. By addressing long-overdue improvements and strengthening our resilience to the changing climate, this investment in our communities across the country will grow the economy sustainably and equitably so everyone gets ahead for decades to come.

Funding from the BIL is provided to USGS as emergency appropriations and is available for obligation with various spending availability terms depending on specific Congressional direction. The enacted amounts are shown below in the following section.

BIL Summary

The Bipartisan Infrastructure Law provides USGS a total of $510.7 million to be spent over a period of 5 years to support integrated mapping and interpretation of mineral resources data, the preservation of data from geochemical samples from the Earth Mapping Resource Initiative (Earth MRI), and a replacement facility for the USGS energy and minerals research center in Golden, CO.

USGS Bipartisan Infrastructure Legislation (BIL) Funding by Year of Availability				
Enacted Amounts Available ($000)				
Account/Program/Activity	**FY 2022**	**FY 2023**	**FY 2024**	**Total**
Program				
USGS Energy and Minerals Research Facility	167.0	0.0	0.0	167.0
National Geological and Geophysical Data Preservation Program (NGGDPP)	8.7	5.0	5.0	18.7
Earth Mapping Resources Initiative (Earth MRI)	64.0	64.0	64.0	192.0
Total, BIL Funding	**239.7**	**69.0**	**69.0**	**377.7**

Program Summaries

The USGS plays an essential role in providing a broad range of science to other Federal, State, and local government agencies, Tribal communities, and the public. The USGS plans to make historic investments in science with the following projects:

USGS Energy and Minerals Research Facility

Funding is available for obligation in 2022 until expended to support the construction of a new Federally-owned building for mineral and energy science on the Colorado School of Mines (CSM) campus. The new building is anticipated to be adjacent to the existing USGS Geologic Hazards Science Center (home to the National Earthquake Information Center), also on the CSM campus. The new building is intended to house the USGS Geology, Geophysics, and Geochemistry (G3) and Central Energy Resources (CER) Science Centers and allow for co-location with CSM geoscience faculty, establishing a center of excellence in minerals and energy science and providing opportunities for science collaboration that leverages USGS science; supports the development of science, technology, engineering and mathematics

(STEM) talent by engaging students in USGS science; and expands the diversity of the USGS workforce. Construction is scheduled to be complete in the 4th Quarter FY 2025.

FY 2022 Completed Accomplishments

- The USGS formally announced a new state-of-the-art research and teaching facility will be built on the Colorado School of Mines campus in Golden, Colorado.
- The USGS announced the award for a Cooperative Agreement for Phase 1 of the design of the Energy and Minerals Research Facility.
- The USGS announced the award for a contract for the preparation and delivery of the NEPA compliance including an Environmental Assessment for the Energy and Minerals Research Facility.

FY 2023 Planned Activities and Milestones

- The USGS transmitted the FY 2022 Annual Report to Congress as required in the provisional language.
- The USGS anticipates that the site preparation will begin in Q2 FY 2023.
- The USGS anticipates that construction is expected to begin in Q3 FY 2023.

FY 2024 Planned Activities and Milestones

- Continue construction and tenant build-out of the new building.

National Geological and Geophysical Data Preservation Program (NGGDPP)

Funding is available for obligation in years 2022 - 2025 to leverage the existing NGGDPP State grants program to provide competitive grants to States quickly and efficiently, to preserve and make publicly available historical geological and geophysical data and samples. The USGS provides competitive grants to State Geological Surveys and funds projects executed by USGS and other Department of the Interior bureaus, to preserve, modernize, and make publicly available, geological and geophysical data and assets.

FY 2022 Completed Accomplishments

- The USGS announced the awarding of approximately 35 competitive grants to State geological surveys and funding approximately 25 DOI bureau projects for data preservation activities that will result in the public availability of historical data and physical samples.
- The USGS awarded 32 competitive grants to State Geological Surveys and funded 18 USGS projects for data preservation activities. The bureau also released a Notice of Funding Opportunity for FY 2023 and 2024 State grant proposals.

FY 2023 Planned Activities and Milestones

- In FY 2023, the BIL appropriates $5.0 million for the National Geological and Geophysical Data Preservation Program project.
- The USGS plans to award competitive grants to State Geological Surveys and DOI bureau projects in FY 2023.
- The bureau also plans to release a Notice of Funding Opportunity for FY 2024 and 2025 state grant proposals.

- The USGS will release the newly re-architected National Digital Catalog (NDC), now known as ReSciColl, short for the Registry of Scientific Collections.

FY 2024 Planned Activities and Milestones

- In FY 2024, the BIL appropriates $5.0 million for the National Geological and Geophysical Data Preservation Program project.
- The USGS plans to award competitive grants to State geological surveys and DOI bureau projects in early FY 2024.

Earth Mapping Resources Initiative (Earth MRI)

Funding is available for obligation in years 2022 - 2026 to identify areas with potential critical mineral resources. The BIL directs the USGS to accelerate efforts to carry out the fundamental resources and mapping mission of the USGS by (1) providing integrated topographic, geologic, geochemical, and geophysical mapping; (2) accelerating the integration and consolidation of geospatial and resource data; and (3) providing interpretation of mineral resources data on the subsurface and above ground.

FY 2022 Completed Accomplishments

- The USGS published the 2022 List of Critical Minerals in February 2022, following the mandate of the Energy Act of 2020.
- Conducted the 2022 annual Earth MRI workshop with over 30 States and focused on reporting out recent Earth MRI results and prioritizing future mine waste inventory and characterization efforts.
- Finalized agreement with NASA for hyperspectral survey over the semi-arid southwestern U.S. to support geologic mapping and legacy mine lands studies for critical minerals.
- The USGS completed funding agreements with 11 State Geological Surveys for geologic mapping, acquire new geochemical data, and establish contracts for new geophysical surveys.
- The USGS established 2 funding agreements with State Geological Surveys to pilot sampling protocols for characterization of mine waste materials.
- The USGS funded the Alaska Division of Geological and Geophysical Surveys to finalize contracting for airborne geophysical surveys across the entire mineral-rich Yukon Tanana Uplands of east-central Alaska for areas permissive for mineral exploration.

FY 2023 Planned Activities and Milestones

- The USGS will augment its geologic mapping funding to State Geological Surveys with new agreements for sampling and characterization of legacy mine waste sites.
- Conduct NASA hyperspectral surveys over the semi-arid southwestern US to support geologic mapping and legacy mine waste studies.
- The USGS will establish 9 agreements with the State Geological Surveys for geologic mapping, acquire new geochemical data using FY 2022 BIL funds in Q2 FY 2023.
- Continue USGS tribal outreach efforts to address the tribal communities' geoscience data needs collected through Earth MRI to support tribal land management decisions on natural resources (e.g., minerals, geothermal energy, groundwater), infrastructure, and geologic hazards issues.

- The USGS plans to conduct the annual Earth MRI workshop October 2022 (FY 2023) with over 30 States and focused on reporting out recent Earth MRI results and prioritizing future mine waste inventory and characterization efforts.

FY 2024 Planned Activities and Milestones

- The USGS will augment its geologic mapping funding to State Geological Surveys with new agreements for sampling and characterization of legacy mine waste sites.
- The USGS plans to conduct the annual Earth MRI workshop October 2023 (FY 2024) with over 30 States and focused on reporting out recent Earth MRI results and prioritizing future mine waste inventory and characterization efforts.
- Continue USGS tribal outreach efforts to address the tribal communities' geoscience data needs collected through Earth MRI to support tribal land management decisions on natural resources (e.g., minerals, geothermal energy, groundwater), infrastructure, and geologic hazards issues.
- Finalize data acquisition of hyperspectral surveys with NASA over the semi-arid southwestern US to support geologic mapping and legacy mine waste studies.