BUDGET JUSTIFICATIONS

The United States Department of the Interior

and Performance Information
Fiscal Year 2013

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.

U.S. GEOLOGICAL SURVEY
FY 2013 BUDGET JUSTIFICATION

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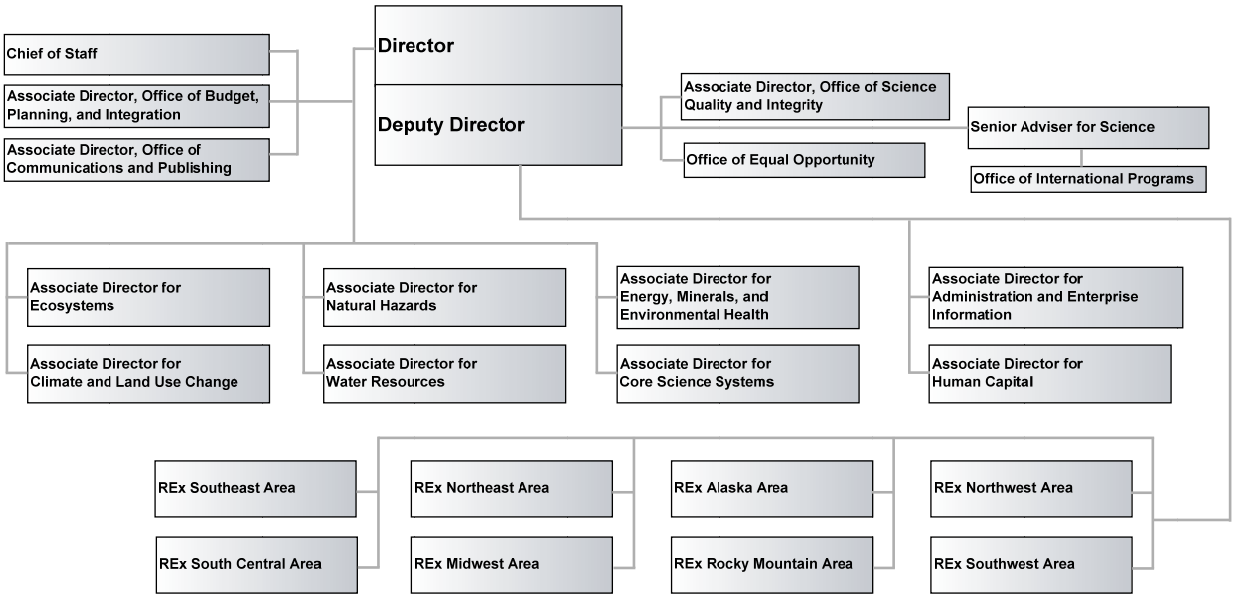
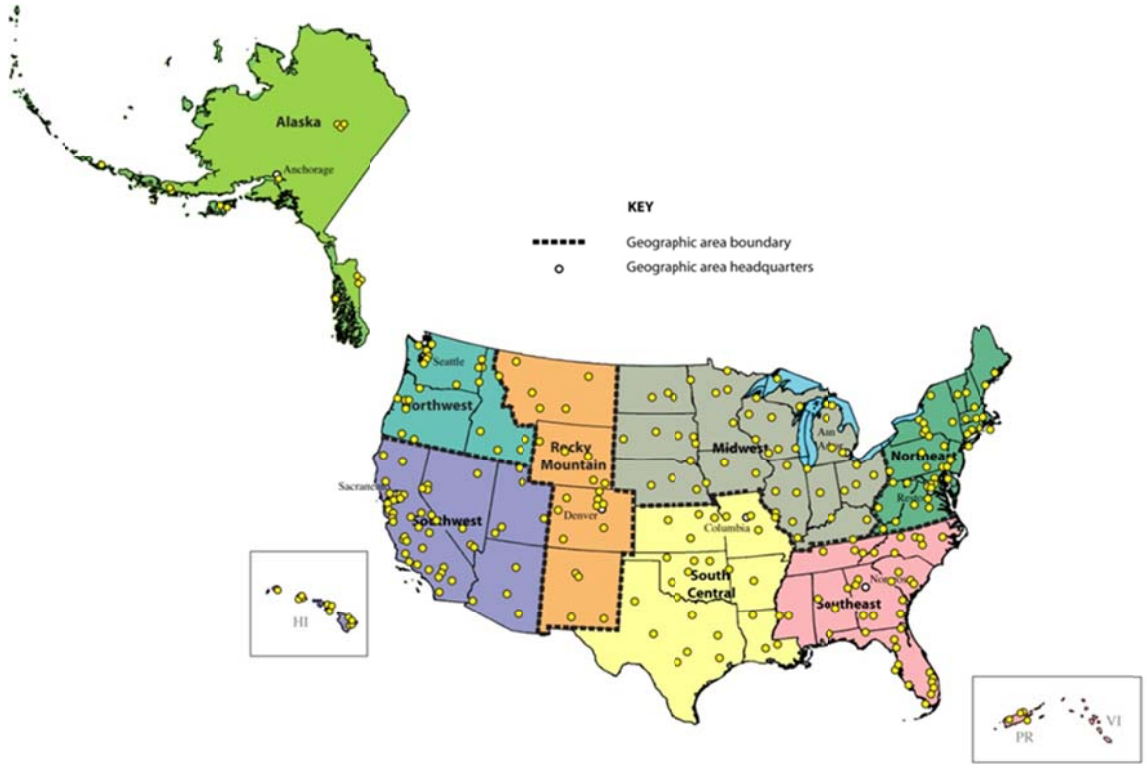
U.S. Geological Survey



USGS Regional Structure



Alphabetical List of Acronyms

AAAS	American Association for the Advancement of Science
AAPG	American Association of Petroleum Geologists
ABC	Activity-Based Costing
ABC/M	Activity-Based Costing/Management
ABP	Asset Business Plan
ACI	American Competitive Initiative
ACP	Arctic Coastal Plain
ACWI	Advisory Committee on Water Information
ADA	Americans with Disabilities Act
AFS	American Fisheries Society
AFWA	U.S. Air Force Weather Agency
AMD	Aviation Management Directorate
AMP	Asset Management Plan
AMWG	Adaptive Management Work Group
ANS	Alaska North Slope
ANS	Aquatic Nuisance Species
ANSS	Advanced National Seismic System
ANWR	Arctic National Wildlife Refuge
APHIS	Agricultures Animal and Plant Health Inspection Service
API	Asset Priority Index
APS	Administration and Policy Services
AR	Accounts Receivable
ARMI	Amphibian Research and Monitoring Initiative
ARRA	American Recovery and Reinvestment Act
ASC	Alaska Science Center
ASIWPCA	Association of State and Interstate Water Pollution Control Administrators
AVHRR	Advanced Very High Resolution Radiometer
AVO	Alaska Volcano Observatory
AWiFS	Advanced Wide Field Sensor
BASIS+	Budget and Science Information System
BBL	Bird Banding Laboratory
BBS	Bird Breeding Survey
BEN	Balkan Endemic Nephropathy
BF&E	Budget Formulation and Execution Team
BGN	Board of Geographic Names
BIA	Bureau of Indian Affairs
BIMD	Biological Information Management and Delivery
BIP	Biological Informatics Program (Equivalent to BMID)
BIS	Commerce - Bureau of Industry and Security
BLM	Bureau of Land Management
BLT	Business Leaders Team
BMPs	Best Management Practices
BNP	Biscayne National Park
BOR	Bureau of Reclamation
BPC	Bureau Program Council
BPXA	BP Exploration (Alaska)
BRD	Biological Resources
BRM	Biological Research and Monitoring
BSR	Business Strategy Review

CA	Condition Assessment
CAC	Civil Applications Committee
CALFED	California Federal (Bay-Delta Authority program)
CAP	Cooperative Agreements Program
CARA	Circum-Arctic Resource Appraisal
C&A	Certification and Accreditation
CC	Cost Center
CBERS	China/Brazil Earth Resources Satellite
CBLCM	Chesapeake Bay Land Cover Management
CBM	Coal bed Methane
CBP	Chesapeake Bay Program
CCI	Collaborative Communications Infrastructure
CCOAT	Coast Chesapeake Online Assessment Tool
CCSP	U.S. Climate Change Science Program
CDC	Centers for Disease Control and Prevention
CDR	Critical Design Review
CDI	Council for Data Integration
CEN	Climate Effects Network
CENR	Committee on Environment and Natural Resources
CEAP	Conservation Effects Assessment Project
CEGIS	Center of Excellence for Geographic Information Science
CEOS	Committee on Earth Observation Satellites
CEQ/NSTC	Council on Environmental Quality**/**National Science and Technology Council
CERC	Columbia Environmental Research Center
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERP	Comprehensive Everglades Restoration Plan
CESU	Cooperative Ecosystems Study Unit
CFO	Chief Financial Officer
CISN	California Integrated Seismic Network
CITES	Conventional on International Trade in Endangered Species
CLU	Climate and Land Use Change
CMG	Coastal and Marine Geology
CMGP	Coastal and Marine Geology Program
CMSP	Coastal and Marine Spatial Planning
CNS	Central portion of the North Slope
CO_2	Carbon Dioxide
COAST	Chesapeake Online Adaptive Support Toolkit
CoML	U.S. National Committee for the Census of Marine Life
CORE	Committee on Resource Evaluation
CPIC	Capital Planning and Investment Control
CR	Central Region
CRADA	Cooperative Research and Development Agreement
CRSSP	Commercial Remote Sensing Space Policy
CRTF	Coral Reef Task Force
CRU	Cooperative Research Units
CRUISE	Columbia River USGS Integrated Science Explorer
CRV	Current Replacement Value
CRWA	Charles River Watershed Association
CSC	Climate Science Center
CSI	Core Science Informatics

CSIP	Cost Savings and Innovation Plan
CSIRC	Computer Security Incident Response Capability
CSMP	California Seafloor Mapping Program
CSRS	Civil Service Retirement System
CSS	Core Science Systems
CTBTO	Comprehensive Test Ban Treaty Organization
CTM	Cooperative Topographic Mapping
CUES	Comprehensive Urban Ecosystems Studies
CUSEC	Central United States Earthquake Consortium
CVJV	Central Habitat Joint Venture
CVO	Cascades Volcano Observatory
CWD	Chronic Wasting Disease
CWP	Cooperative Water Program
CWS	Canadian Wildlife Service
DCIA	Debt Collection Improvement Act
DEM	Digital Elevation Model
DEP	[State] Department of Environmental Protection
DEQ	[State] Department of Environmental Quality
DFRs	Departmental Functional Reviews
DGH	Indian Directorate General of Hydrocarbons
DHS	Department of Homeland Security
DiGIR	Distributed Generic Information Retrieval
DMC	Data Management Center
DMC	Disaster Monitoring Constellation
DMCI	Deferred Maintenance and Capital Improvements
DNR	Department of Natural Resources
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOGAMI	Oregon Department of Geology and Mineral Industries
DPAS	Data Processing and Archiving
DRAGON	Delta Research and Global Observation Network
DROT	Drift River Oil Terminal
DRTO	Dry Tortugas National Park
DSS	Decision Support System
EA	Enterprise Architecture
EAD	Enterprise Active Directory
EAL	Energy Analytical Laboratory
ECMs	Energy Conservation Measures
ECO	Energy Conserving Opportunities
ECS	[U.S.] Extended Continental Shelf
EDCs	Endocrine Disrupting Chemicals
EDEN	Everglades Depth Estimation Network
EDMAP	Education Mapping Program (in National Cooperative Geologic Mapping Program)
EDRR	Early Detection, Rapid Assessment and Response
EEOC	Equal Employment Opportunity Commission
EFT	Electronic Funds Transfer
EGIM	Enterprise Geographic Information Management
EGS	Enhanced Geothermal Systems
EHP	Earthquake Hazards Program
EHP	Enterprise Hosting Platform

EI	Enterprise Information
EIR	Enterprise Information Resources
EISA	Energy Independence and Security Act of 2007
EIS&T	Enterprise Information Security and Technology
ELA	Enterprise License Agreement
ELT	Executive Leadership Team
EMS	Environmental Management System
E.O.	Executive Order
EOL	Encyclopedia of Life
EOP	Executive Office of the President
EPA	U.S. Environmental Protection Agency
EPCA	Energy Policy and Conservation Act of 2000
EPM	Ecosystem Portfolio Model
EPN	Enterprise Publishing Network
ER	Eastern Region
ERA	E-Risk Assessment
ERAS	eRemote Access Services
EROS	Earth Resources Observation and Science
ERP	Energy Resources Program
ESD	Earth Surface Dynamics
ESI	Environmental Sensitivity Index
ESN	Enterprise Services Network
ESPC	Energy Savings Performance Contract
ESRI	Environmental Systems Research Institute
ET	Evapotranspiration
ETM+	Enhanced Thematic Mapper Plus
EVMS	Earned Value Management System
FAA	Federal Aviation Administration
FAC	Federal Advisory Committee
FACA	Federal Advisory Committee Act
FAER	Fisheries: Aquatic and Endangered Resources
FASAB	Federal Accounting Standards Advisory Board
FBAT	Facilities Budget Allocation Team
FBMS	Financial Business Management System
FBWT	Fund Balance with Treasury
FCI	Facilities Condition Index
FEA	Federal Enterprise Architecture
FECA	Federal Employee Compensation Act
FEDMAP	Federal lands Mapping Program (in National Cooperative Geologic Mapping Program)
FEGLI	Federal Employees Group Life Insurance
FEHB	Federal Employees Health Benefit
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FERS	Federal Employees Retirement System
FFMIA	Federal Financial Management Improvement Act of 1996
FFS	Fire and Fire Surrogate
FGDC	Federal Geographic Data Committee
FICA	Federal Insurance Contributions Act
FICMNEW	Federal Interagency Committee for the Management of Noxious and Exotic Weeds
FISC	Florida Integrated Science Center

FISMA	Federal Information Security Management Act
FMT	Field Managers Team
FMFIA	Federal Managers' Financial Integrity Act of 1982
FMMS	Facilities Maintenance Management System
FOS	Flight Operations Segment
FOT	Flight Operations Team
FRAMES	Fire Research and Management Exchange System
FRB	Federal Reserve Board
FRPC	Federal Real Property Council
FRPP	Federal Real Property Profile
FSA	Farm Service Agency
FSAM	Federal Segment Architecture Methodology
FTE	Full-Time Equivalent
FWS	U.S. Fish and Wildlife Service
GAAP	Generally Accepted Accounting Principles
GAM	Geographic Analysis and Monitoring Program
GAP	Gap Analysis Program
GAO	Government Accountability Office
GBIP	Great Basin Information Project
GBIS	Global Biodiversity Information Facility
GCDAMP	Glen Canyon Dam Adaptive Management Program
GC-IMS	Global Change-Information Management System
GCP	Global Change Program
GCMRC	Grand Canyon Monitoring and Research Center
GEO	Group on Earth Observations
GEODE	GEO-Data Explorer
GeoMAC	Geospatial Multi-Agency Coordination Group
GEOMAG	Geomagnetism Program
GEOSS	Global Earth Observation System of Systems
GFDL	Geophysical Fluid Dynamics Laboratory
GFL	Global Fiducials Library
GIO	Geographic Information Office
GIRT	Geospatial Information Response Team
GIS	Geographic Information System
GLS	Global Land Survey
GLSC	Great Lakes Science Center
GNIS	Geographic Names Information System
GOES	Geostationary Operational Environmental Satellites
GOS	Geospatial One-Stop
GPRA	Government Performance and Results Act
GRB	Green River Basin
GHG	Greenhouse Gas
GPS	Global Positioning System
GPSC	Geospatial Products and Services Contract
GSA	General Services Administration
GS-FLOW	Groundwater and Surface-water flow model
GSN	Global Seismographic Network
GWRP	Ground-Water Resources Program
HAZUS	Federal Emergency Management Agency's Earthquake Loss Estimation Program
HBN	USGS Hydrologic Benchmark Network

HDOA	Hawaii Department of Agriculture
HDR	High-Data Rate Radio
HEDDS	Highly Pathogenic Avian Influenza Early Detection Data System
HDDS	Hazards Data Distribution System
HHS	Department of Health and Human Services
HIF	Hydrologic Instrumentation Facility
HLI	Healthy Lands Initiative
HNA	Hydrologic Networks and Analysis Program
HPO	High Performing Organization
HPPG	High Priority Performance Goal
HR	Human Resources
HR&D	Hydrologic Research and Development Program
HRS	Helibourne electromagnetic Surveys
HSPD -12	Homeland Security Presidential Directive 12
HUD	US Department of Housing and Urban Development
HVO	Hawaii Volcano Observatory
HWATT	Hemlock Woolly Adelgid Action Team
I&M	Inventory and Monitoring – NPS
IAGA	International Association of Geomagnetism and Aeronomy
ICAO	International Civil Authorization Organization
ICL	International Consortium on Landslides
ICRP	Internal Control Review Plan
ICWP	Interstate Council on Water Policy
IDWR	Idaho Department of Water Resources
IEAM	Integrated Environmental Assessment and Management
IGPP	Institute for Geophysics and Planetary Physics
IIE	Integrated Information Environment
ILM	Integrated Landscape Monitoring
IOOS	Integrated Ocean and coastal Observing System
IP	Investment Plan
IPCC	Intergovernmental Panel on Climate Change
IPDS	Information Product Data System
IRB	Investment Review Board
IRIS	Incorporated Research Institutions for Seismology
IRS	Indian Remote Sensing Satellite
InSAR	Interferometric Synthetic Aperture Radar
ISO	International Organization for Standardization
ISSP	Information Security Strategic Plan
IT	Information Technology
ITAP	Invasive Terrestrial Animals and Plants
ITILOB	Information Technology Infrastructure Line of Business
ITIS	Integrated Taxonomic Information System
ITSOT	IT Security Operations Team
ITSSC	IT Security Steering Committee
IUCN	International Union for the Conservation of Nature
IUCN	International Union of Conservation Nations
JFA	Joint Funding Agreement
JV	Joint Venture Partnerships
KSF	Thousand Square Feet
LAS	Local Action Strategy

LCAT	Land Cover Analysis Tool
LCC	Landscape Conservation Cooperatives
LDCM	Landsat Data Continuity Mission
LDGST	Landsat Data GAP Study Team
LEAG	Long-term Estuary Assessment Group
LHP	Landslide Hazards Program
LiDAR	Light Detecting and Ranging
LIFE	NBII Library of Images from the Environment
LIMA	Landsat Image Mosaic of Antarctica
LMV	Lower Mississippi Valley
LMVJV	Lower Mississippi Valley Joint Venture Office
LOA	Level of Authentication
LRS	Land Remote Sensing
LSC	Leetown Science Center
LST	Landsat Science Team
LTRMP	Long-Term Resource Monitoring Program
LTWG	Landsat Technical Working Group
LUPM	Land Use Portfolio Model
MARCO	Mid-Atlantic Research Consortium for Oceanography
MBTU	Million British thermal units
MD	Management Directive
MEO	Most Effective Organization
METRIC	Mapping EvapoTranspiration with high Resolution and Internalized Calibration
MHDP	Multi-Hazards Demonstration Project
MMS	Minerals Management Service
MOA	Memorandum of Agreement
MOC	Mission Operations Center
MODIS	Moderate Resolution Imaging Spectroradiometer
MODFLOW	Modular Ground-Water Flow Model
MOU	Memorandum of Understanding
MRBI	Mississippi River Basin Healthy Watersheds Initiative
MRDS	Mineral Resources Data System
MRERP	Mineral Resources External Research Program
MRLC	Multi-Resolution Land Characteristics Consortium
MRP	Mineral Resources Program
MSCP	Multi-Species Conservation Program
MSH	Mount St. Helens
MSS	Multi Spectral Scanner
MTBE	Methyl Tert-Butyl Ether
MTBS	Monitoring Trends in Burn Severity
MUSIC	MIT-USGS Science Impact Collaborative
MW	Megawatt
MWE	Megawatt electric
NABCI	North American Bird Conservation Initiative
NACO	National Association of Counties
NADP	National Atmospheric Deposition Program
NAGT	National Association of Geoscience Teachers
NANPCA	Non-indigenous Aquatic Nuisance Prevention and Control Act
NARA	National Archives and Records Administration
NAS	National Academy of Sciences

NAS	USGS National Non-indigenous Aquatic Species Database
NASA	National Aeronautics and Space Administration
NASQAN	National Stream Quality Accounting Network
NAWQA	National Water-Quality Assessment
NBC	Department of the Interior – National Business Center
NBII	National Biological Information Infrastructure
NCAR	National Center for Atmospheric Research
NCAP	National Civil Applications Program
NCCWSC	National Climate Change and Wildlife Science Center
NCDE	Northern Continental Divide Ecosystem
NCEP/NOAA	National Centers for Environmental Prediction
NCGMP	National Cooperative Geologic Mapping Program
NCIA	National Competitiveness Investment Act
NCPP	USGS National Coastal Program Plan
NCRDS	National Coal Resources Data System
NDMC	National Drought Mitigation Center
NDOP	National Digital Orthoimagery Program
NED	National Elevation Dataset
NEHRP	National Earthquake Hazards Reduction Program
NEIC	National Earthquake Information Center
NEON	National Ecological Observatory Network
NEPA	National Environmental Policy Act
NEST	National Environmental Status and Trends
NETL	National Energy Technology Laboratory
NFHAP	National Fish Habitat Action Plan
NGA	National Geospatial-Intelligence Agency
NGAC	National Geospatial Advisory Committee
NGGDPP	National Geological and Geophysical Data Preservation Program
NGIC	National Geomagnetic Information Center
NGMA	National Geologic Mapping Act
NGMDP	National Geologic Map Database Project
NGO	Nongovernmental organization
NGP	National Geospatial Program
NGTOC	National Geospatial Technical Operations Center
NGWMN	National Ground Water Monitoring Network
NHD	National Hydrography Dataset
NHWC	National Hydrologic Warning Council
NIEHS	National Institute of Environmental Health Sciences
NIFC	National Interagency Fire Center
NIH	National Institute of Health
NISC	National Invasive Species Council
NIISS	National Institute for Invasive Species Science
NISMP	National Invasive Species Management Plan
NIST	National Institute of Standards and Technology
NIWR	National Institutes for Water Resources
NLC	National League of Cities
NLCD	National Land Cover Database
NLIC	National Landslide Information Center
NLIP	National Land Imaging Program
NOAA	National Oceanic and Atmospheric Administration

NORAD	North American Aerospace Defense Command
NORTHCOM	U.S. Northern Command
NOSC	National Operations and Security Center
NPN	National Phenology Network
NPRA	National Petroleum Reserve Alaska
NPS	National Park Service
NRDA	Natural Resource Damage Assessment
NRIS	Natural Resource Information System
NRC	National Research Council
NRC	Nuclear Regulatory Commission
NRCS	Natural Resources Conservation Service
NRMP	National Resource Monitoring Partnership
NROC	Northeast Regional Ocean Council
NRP	National Research Program (research organization in USGS Water Resources)
NRPP	National Resource Preservation Program
NSDI	National Spatial Data Infrastructure
NSF	National Science Foundation
NSGIC	National States Geographic Information Council
NSIP	National Streamflow Information Program
NSLRSDA	National Satellite Land Remote Sensing Data Archive
NSMP	National Strong Motion Program
NSPD	National Space Policy
NSTC	National Science and Technology Council
NSVRC	Northern Shenandoah Valley Regional Commission
NTN	National Trends Network
NVCS	National Vegetation Classification Standard
NVEWS	National Volcano Early Warning System
NWAVU	National Water Availability and Use Assessment
NWHC	National Wildlife Health Center
NWIS	National Water Information System
NWQL	National Water Quality Laboratory
NWQMN	National Water Quality Monitoring Network
NWRC	National Wetlands Research Center
NWS	National Weather Service
O&M	Operations and Maintenance
OAFM	USGS Office of Accounting and Financial Management
OAG	USGS Office of Acquisition and Grants
OAP	Ocean Action Plan
OBIS	Ocean Biogeographic Information System
OBIS	USGS Office of Business Information Systems
OBP	USGS Office of Budget and Performance
OC	USGS Office of Communications
OEPC	Office of Environmental Policy and Compliance
OES	Office of Emergency Services
OFDA	Office of Foreign Disaster Assistance
OFEE	Office of the Federal Environmental Executive
OFR	Open-File Report
OGC	Open Geospatial Consortium
OHC	USGS Office of Human Capital
OIA	Office of Insular Affairs

OICR	USGS Office of Internal Control and Reporting
OIG	Office of the Inspector General
OGDB	Organic Geochemistry Database
OLI	Operational Land Imager
OMB	Office of Management and Budget
OMS	USGS Office of Management Services
OPA	USGS Office of Policy and Analysis
OPM	Office of Personnel Management
ORPP	Ocean Research Priority Plan
ORPPIS	Ocean Research and Priorities Plan and Implementation Strategy
OSHA	Occupational Safety and Health Administration
OSM	Office of Surface Mining
OSTP	Office of Science and Technology Policy
OWRS	Office of Western Regional Services
PAGER	Prompt Assessment of Global Earthquakes for Response
PAR	Performance and Accountability Report
PBO	Plate Boundary Observatory
PBX	Private Branch eXchange
PCR	Polymerase Chain Reaction
PDA	Personal Digital Assistant
PDF	Portable Document Format
PDR	Preliminary Design Review
PES	Priority Ecosystem Science
PFM	(Department) Office of Financial Management
PI	Principal Investigator
PII	Personally Identifiable Information
PIP	Performance Improvement Plan
PIP	Program Improvement Plan
PMO	Project Management Office
PNAMP	Pacific Northwest Aquatic Monitoring Partnership
POA&M	Plan of Action and Milestone
PP&E	Property, Plant, and Equipment
PPM	Planning Performance Management
P&PM	Planning and Performance Management Team
PRB	Powder River Basin
PSNER	Puget Sound Near Shore Ecosystem Restoration
PSS	Perimeter Security Standard
PTWC	Pacific Tsunami Warning Center
PWRC	Patuxent Wildlife Research Center
QOL	Quality of Life
R&D	Research and Development
RASA	Regional Aquifer-System Analysis
RCCRC	Regional Climate Change Response Centers
RCM	Regional Climate Models
RCOOS	Regional Coastal Ocean Observing Systems
REE	Rare Earth Elements
REMS	River Ecosystem and Modeling Science
RFP	Request for Proposal
RGIO	Regional Geospatial Information Office®
RIF	Reduction in Force

RIM	River Input Monitoring Program
RISA	Regional Integrated Science and Assessments – NOAA
RPM	Real Property Management System
RSAC	Remote Sensing Application Center
RSSC	Reston Supply Service Center
RSSI	Required Supplementary Stewardship Information
RTS	Reports Tracking System (Water Resources)
R/V	Research Vessel
RWRPC	Regional Water Resources Policy Committee
S&T	USGS Status and Trends of Biological Resources program
SAC	USGS Science Advisory Council
SAFOD	San Andreas Fault Observatory at Depth
SAIN	Southern Appalachian Information Node
SAP	Synthesis and Assessment Product
SAR	Synthetic Aperture Radar
SAUS	Storage Assessment Units
SBFD	San Francisco Bay and freshwater delta
SBSP	South Bay Salt Pond Restoration Project
SCEC	Southern California Earthquake Center
SCR	System Concept Review
SDI	Spatial Data Infrastructures
SDR	Subcommittee for Disaster Reductions
SDRT	Supervisory Development Review Team
SES	Senior Executive Service
SETAC	Society of Environmental Toxicology and Chemistry
SFBD	San Francisco Bay Delta
SFMP	Strategic Facilities Master Plan
SFWMD	South Florida Water Management District
SHC	Strategic Habitat Conservation
SLC	Scan Line Corrector
SGL	Standard General Ledger
SIR	Surveys, Investigations, and Research
SOGW	Subcommittee of Ground Water
SoIVES	Social Values for Ecosystem Services
SOW	Statement of Work
SPARROW	Spatially Referenced Regressions on Watershed Attributes
SPOC	Security Point of Contact
SPOT	Satellite Pour L'Observation de la Terre
SPRESO	South Pole Remote Earth Science Observatory
SRR	Systems Requirement Review
SRTM	Shuttle Radar Topographic Mission
SSRIs	Selective Seronin Reuptake Inhibitors
STATEMAP	State Mapping Program (in Cooperative Geologic Mapping Program)
STIG	Security Technical Implementation Guides
SWAQ	Subcommittee on Water Availability and Quality
SWPC	Space Weather Prediction Center
TAA	Technical Assistance Agreements
TANC	Transport of Anthropogenic and Natural Contaminants
TCOM	Tahoe Constrained Optimization Model
TDWG	Biodiversity Information Standards

TIC	Trusted Internet Connection
TIRS	Thermal Infrared Sensor
TM	Thermatic Mapper
TMDL	Total Maximum Daily Loads (Clean Water Act requirement)
TRIGRS	Transient Rainfall Infiltration and Grid-Based Regional Slope-Stability Analysis
TRIP	The Road Indicator Project
TROR	Treasury Report on Receivables
TRPA	Tahoe Regional Planning Agency
TSP	Thrift Savings Plan
UAS	Unmanned Aerial Systems
UHM	University of Hawaii-Manoa
UIC	Underground Injection Control
URISA	Urban and Regional Information System Association
U.S.	United States
USACE	U.S. Army Corps of Engineers
USAID	U.S. Agency for International Development
U.S.C.	United States Code
USDA	U.S. Department of Agriculture
USDOE	U.S. Department of Energy
USFS	U.S. Forest Service
USGCRP	U.S. Global Change Research Program
USGEO	U.S. Group on Earth Observations
USGS	U.S. Geological Survey
UMESC	Upper Midwest Environmental Services Center
USNG	United States Nation Grid
VANS	Volcano Activity Notices
VBNS	Very Broadband Network Services
VCP	Vegetation Characterization Program
VDAP	Volcano Disaster Assistance Program
Veg	Vegetation Characterization
VegDRI	Vegetation Drought Response Index
VHP	Volcano Hazards Program
VHSV	Viral Hemorrhagic Septicemia Virus
VOIP	Voice over IP Systems
VONA	Volcano Observatory Notifications for Aviation
VSIP/VERA	Voluntary Separation Incentive Payment/Voluntary Early Retirement Authority
WAN	Wide Area Network
WCCI	Wyoming Cooperative Conservation Initiative
WCF	Working Capital Fund
WCMC	UNEP-World Conservation Monitoring Center
WERC	Western Ecological Research Center
WFRC	Western Fisheries Research Center
WLCI	Wyoming Landscape Conservation Initiative
WNS	White-Nose Syndrome
WNV	West Nile Virus
WPA	World Petroleum Assessment 2000
WR	Western Region
WRD	Water Resources
WRIR	Water Resources Investigation Report
WRRA	Water Resources Research Act

WRRIs	[State] Water Resources Research Institutes
WSC	[USGS State] Water Science Center
WSWC	Western States Water Council
WTER	Wildlife: Terrestrial and Endangered Resources
WUI	Wildland-Urban Interface
YMP	Yucca Mountain Program
YVO	Yellowstone Volcano Observatory

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General Statement

Total 2013 Budget Request
(Dollars in Thousands)

Budget Authority	2011 Actual	2012 Enacted	2013 Budget Request	Inc (+)/Dec (-) from 2012
Discrectionary	1,083,672	1,068,032	1,102,492	34,460
Mandatory	961	597	664	67
Total	**1,084,633**	**1,068,629**	**1,103,156**	**34,527**
FTE	8,622	8,518	8,512	-6

FTE	2011 Actual	2012 Enacted	2013 Budget Request	Inc (+)/Dec (-) from 2012
Direct	5,526	5,466	5,460	-6
Reimbursable	2,823	2,823	2,823	0
Working Capital Fund	248	204	204	0
Allocation Account	14	14	14	0
Contributed Funds	11	11	11	0
Total	8,622	8,518	8,512	-6

Overview

The 2013 U.S. Geological Survey (USGS) budget request is $1.1 billion, which is $34.5 million or 3.2 percent above the 2012 Enacted Budget. The Nation's largest water, Earth, and biological science and civilian mapping agency, the USGS collects, monitors, analyzes, and provides scientific understanding of natural resource conditions, issues, and problems. For more than a century, this diversity of scientific expertise has enabled the USGS to carry out large-scale, multi-disciplinary investigations and provide impartial scientific information to resource managers, planners, policymakers, and the public. The 2013 Budget reflects careful and tough decisions, made within a fiscally constrained environment, to prioritize science investments that address critical needs and support a resilient and robust economy, while also protecting the health and environment of the Nation. To do so, the 2013 budget builds on the core historical mission of the USGS, increases research and development funding by $51.0 million to advance priorities in science-based resource management and protection of public health and safety from hazards, focuses existing resources on science priorities identified in the USGS Science Strategy, and makes difficult targeted program decreases.

The USGS continues to provide high quality, unbiased science to meet the growing needs of other Interior bureaus, government agencies, and the private sector. In 2011, the USGS aligned its programs and workforce to address increasingly complex resource management issues such as the development of alternative energy, restoration of critical ecosystems, understanding and adaptation to climate change, and responses to natural and human-induced hazards. USGS management and staff ensure that they work efficiently and effectively, and any savings realized are reinvested in science to answer additional questions unearthed by research. Additionally, the USGS leverages appropriated resources to operate a robust nationwide streamgaging network, update information for digital topographic maps, create geologic maps, monitor the Earth's earthquake and volcanic activity, collect vital information to address complex science issues, and develop decision support tools.

The importance of USGS science was recognized in 2011 when the USGS's Paul Hsieh became the first Department of the Interior (Interior) employee ever to earn the Federal Employee of the Year award. The medal was awarded to Dr. Hsieh to recognize his achievements in helping to stop oil from flowing into the Gulf of Mexico during the 2010 Deepwater Horizon disaster. Dr. Hsieh's timely scientific analysis convinced Federal leaders that the Macondo well could be safely shut in, thus ending America's 86-day oil spill nightmare. Dr. Hsieh's reservoir depletion model yielded the result that the Macondo well had released 4.9 million barrels of oil, a number declared by at least one major news source as the most important number of 2010.

USGS Organic Act

43 U.S.C. 31 et seq. Organic Act of March 3, 1879, as amended, establishes the United States Geological Survey. Provides, among other matters, that the USGS is directed to classify the public lands and examine the geologic structure, mineral resources, and products within and outside the national domain. Establishes the Office of the Director of the United States Geological Survey under the Department of the Interior. The Director is appointed by the President with the advice and consent of the Senate.

Throughout 2011, the USGS responded to flood and earthquake hazards. Floods impacted more than 30 States in 2011. Across these States, the USGS provided flood monitoring through real-time streamgages, mobile storm surge monitors, and acoustic Doppler profile technology. The USGS streamgage network provides the National Weather Service with the information they need to issue flood alerts. In addition to providing rapid information for immediate response to the 5.8 magnitude earthquake in Mineral, VA, the USGS has deployed portable seismometers around northern Virginia in order to better characterize and monitor aftershock activity, capture ground motion records, and better define the fault zone from which the earthquake emanated. This response and follow-up will enhance understanding of future earthquake hazards and provide basic data needed for improving earthquake resistant construction in the eastern United States.

The USGS 2013 Budget Request

A balanced portfolio is essential to a healthy science agency, ensuring that it can maintain diverse expertise to respond to constantly evolving science needs. Accordingly, the budget request was developed with an eye toward balancing investments in monitoring, research, assessments, technical assistance, information delivery, and partner-driven activities. The principles used to prioritize budget formulation include:

- Maintaining programs that are unique to the USGS and conducted on behalf of the Nation;

- Retaining programs that are legislatively mandated;
- Maintaining national long-term monitoring and observational networks;
- Aligning targeted increases with emerging science priorities that are of national and global significance;
- Supporting Administration and departmental priorities; and
- Eliminating projects that are nearing the end of their current scope of work.

Funding for Administration Priorities in 2013 Budget Request

($ in Thousands)

Initiative	2011 Actual	2012 Enacted	2013 Request	Changes from 2012 Enacted (+/-)
New Energy Frontier	31,193	30,791	43,991	13,200
WaterSMART	5,937	7,974	20,974	13,000
Cooperative Landscape Conservation	64,334	58,921	67,741	8,820
Youth in the Great Outdoors	2,636	2,202	2,154	-48
Ecosystem Priorities	45,700	49,276	65,477	16,201
Rapid Disaster Response	2,535	2,325	10,925	8,600
Science for Coastal and Ocean Stewardship	500	2,000	8,750	6,750

The 2013 request includes targeted increases of $73.2 million and refocus of existing program efforts to advance Administration priorities such as New Energy Frontier, WaterSMART, Cooperative Landscape Conservation, Youth in the Great Outdoors, Ecosystem Priorities, Rapid Disaster Response, and Science for Coastal and Ocean Stewardship at funding levels consistent with that of the 2012 enacted level or higher. Below is a description of USGS efforts in the priority areas for 2013:

- **New Energy Frontier** – Broadening the energy sources of the United States requires information to evaluate and minimize the impacts of development on fish and wildlife habitat and water quality. The USGS will continue work on the impacts of wind development on ecosystems conduct assessments to increase understanding regarding the extent to which geothermal energy contributes to the national mix of energy resources, conduct a global assessment of technically recoverable unconventional oil and gas resources, and build the science base for addressing the complex environmental, health, and safety issues related to hydraulic fracturing. More information can be found in the Program Change and Energy, Minerals, and Environmental Health Sections.
- **WaterSMART** – The USGS contribution to Interior's Water Challenges initiative is the WaterSMART effort that involves multiple USGS mission areas and is coordinated with the Bureau of Reclamation (Reclamation). As competition for water resources grows for irrigation of crops, growing cities and communities, energy production, and the environment, the need for information and tools to aid water resource and land

managers grows. WaterSMART, through the combined efforts of Reclamation in the West and the USGS throughout the entire Nation, provides the foundation for a sustainable water strategy. More details about WaterSMART can be found in the Program Changes Section.

- **Cooperative Landscape Conservation** – Effectively responding to impacts of climate change requires science that meets resource managers' needs. Through the leadership of the Department of the Interior Climate Science Centers (DOI CSCs) the USGS will conduct climate change vulnerability assessments, advance national assessments of geological and biological carbon sequestration, and continue to build the scientific base for the Landscape Conservation Cooperatives (LCCs). For more information see the Climate and Land Use Change Section.
- **Youth in the Great Outdoors** – The Secretary challenged Interior bureaus to increase youth employment. The USGS responded to the challenge by creating a Youth Office to coordinate with its program offices to provide meaningful, mentored work experiences and training and to support graduate research in the natural sciences. These programs help the USGS meet its scientific mission today, while preparing the workforce of tomorrow. The successful retention of the next generation of USGS employees, increasing science literacy in our country's youth, and maintaining relationships with tribal partners will continue to be a top priority. More information can be found in the Administration and Enterprise Information Section.
- **Ecosystem Priorities** – To complement the America's Great Outdoors Initiative, the 2013 budget request includes strong support for the USGS to contribute to ecosystem restoration efforts in the Chesapeake Bay, Everglades, California Bay Delta, Great Lakes, Upper Mississippi River, Columbia River, Puget Sound, Klamath River, and Gulf Coast. The USGS is working with Interior bureaus and other agencies to provide scientific tools for strategic decisionmaking in support of restoring clean water, conserving treasured places, restoring habitats for fish and wildlife, and better understanding ecosystem services as outlined in the *Sustaining Environmental Capital* report by the President's Council of Advisors on Science and Technology. Information on the increases proposed for Ecosystem Restoration can be found in the Program Changes Section.
- **Rapid Disaster Response** – Recent events have increased expectations for the USGS to provide rapid, robust information in response to natural disasters. This initiative will support improvements for early warning and disaster event characterizations and scenario products for earthquakes, eruptions of volcanic ash, debris flows and flood monitoring. The investments proposed in this budget request would leverage substantial investments in earthquake and volcano monitoring made through the American Recovery and Reinvestment Act (ARRA). More details about Rapid Disaster Response can be found in the Program Changes Section.
- **Science for Coastal and Ocean Stewardship** – Increased population growth, energy development and resource use in coastal areas requires information that helps communities make wise decisions. This initiative supports the National Ocean Policy by investing in the science and information necessary to develop and provide access to integrated assessments of marine and coastal resource status and vulnerability; and providing data and model-based assessments of the consequences of changing coastal conditions and alternative management scenarios. More details about Science for Coastal and Ocean Stewardship can be found in the Program Changes Section.

Budget Change Summary ($ in Thousands)	
2012 Enacted	**1,068,032**
Program Increase	73,152
Program Decrease	-49,472
Fixed Costs	10,780
2013 Request	**1,102,492**

Despite a significant effort to balance priorities and meet mission needs, the budget request required difficult choices that include program reductions totaling $49.5 million. For example there are reductions of $5.3 million for mineral resources research and external grants, $1.5 million for cooperative geologic mapping, $6.5 million for the Water Resources Research Act Program, $4.1 million for administrative services and $4.4 million for Operations and Maintenance of facilities. More details about program reductions can be found in the Program Changes Section.

High Priority Performance Goals

Responding to a Changing Climate

The USGS is a primary contributor to the Responding to a Changing Climate High Priority Performance Goal (HPPG): *By September 30, 2013, for 50 percent of the Nation, the Department of the Interior will identify resources that are particularly vulnerable to climate change and implement coordinated adaptation response actions.*

Bureau Contribution: The USGS Climate and Land Use Change Mission Area is the primary contributor to this HPPG and, along with other USGS mission areas including Ecosystems, Water, and Natural Hazards, conducts climate vulnerability assessments used by Interior land management bureaus to develop adaptation plans. The National Climate Change and Wildlife Science Center (NCCWSC) and the eight DOI CSCs will lead the effort for the USGS to conduct science that can be attributed to this HPPG. The USGS funding for climate change in 2011 is $64.3 million, $58.9 million in 2012, and $67.7 million in 2013.

Implementation Strategy: The Responding to a Changing Climate HPPG presents an opportunity to unite climate change research and science that Interior bureaus have been doing. Interior's implementation strategy for the Climate Change Adaptation HPPG includes:

- Climate Change Impact Science: The DOI CSCs and LCCs conduct research and monitoring and communicate research findings to improve understanding of climate change impacts and vulnerabilities. The LCCs are also deeply engaged in adaptation planning, thus serving as a key science-management bridge. This joint effort helps to support strategic decisions in response to vulnerabilities: the DOI CSCs will be centers for basic climate change science associated with broad regions of the country; and LCCs will focus on applied science and management decisionmaking at the landscape level.

- Assessing the Vulnerability of Areas and Species Related to Climate Change: The USGS (as well as other Interior bureaus) have been conducting climate change vulnerability assessments across the United States in an effort to determine the resources that are most vulnerable and assess the threats to resources that may be exacerbated by climate change. Of the Interior bureaus, the USGS conducts the most climate change vulnerability science, and thus is the largest contributor to this section of the HPPG.

USGS climate change vulnerability assessments are currently being conducted in the Ecosystems, Climate and Land Use Change, Water Resources, and Natural Hazards mission areas. The USGS is currently tracking 136 climate change vulnerability assessments that will be completed by the end of 2013.

Performance Metrics: The USGS is responsible for reporting the following performance measures related to this HPPG:

- Number of DOI CSCs formed
  - 2011 Actual: 5
  - 2012 Target: 8
- Number of DOI CSC research priority documents completed
  - 2011 Actual: 3
  - 2012 Target: 8
- Number of climate change vulnerability assessments underway
  - 2011 Actual: 172 of 173 (99 percent)
  - 2012 Target: 173 of 173 (100 percent)
- Number of climate change vulnerability assessments completed through 2016 (cumulative)
  - 2011 Actual: 11 of 173 (6 percent)
  - 2012 Target: 101 of 173 (58 percent)
  - 2013 Target: 136 of 173 (79 percent)
  - 2014 Target: 150 of 173 (87 percent)
  - 2015 Target: 159 of 173 (92 percent)
  - 2016 Target: 160 of 173 (92 percent)
  - Ongoing: 13 of 173 (8 percent)

Youth Stewardship

The USGS is a contributor to Interior's Youth Stewardship HPPG: *By September 30, 2013, the Department of the Interior will maintain the increased level of employment of individuals between the ages of 15 to 25 that was achieved in FY 2010 (35 percent increase in total youth employment over FY 2009) to support the Department's mission of natural and cultural resource management.*

Bureau Contribution: The USGS contributes to Interior's goal by engaging youth through meaningful hands-on work experience, training, professional mentoring and graduate research in the natural sciences. Investing in science, technology, engineering and mathematics (STEM) education and increasing the number of youth hired at the USGS is critical to achieving the USGS mission now and in the future. The USGS budget contribution to Youth in the Great Outdoors in 2011 was $2.6 million, $2.2 million in 2012, and is $2.2 million in the 2013 Budget request. In addition to this funding, base funding is included in several USGS programs that support Youth activities.

Implementation Strategy: As a bureau of scientists, the USGS has a rich culture of mentoring, engaging, employing, and educating youth in the geosciences. In 2011, the USGS engaged in a wide array of Youth activities nationwide. For example:

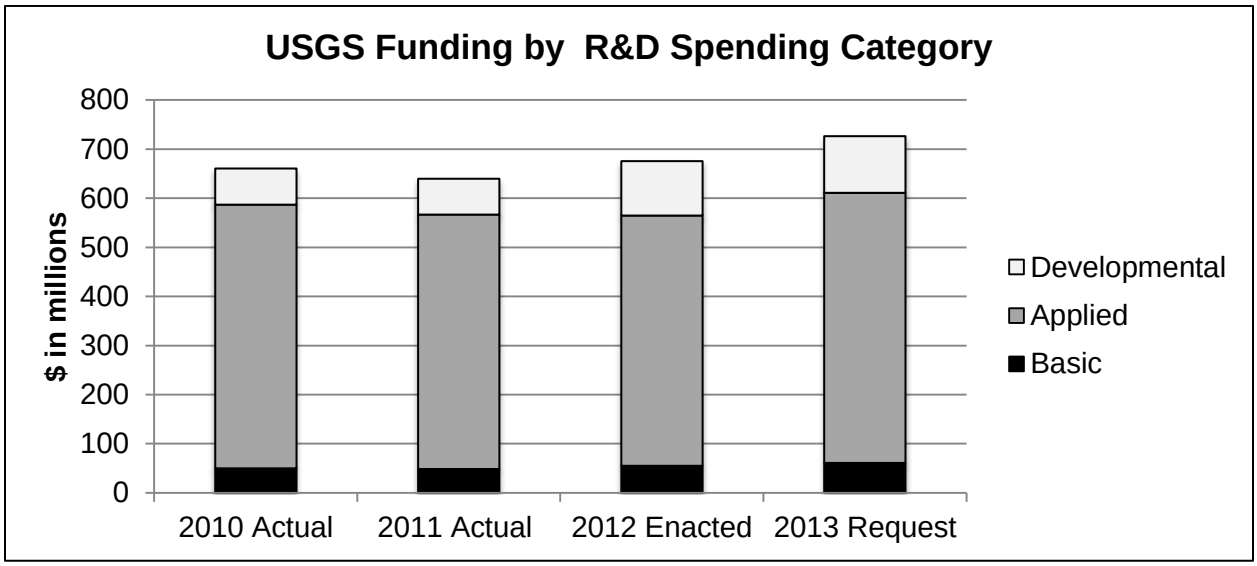
- GeoFORCE: The USGS has worked closely for the past 6 years with GeoFORCE, a University of Texas/Austin program, to engage minority high school students in the Earth sciences. The USGS, primarily through the National Cooperative Geologic Mapping Program's EDMAP training component, is realizing a high return on investment by encouraging the "graduates" of this 4-year high school science experience to continue to work with the USGS throughout their college education. This year's GeoFORCE class of 40 includes 25 women and is 80 percent Hispanic.
- Denver Mayor's Office Partnership: The USGS worked closely with the Denver Public Schools and the Denver Mayor's office to hire 11 diverse students, ages 15 to 21 years. The Mayor's office sponsored a 3-week training session to prepare these young people to work with the USGS. The USGS identified a sponsor for each student in the program, with a focus on mentoring, career exploration, and understanding the missions of the USGS and Interior. The students made presentations describing what they had learned and experienced throughout the summer. Eight of the 11 students were extended for employment beyond the summer.

The USGS met the HPPG measure of increasing youth hires by 35 percent over 2009 figures by the third quarter of 2011. In 2012 and 2013, the USGS will continue to participate in the Youth in the Great Outdoors Initiative. The USGS is implementing a Youth and Education in Science component to leverage resources; is tracking new and current youth hires and youth hired by our partners; is enhancing participation in the sciences by women, Native American, and minority students; is providing training and experiences in the natural sciences outdoors; and is creating science career pathways that reach out to students in grades K-16.

National Science Perspective: Addressing National Science and Technology Priorities

Investments in Research and Development (R&D) promote economic growth and innovation and ensure American competitiveness in a global market. R&D is the core of the USGS mission. Total R&D funding is $726.5 million[1], which is 65.9 percent of the total USGS appropriated budget. This level is a net increase of $51.0 million, or 7.6 percent above the 2012 enacted level.

[1] R&D funding shown for the USGS has been updated from figures shown in the Analytical Perspectives volume of the 2013 Budget.



Of the $726.5 million R&D total, $61.2 million is for basic research, $550.2 million is for applied research, and $115.2 million is for developmental research. The increased funding for R&D will advance USGS capacity to address emerging societal challenges related to hydraulic fracturing, marine and ocean science, rapid disaster response, water availability, and ecosystem priorities.

The importance of investing in fundamental science becomes clearer when looking at the continuing relevance of USGS investments over the last 120 years. For example, a USGS scientist first described the impacts of pumping well water on groundwater flow in 1899. At that time, a relatively small portion of water needs were addressed by groundwater and proper management of groundwater was not a major concern. By 1923, use of groundwater had increased, and in response, the USGS produced the first Ground Water Atlas of the United States. Today, more than 40 percent of the Nation's drinking water and one half of the Nation's irrigation water is supplied by groundwater. Without initial investments over 120 years ago, with considerable improvements made since then by the USGS, the Nation would not be as well situated to provide real-time data and forecasts that are necessary to understand water availability as water resources become more scarce. In 2013, the USGS is requesting funding to build on the investment of past years and address current issues by establishing the National Groundwater Monitoring Network.

In 2011, the USGS continued to apply investments in R&D to address critical societal challenges. For example, USGS fundamental research played a fundamental role in increasing the Nation's capacity to reduce loss of life and property from natural hazards. The USGS played a critical role in the emergency response to flooding along the Mississippi and Missouri Rivers. Emergency managers needed information to understand how the flow of the river would change when a levee was breached—whether intentionally or due to flooding. The USGS provided the necessary data, maps, and models to improve understanding of how the river flow would change under various conditions. The data collected during extreme floods such as these will help reduce loss of life and property in the future as it is applied to support improved flood forecasts. Similarly, in preparation for Hurricane Irene, the USGS deployed portable streamgages and storm surge monitoring stations to improve emergency alert capabilities and provide more data that will help inform preparation for future hurricanes.

USGS fundamental, multidisciplinary science capabilities are necessary to address the Nation's increasingly connected societal and economic challenges. The USGS aided in the response to the earthquake and tsunami disaster in Japan by providing earthquake and tsunami impact information needed by scientists, engineers, and emergency managers to improve their understanding of the nature and effects of these hazards. Due to concerns about impacts to nuclear reactors, USGS ShakeCast products were delivered to nuclear plants worldwide, including Japan, to the International Atomic Energy Agency and the Nuclear Regulatory Commission. In addition to earthquake information products, the USGS provided timely products estimating fatalities and economic impacts. The USGS Minerals Information Team produced maps useful to decisionmakers globally, showing the mining and mineral processing facilities and infrastructure in Japan that were likely to have been impacted by the earthquake and tsunami.

Similarly, USGS interdisciplinary science is informing decisions that link wildlife, environmental health, and the economy. In 2011, the USGS used cutting edge technology to complete the genome sequencing of the fungus that causes the skin infection that is hallmark of the white-nose syndrome (WNS) that is decimating bat populations. This sequencing will support further research that is necessary to develop management strategies to mitigate the spread of the syndrome among bats. Recognizing that the impact of WNS is not limited to wildlife health, the USGS and university partners produced a study, which determined that bats contribute $3.7 billion to the agricultural economy by eating pests that are harmful to agricultural and forest commodities.

Ensuring Scientific and Scholarly Integrity

Robust, high quality science and scholarship plays an important role in advancing Interior's mission. In February 2011, Interior released a new Scientific and Scholarly Integrity Policy that sets forth clear expectations for all employees to uphold the principles of scientific integrity, and establishes a process for impartial review of alleged breaches of those principles. The policy is based on the principles found in Secretarial Order 3305 and builds on the previous USGS Scientific Integrity Policy. The policy applies to all departmental employees when they engage in, supervise or manage scientific or scholarly activities; analyze and publicly communicate scientific or scholarly information; or use this information or analyses to make policy, management or regulatory decisions. Additionally, the policy includes provisions for contractors, partners, grantees, leasees, volunteers and others, who conduct these activities on behalf of Interior. The USGS established the Office of Science Quality and Integrity in 2011, with oversight for implementation of this and other critical policies that ensure the highest quality objective science.

Campaign to Cut Waste

Over the last 2 years, the Administration has implemented a series of management reforms to curb uncontrolled growth in contract spending, terminate poorly performing information technology projects, deploy state-of-the-art fraud detection tools, focus agency leaders on achieving ambitious improvements in high priority areas, and open Government up to the public to increase accountability and accelerate innovation.

In November 2011, President Obama issued an Executive Order reinforcing these performance and management reforms and the achievement of efficiencies and cost-cutting across the government. This Executive Order identifies specific savings as part of the Administration's Campaign to Cut Waste to achieve a 20 percent reduction in administrative spending from 2010

to 2013. Each agency is directed to establish a plan to reduce the combined costs associated with travel, employee information technology devices, printing, executive fleet efficiencies, and extraneous promotional items and other areas.

The Department of the Interior's goal is to reduce administrative spending by $207 million from 2010 levels by the end of 2013. To meet this goal, the Department is leading efforts to reduce waste and create efficiencies by reviewing projected and actual administrative spending to allocate efficiency targets for bureaus and departmental offices to achieve the 20 percent target. Additional details on the Campaign to Cut Waste can be found at *http://www.whitehouse.gov/the-press-office/2011/11/09/executive-order-promoting-efficient-spending*.

DOI Strategic Plan

The 2011-2016 DOI Strategic Plan, in compliance with the principles of the GPRA Modernization Act of 2010, provides a collection of mission objectives, goals, strategies and corresponding metrics that provide an integrated and focused approach for tracking performance across a wide range of DOI programs. While the DOI Strategic Plan for 2011–2016 is the foundational structure for the description of program performance measurement and planning for the 2013 President's Budget, further details for achieving the Strategic Plan's goals are presented in the DOI Annual Performance Plan and Report (APP&R). Bureau and program specific plans for 2013 are fully consistent with the goals, outcomes, and measures described in the 2011-2016 version of the DOI Strategic Plan and related implementation information in the Annual Performance Plan and Report (APP&R).

USGS Strategic Planning

The USGS chartered Science Strategy Planning Teams (SSPTs) which are charged with developing long-term (10-year) strategic plans for each of the missions defined in the USGS Science Strategy and the programs that support those missions. To develop the plans, the SSPTs have reviewed the current projects across the USGS and conducted an inventory of the science needs of other Interior bureaus and partners. The plans will identify core competencies, noting critical capabilities and strengths the USGS uses to overcome key problem areas. The SSPT plans will provide the vision and priorities necessary to assist national and regional leadership with development of guidance, implementation planning and accountability reporting to ensure that the USGS meets the goals of the USGS Science Strategy.

Program Changes

Program Changes - USGS Initiatives

Component	Subactivity	2013 Program Change Amount ($000)	FTE Changes
WaterSMART		**13,000**	**51**
	Fisheries: Aquatic & Endangered Resources	[1,250]	[5]
	Contaminant Biology	[1,000]	[4]
	Toxic Substances Hydrology	[2,500]	[11]
	Groundwater Resources	[2,500]	[10]
	National Water Quality Assessment	[3,500]	[19]
	Hydrologic Networks and Analysis	[500]	[2]
	National Cooperative Geologic Mapping Program	[1,000]	[0]
	National Geospatial Program	[750]	[0]
Rapid Disaster Response		**8,601**	**12**
	Land Use Change	[750]	[4]
	Earthquake Hazards	[851]	[1]
	Volcano Hazards	[1,000]	[3]
	Landslide Hazards	[500]	[4]
	National Streamflow Information Program	[5,500]	[0]
Science for Coastal and Ocean Stewardship		**6,750**	**12**
	Coastal and Marine Geology	[5,750]	[12]
	Science Synthesis, Analysis, and Research	[1,000]	[0]
Hydraulic Fracturing		**13,000**	**29**
	Fisheries: Aquatic & Endangered Resources	[2,200]	[10]
	Energy Resources	[3,000]	[12]
	Earthquake Hazards	[1,100]	[2]
	Groundwater Resources	[2,100]	[0]
	Hydrologic Research and Development	[2,000]	[1]
	Science Synthesis, Analysis, and Research	[600]	[1]
	National Cooperative Geologic Mapping Program	[2,000]	[3]
Ecosystem Priority		**16,201**	**52**
	Fisheries: Aquatic & Endangered Resources	[901]	[5]
	Terrestrial, Freshwater & Marine Environments	[5,100]	[15]
	Invasive Species	[4,000]	[11]
	Climate Variability	[500]	[0]
	Land Use Change	[1,500]	[6]
	Contaminant Biology	[200]	[0]
	Toxic Substances Hydrology	[200]	[1]
	National Water Quality Assessment	[1,500]	[3]
	National Streamflow Information Program	[300]	[2]
	Hydrologic Research and Development	[300]	[1]
	Science Synthesis, Analysis, and Research	[1,000]	[5]
	National Geospatial Program	[700]	[3]
Total: USGS		**57,552**	**156**

Program Changes - USGS Increases

Component	Subactivity	2013 Program Change Amount ($000)	FTE Changes
White-Nose Syndrome		**1,000**	**1**
	Wildlife: Terrestrial & Endangered Resources	[1,000]	[1]
Coral Reefs		**500**	**1**
	Terrestrial, Freshwater & Marine Environments	[500]	[1]
Brown Tree Snakes		**500**	**0**
	Invasive Species	[500]	[0]
Climate Research and Development		**1,000**	**0**
	Climate Variability	[1,000]	[0]
Rare Earth Elements Research		**1,000**	**5**
	Mineral Resources	[1,000]	[5]
New Energy Frontier - Wind Energy		**1,000**	**2**
	Energy Resources	[1,000]	[2]
Eastern US Earthquake Research and Assessment		**1,600**	**-4**
	Earthquake Hazards	[1,600]	[-4]
Data Preservation *		**1,000**	**3**
	Science Synthesis, Analysis, and Research	[1,000]	[3]
Program Increase		**8,000**	**4**
	Carbon Sequestration	[250]	[0]
	Science Support for DOI Bureaus	[6,450]	[4]
	Hydrologic Research and Development	[1,300]	[0]
Total: USGS		**15,600**	**12**

Program Changes - USGS Decreases

Component	Subactivity	2013 Program Change Amount ($000)	FTE Changes
Landsat Development		**-1,750**	**0**
	Land Use Change	[-1,750]	[0]
Mineral Resources		**-5,000**	**-39**
	Mineral Resources	[-5,000]	[-39]
Mineral External Research Program		**-250**	**0**
	Mineral Resources	[-250]	[0]
Energy Resources - Conventional Energy		**-1,000**	**-2**
	Energy Resources	[-1,000]	[-2]
Impact of Environmental Contaminants		**-500**	**-3**
	Contaminant Biology	[-500]	[-3]
Methods Development and Assessments		**-2,000**	**-11**
	Toxic Substances Hydrology	[-2,000]	[-11]
Great Lakes Beach Health		**-600**	**-1**
	Coastal and Marine Geology	[-600]	[-1]
Multi-Hazards		**-700**	**-2**
	Volcano Hazards	[-700]	[-2]
Volcano Observatory Assessments		**-300**	**-1**
	Volcano Hazards	[-300]	[-1]
Availability Studies		**-2,000**	**-11**
	Groundwater Resources	[-2,000]	[-11]
Methods Development and Monitoring		**-6,049**	**-35**
	National Water Quality Assessment	[-6,049]	[-35]
Federal Network Operations		**-2,847**	**0**
	National Streamflow Information Program	[-2,847]	[0]
Information Management and Delivery		**-3,300**	**-19**
	Hydrologic Networks and Analysis	[-3,300]	[-19]
Interpretative Studies		**-4,963**	**-16**
	Cooperative Water Program	[-4,963]	[-16]
Elimination		**-6,490**	**-2**
	Water Resources Research Act Program	[-6,490]	[-2]
Ecosystem Science Centers		**-700**	**-6**
	Science Synthesis, Analysis, and Research	[-700]	[-6]
NGGDP *		**-996**	**-3**
	Nat'l Geological & Geophysical Data Preservation	[-996]	[-3]
NCGMP Federal and State Partnerships		**-1,500**	**-2**
	National Cooperative Geologic Mapping Program	[-1,500]	[-2]
Administrative Services		**-4,137**	**-21**
	Science Synthesis, Analysis, and Research	[-446]	[-3]
	Science Support	[-2,369]	[-8]
	Security and Technology	[-1,322]	[-10]
Operations and Maintenance Efficiencies		**-4,390**	**0**
	Rental Payments and Operations & Maintenance	[-4,390]	[0]
Total: USGS		**-49,472**	**-174**

* The increase and decrease noted in the above tables is not an increase to the budget request. For details see page B-36.

Program Changes - USGS Internal Transfers

Subactivity	Internal Transfer	2013 Program Change Amount ($000)	FTE Changes
Internal Transfer		**15,802**	**63**
Science Support	Internal Transfer from Information Resources	[4,479]	[18]
Security and Technology	Internal Transfer from Information Resources	[2,732]	[11]
Science Synthesis, Analysis, and Research	Internal Transfer from Information Resources	[8,591]	[34]
Internal Transfer Decrease		**-15,802**	**-63**
Information Resources	Internal Transfer to Science Synthesis, Analysis, and Research	[-8,591]	[-34]
	Internal Transfer to Science Support	[-4,479]	[-18]
	Internal Transfer to Security and Technology	[-2,732]	[-11]
Internal Transfer Total		**0**	**0**

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Priority Increases

WaterSMART

WaterSMART						
		2011 Actual	2012 Enacted	Program Changes (+/-)	2013 Budget Request	Change from 2012 Enacted (+/-)
Fisheries: Aquatic & Endangered Resources		499	498	1,250	1,748	1,250
	FTE	0	0	5	5	5
Geographic Analysis and Monitoring		499	498	0	498	0
	FTE	0	0	0	0	0
Contaminant Biology		0	0	1,000	1,000	1,000
	FTE	0	0	4	4	4
Toxic Substances Hydrology		0	0	2,500	2,500	2,500
	FTE	0	0	11	11	11
Groundwater Resources		2,090	2,685	2,500	5,185	2,500
	FTE	0	0	10	10	10
National Water Quality Assessment		0	0	3,500	3,500	3,500
	FTE	0	0	19	19	19
Hydrologic Networks and Analysis		2,849	4,293	500	4,793	500
	FTE	2	3	2	5	2
National Cooperative Geologic Mapping Program		0	0	1,000	1,000	1,000
	FTE	0	0	0	0	0
National Geospatial Program		0	0	750	750	750
	FTE	0	0	0	0	0
Total Requirements		**5,937**	**7,974**	**13,000**	**20,974**	**13,000**
	Total FTE	**2**	**3**	**51**	**54**	**51**

Justification of 2013 Program Changes

The 2013 budget request for the U.S. Geological Survey's WaterSMART Availability and Use Assessment initiative is $20,974,000 and 54 FTE, a net program change of +$13,000,000 and +51 FTE from the 2012 Enacted level.

Overview

WaterSMART is a multidisciplinary effort designed to further understand the complex linkage between water quantity, quality, and the environment, resulting in improved management of this finite resource. The USGS possesses both the skills and foundational resources to unlock this knowledge and provide water resource, wildlife, and land use managers the decision support tools to make more informed decisions. The goal of this initiative is to provide a well-integrated and thorough understanding of how water quantity and quality combine to influence water availability for human and ecosystem uses. USGS expertise in understanding the hydrologic cycle, water geochemistry, land use effects on water, human water use, and the ways in which water quality and quantity affect the natural environment make the USGS the premier science agency to address this issue. As competition for water resources grows for irrigation of crops, for growing cities and communities, for energy production, and for the environment, the need for information and tools to aid water and natural resource managers grows. WaterSMART, through the combined efforts of Reclamation in the West and the USGS throughout the entire Nation, provides the foundation for a sustainable water strategy. The Nation will be well served through this effort, by gaining the ability to balance water resource sustainability through consideration of water quantity, quality and water uses, including ecological uses.

Program Performance

Estimating Water Budget Indicators **(+$100,000/0 FTE)**

Hydrologic Networks and Analysis (+$100,000/0 FTE)

USGS researchers are developing a system by which water managers and the public will be able to access and use critical water budget information in their water availability analyses. The USGS will make available databases containing key hydrologic information that addresses precipitation; water in snowpack, ice fields, and large lakes; evapotranspiration; stream and river run-off characteristics; total water withdrawals by source; stream and river baseflow characteristics; interbasin transfers; groundwater level indices; consumptive uses; rates of groundwater recharge; changes in groundwater storage; and return flows.

Ecological Water Science **(+$100,000/0 FTE)**

Hydrologic Networks and Analysis (+$100,000/0 FTE)

The USGS will advance understanding of water availability needs of wildlife and habitat. The process involves three major steps:

- Classify the streams across the Nation for their hydro-ecological type;
- Systematically examine the ecological response to hydrologic alteration; and
- Develop flow alteration – ecological response relationships for each type of river or stream.

Efforts in 2011 and 2012 have concentrated on developing the classification system for streams and supporting ecological water needs work in the geographic focus area studies. Efforts in 2013 will include completing the classification system and developing means to efficiently access biological databases that allow for the systematic analysis of ecological responses to hydrologic alteration.

National/Regional Synopsis and Surveys **(+$500,000/+3 FTE)**

National Water Quality Assessment (+$500,000/+3 FTE)

The USGS will conduct national and regional surveys of emerging environmental contaminants, which identify major emerging water quality issues. Funding will support methods development necessary to conduct these surveys. For example, new methods to measure emerging contaminants in environmental media and new bioassays that identify potential biological activity of exposures will be needed.

National Groundwater Monitoring Network **(+$2,500,000/+10 FTE)**

Groundwater Resources (+$2,500,000/+10 FTE)

A National Groundwater Monitoring Network (NGWMN) is authorized under the SECURE Water Act (P.L. 111-11) Section 9507 (b), which states that: “The Secretary shall develop a systematic groundwater monitoring program for each major aquifer system located in the United States.”

The USGS will begin the necessary steps toward full implementation of the NGWMN as conceptualized by the Advisory Committee on Water Information Subcommittee on Ground Water in their report "A National Framework for Ground Water Monitoring in the United States." In 2013, the USGS will transition from the pilot-scale NGWMN data portal to a production-scale portal. Using hydrologic understanding and modeling tools currently available and being developed for selected major aquifers, as part of groundwater availability studies, USGS scientists will identify monitoring locations to enhance the national monitoring network. In consultation with State and local agencies, the USGS will incorporate qualified wells and springs from State and local agencies into the NGWMN. The USGS will begin expansion of the groundwater climate response network to improve the understanding of the effects of climate change on groundwater recharge and availability. The proposed NGWMN will bring comparable monitoring data together from disparate sources in order to close spatial data gaps and evaluate national-scale groundwater levels, quality, and rates of change.

A Brackish Aquifer Assessment is also authorized by the SECURE Water Act. Hydrologic understanding for selected major aquifers gained through the regional groundwater availability studies will be used to assist in identification of brackish groundwater resources. In addition, the USGS, in consultation with State and local water resource agencies, will begin assembling available data and other relevant information in order to identify significant brackish groundwater resources located in the United States and develop a work plan for the national Brackish Aquifer Assessment.

Water Quality Enhancement **(+$6,750,000/+31 FTE)**

Fisheries: Aquatic and Endangered Resources	(+$1,250,000/+5 FTE)
Contaminant Biology	(+$1,000,000/+4 FTE)
Toxic Substances Hydrology	(+$2,000,000/+10 FTE)
National Water Quality Assessment	(+$2,000,000/+12 FTE)
National Cooperative Geologic Mapping	(+$500,000/+0 FTE)

Efforts in this component will produce a national synthesis of knowledge on the degree to which water quantity and quality combine to influence water resource availability for both human and ecosystem uses. It will focus on understanding the natural and human-induced variability in the water quality and water quantity linkage; developing fundamental ways of assessing the degree to which water quality and quantity combine to influence water availability for human uses and ecosystem services; and improving understanding of the cause and effect linkages between water quantity and quality. This involves the integration of water quality and quantity information and relating this to the human and ecological needs for water within immediate settings.

Funding for this effort will help predict the hydrologic and ecologic consequences of new dam construction and, more importantly, dam removal and failure as the Nation's 75,000+ dams age and outlive their original purpose. In 2013, a comprehensive monitoring strategy will be developed for assessing dam removal sites and a priority system for how these resources will be used to monitor the effects of dam removals. A plan for piloting these efforts at high-priority dam sites will also be part of the first year of funding. Reconnaissance of existing sediment and water quality will be used to shape a program for predicting the consequences of new dam construction on human and ecological communities.

This synthesis effort will add a strong component of water quality to the water availability analysis. Water quality will be examined in the context of suitability of ambient water for environmental needs, as well as the potential increased costs for making the raw water suitable

for intended human needs. In 2013, the USGS will develop a plan for this comprehensive national synthesis, identify early synthesis products that can be developed and published, and to begin the long-term effort of assembling the necessary datasets for the national synthesis.

Program and Information Management **(+$2,050,000/+4 FTE)**

National Water Quality Assessment	(+$500,000/+2 FTE)
Hydrologic Networks and Analysis	(+$300,000/+2 FTE)
National Cooperative Geologic Mapping	(+$500,000/0 FTE)
National Geospatial Program	(+$750,000/0 FTE)

Managing the various data streams and integrating this information into a cohesive picture is a major effort under WaterSMART. In 2012, a system is being developed for managing the data for estimating flows at ungaged stations and effectively serving this to the public. Future efforts will concentrate on storing, integrating and serving all of the information about water budget components within a defined watershed. The end result will be a Web-based system in which one can identify a watershed of interest and then access all information on daily streamflows, recharge, precipitation, evapotranspiration, changes in storage, and monthly water use characteristics for that watershed and all watersheds above it. The same system will be used to develop the overall water budget and access information on historical trends in water budget components. Other data and information management efforts will focus on supporting ecological water needs science by providing more effective ways to access biological data from multiagency sources and integrate that data with hydrologic information. WaterSMART will enhance USGS capabilities that link concentrations and loads of water quality constituents to the water resources that they influence, so that the consequences of changing water quality can be related to overall water availability. The USGS will integrate existing information with decision-support tools that facilitate exploitation of that information in a manner that is relevant to natural resource management and public use decisionmaking.

As part of WaterSMART, the USGS will develop specialized tools, based on the USGS National Hydrography Dataset (NHD), to help resource managers target basins and watersheds of environments, and ecosystems of particular concern, from a water quantity, quality, or use perspective. Current NHD tools are being used to create pollutant discharge models, allow analysis of upstream and downstream water quality, help establish regional nutrient water quality criteria and total maximum daily loads, modeling of fish passage barrier removal, and calculation of basin characteristics for peak-flow frequency and flow duration. Within WaterSMART, the NHD will be used to locate and address water use infrastructure, including points of withdrawal, diversions, interbasin transfers, and return flows.

Predictive Models **(+$1,000,000/+3 FTE)**

Toxic Substances Hydrology	(+$500,000/+1 FTE)
National Water Quality Assessment	(+$500,000/+2 FTE)

USGS researchers will develop predictive models, visual displays of scientific information, and other decision-support tools for developing scenario analyses on the water quantity and quality linkage and the effects on vulnerable resources, human uses, ecosystems, and species. These models will incorporate water quality data that have been collected by the USGS systematically across the Nation, and through geochemical studies of water and rock interactions. USGS water quality models**,** such as Spatially Referenced Regressions on Watershed attributes (SPARROW) and Watershed Regressions for Pesticides (WARP), which link concentrations

and loads of pesticides, nutrients, sediment, or salinity to sources and hydrologic conditions will also be enhanced and improved through this effort. Dynamic SPARROW models that would predict changes in water quality in response to changes in land cover or hydroclimatic conditions will be developed.

Improving USGS Rapid Disaster Response through Preparedness and Robust Monitoring

Rapid Disaster Response						
		2011 Actual	2012 Enacted	Program Changes (+/-)	2013 Budget Request	Change from 2012 Enacted (+/-)
Geographic Analysis and Monitoring		300	550	750	1,300	750
	FTE	1	1	4	5	4
Earthquake Hazards		715	715	851	1,566	851
	FTE	0	0	1	1	1
Volcano Hazards		800	800	1,000	1,800	1,000
	FTE	0	0	3	3	3
Landslide Hazards		200	200	500	700	500
	FTE	3	3	4	7	4
National Streamflow Information Program		520	60	5,500	5,560	5,500
	FTE		0	0	0	0
Total Requirements		**2,535**	**2,325**	**8,601**	**10,926**	**8,601**
	Total FTE	**4**	**4**	**12**	**16**	**12**

Justification of 2013 Program Changes

The 2013 budget request for Improving USGS Rapid Disaster Response through Preparedness and Robust Monitoring is $10,926,000 and 16 FTE, a net program change of +$8,601,000 and +12 FTE from the 2012 Enacted level.

Overview

Every year the United States faces natural and human disasters that threaten the Nation through loss of life and property, degradation of human health and the environment, and threats to national security and economic vitality. In domestic and global events, the Nation's emergency managers and public officials look to USGS science to inform them of the risks hazards pose to human and natural systems and how to reduce losses and improve response. Recent events included the Midwest flooding, the Deepwater Horizon Oil Spill, Japan's Great Tohoku earthquake and Pacific-wide tsunami, the Icelandic volcanic eruption, and vector-carried disease and epidemics. Faced with rising expectations for rapid, robust information in response to these events, the 2013 budget request will allow the USGS to strengthen its capabilities both before and after disasters strike.

Program Performance

Robust Monitoring Networks for Effective Warning **+$7,851,000/+8 FTE**

Earthquake Early Warning and Rapid Event Characterization (+$851,000/+1 FTE)

Earthquake Hazards Program (+$851,000/+1 FTE)

To develop an earthquake early warning system similar to the one used successfully in Japan during the Tohoku earthquake, USGS monitoring networks must be improved to provide warning of earthquakes already underway to nearby areas. Academic partners of the USGS in California and Washington have recently received funding from a private foundation for research and scientific development of such a warning system on the U.S. west coast. In order for the

USGS Advanced National Seismic System (ANSS) to take the results of this research effort to implementation and deliver early warnings, further development of the ANSS is needed. The proposed work will build on the investments made by the USGS in 2009-2011, using American Recovery and Reinvestment Act (ARRA) funding, to upgrade seismic and Global Positioning System (GPS) networks in California, Oregon and Washington, which will enable earthquake detection and evaluation within seconds.

Improvements to both hardware and software will enable existing seismic and geodetic monitoring networks to process the seismic signals quickly and complete the early warning system. This process will begin with telecommunications improvements, so that warning can be delivered more quickly, and will extend to a partnership with social scientists to better understand how the technical information can be most effectively communicated. The result will be a system better suited to support emergency managers and other decisionmakers as they respond to earthquake activity.

Improve Rapid Response to Eruptions of Volcanic Ash (+$1,000,000/+3 FTE)

Volcano Hazards Program (+$1,000,000/+3 FTE)

The Icelandic volcanic ash eruptions of April 2010 and May 2011, and the Chilean ash eruption of June 2011, provide examples of the importance of volcano monitoring, early warning, and pre-crisis planning. Improved early warning of impending ash eruptions, followed by rapidly updated forecasts of ash impacts as an eruption progresses, maximizes the time and information available for undertaking mitigating actions. Tasks will be undertaken to mitigate risk from volcanic activity to aviation, airports, communities, and infrastructure, to improve resiliency, and to enhance monitoring of ash-producing volcanoes. These steps comprise continued gradual implementation of the National Volcano Early Warning System (NVEWS) and recognize the emerging urgency of the ash issue.

Volcanic ash is a major threat to international aviation from even remote volcanoes in Alaska and the Northern Marianas. In-flight encounters with ash clouds result in engine and avionic failures, with potential for catastrophic losses. Explosive eruptions of volcanoes in California, Oregon, Washington, and Hawaii could have major regional impacts on the ground as well. Volcanic ash can disrupt power generation and distribution, transportation systems, water supplies, business operations, and agriculture, and poses a direct threat to public health and safety. The USGS proposes to implement a real-time, ash-fall modeling capability to provide emergency managers, decisionmakers, and the public with the best possible information on expected time of onset and amount of ash fall. Working together with the National Oceanic and Atmospheric Administration's (NOAA) National Weather Service (NWS), the USGS will engage users to design and provide useful text and graphic products derived from model runs and real-time observations. This will be complemented by field work to construct a more comprehensive database of ash-fall deposits in the Western United States to better inform and guide preparedness. Upgrades will commence to the monitoring network at Mount Hood, a very high threat ash-producing volcano adjacent to Portland, OR, designated as a high priority for NVEWS.

Expanded Debris Flow Warning System (+$500,000/+4 FTE)

Landslide Hazards Program (+$500,000/+4 FTE)

The prototype debris flow early warning system developed by the USGS and the NWS is assisting in the protection of lives, important infrastructure, and lifelines in southern California. This initiative will expand the successful partnership to northern California and the southern part of Oregon. It will support the development of predictive tools (rainfall intensity and duration thresholds and susceptibility models) in fire related and non-fire related areas, as well as expanding monitoring efforts in intensely burned areas. Partners include NOAA, local and State governments, and the private sector. The products are rainfall thresholds and real-time warnings of debris flows, particularly in burned areas.

Innovative Streamgaging and Hydrologic Modeling to Reduce Flood Damages (+$5,500,000/0 FTE)

National Streamflow Information Program (+$5,500,000/0 FTE)

Effective flood fighting requires timely river forecasts, highly reliable real-time situational awareness of river levels and flood flows, and geospatial understanding of the extent and timing of potential flood inundation, all of which the USGS can provide. New technologies such as the acoustic Doppler current profiler (ADCP), which the USGS pioneered and developed, enables the USGS to provide more accurate and timely data, thus enabling forecasters to leverage recent improvements in precipitation monitoring and watershed modeling so that forecasts are more reliable. In addition, the use of mobile networks has expanded the potential applicability of USGS streamgaging capabilities. Both developments (the ADCP and mobile networks) contributed to the U.S. Army Corps of Engineers' successful management of Mississippi floodwaters in May 2011. There are growing demands to provide temporary real-time situational awareness of flood levels to threatened communities that lack permanent USGS streamgages. The recently developed, rapidly-deployable streamgage can be deployed to address this need by providing water level information needed to monitor flood heights, especially as water levels approach elevations requiring management of reservoir releases or levee performance. In 2013, USGS efforts will include development and staging of rapidly-deployable streamgages and other instrumentation, as well as rapid-deployment of field teams to temporarily collect emergency streamflow data and interface with local responders and local news media, in addition to adding more permanent streamgages.

The USGS is engaged in a demonstration effort to develop and standardize site-specific hydraulic models that convert forecasted flows into flood maps, enabling emergency management officials at the Federal, State, tribal and local levels to assess the flood threat. In 2013, this effort will be expanded. For the first time, emergency management officials and the general public can see, on a street-by-street basis, the expected extent of a flood hours, or even days, before it occurs. Such information can assist in reducing damages and in time, may help increase public acceptance of the value of floodplain management, reducing the devastating toll of floods on American communities.

Disaster Scenarios and Strategic Science Crisis Response +$750,000/+4 FTE

Geographic Analysis and Monitoring (+$750,000/+4 FTE)

To prepare for the impacts of hazards before they strike, the USGS will develop fully realized scenarios of disaster events in collaboration with Federal, State, local, and university partners, by simulating a real hazard event. By understanding the potential impacts of these hazards before they hit, the USGS will strengthen capabilities in warning, responding and recovering from such events. These scenarios will improve the Nation's resilience to natural hazards, biological epidemics (e.g., epidemic avian influenza), and human-triggered disasters (e.g., industrial accidents). These scenarios apply integrated science across multiple mission areas to inform community decisionmaking on hazard mitigation and emergency response. In 2013, efforts will facilitate development of a standing Department of the Interior (Interior) capacity for rapidly implementing strategic science working groups, similar to what was done during the Deepwater Horizon Oil Spill disaster, to allow crisis responders to quickly evaluate the impacts of alternative response strategies. The working groups will engage with other Interior bureaus, the Landscape Conservation Cooperatives (LCC), and the Department of the Interior Climate Science Centers (DOI CSC).

Science for Coastal and Ocean Stewardship

Science for Coastal and Ocean Stewardship						
		2011 Actual	2012 Enacted	Program Changes (+/-)	2013 Budget Request	Change from 2012 Enacted (+/-)
Coastal and Marine Geology		500	2,000	5,750	7,750	5,750
	FTE	2	5	12	17	12
Science Synthesis, Analysis and Research		0	0	1,000	1,000	1,000
	FTE	0	0	0	0	0
Total Requirements		**500**	**2,000**	**6,750**	**8,750**	**6,750**
	Total FTE	**2**	**5**	**12**	**17**	**12**

Justification of 2013 Program Changes

The 2013 budget request for Science for Coastal and Ocean Stewardship is $8,750,000 and 17 FTE, a net program change of +$6,750,000 and +12 FTE from the 2012 Enacted level.

Overview

Increased population growth, energy development and resource use in coastal, ocean and the Great Lakes areas have increased the need for scientific information to help local communities, State, tribal and Federal entities in decisionmaking and management. The National Ocean Policy (NOP) establishes priority objectives to ensure that current and future uses of ocean, coastal, and Great Lakes ecosystems and resources are effectively managed in a way that maintains and enhances the environmental sustainability of multiple uses. A cornerstone of the NOP is Coastal and Marine Spatial Planning (CMSP), a comprehensive mechanism to advance national objectives for our coasts, oceans, and Great Lakes. The USGS is recognized as a critical source of integrated assessments of resources and their vulnerability; data and models to assess the consequences of changing conditions and alternative management scenarios; and monitoring and interpretive tools to advance the CMSP component of the NOP.

This initiative will allow the USGS to expand efforts in those regions where CMSP objectives intersect with the Interior's responsibilities for energy resource development, adaption to climate change, ecosystem sustainability, and resilience of vulnerable native and indigenous communities. Addressing CMSP requirements in the Northeast, Mid-Atlantic, and Pacific Northwest, the USGS will provide information products across all regional areas, providing a model for effective information delivery for national CMSP implementation. In the Pacific Islands and Arctic, the USGS will develop additional products to enable native and indigenous communities to anticipate and respond to threats and opportunities in areas most vulnerable to climate change. A particular USGS focus will be on the processes of coastal and seafloor change that are linked to ecosystem health, maintenance of critical habitats, and the vulnerability and consequences associated with alternative and conventional energy development.

Program Performance

Comprehensive Mapping and Resource Assessments (+$2,250,000/+3 FTE)

Coastal and Marine Geology	(+$2,000,000/+3 FTE)
Science Synthesis, Analysis, and Research	(+$250,000/0 FTE)

In priority regions, the USGS will engage with Federal, State, tribal, and other regional partners to provide access to comprehensive maps and assessments of seabed and coastal conditions and vulnerability. These efforts will support Interior priorities by focusing on areas proposed for advancing renewable energy development (e.g., the Interior's Smart from the Start initiative for offshore wind energy development off the Atlantic coast). Activities supported will include development of comprehensive seabed and geologic characterization; multiresolution and multitemporal elevation models; indices of seabed disturbance potential and resilience; assessments and forecasts of the vulnerability and response of indicator species; and integrated coastal vulnerability assessments.

The USGS has a unique Federal role to provide the geologic characterization of public lands required to assess hazard and resource potential. Marine assessments of hazard sources and the location and potential of energy and mineral resources are the foundation for policy and management decisionmaking across the vast Exclusive Economic Zone (EEZ) and the Extended Continental Shelf (ECS). Assessments in these poorly surveyed and remote regions require marine field programs utilizing large research vessels and specialized technologies. Access to these assets and effective utilization of USGS resources demands collaborative marine field programs with other USGS programs, Federal agencies, and academic partners. Increased funding will provide opportunities to leverage ongoing USGS activities, such as the ECS study, and broader federally-supported programs to ensure that expensive marine field programs are cost effective and meet the compelling need for marine geologic surveys and the resulting resource and hazards assessments.

In 2013, efforts will focus on enhancing access to and application of existing data and models. Development of consistent formats and delivery tools for CMSP priority geospatial, oceanographic, and biological information will provide CMSP planning bodies and other users increased access to information while decreasing inefficiencies in locating, evaluating, and integrating relevant information resources. Providing quality assured data in standard formats will minimize effort required by users and facilitate integration within and across regional areas to enable comparison of environmental responses to facilitate better planning decisions. New data and products will result from efforts that will include creation of Web maps or feature services for Web enabled datasets; updating Web services to current and appropriate technology; enhancement of metadata creation tools; improved mechanisms for storage and delivery of data and products; and development of tools that facilitate integration and analysis of data into models.

Regionally Focused Integrated Research and Assessments (+$4,500,000/+9 FTE)

Coastal and Marine Geology	(+$3,750,000/+9 FTE)
Science Synthesis, Analysis, and Research	(+$750,000/0 FTE)

The products and activities discussed above have broad relevance across all CMSP regions and provide for more directed efforts focused on issues, conditions, and processes of particular

regional relevance. Regionally-focused efforts, while addressing objectives specific to those regions, will provide models for application to national issues arising in other regions.

Integrated Resource and Coastal Vulnerability Assessments – Arctic

The proposed increase will improve the integrated science needed to inform sustainable development of resources, in the right places and the right ways, and will balance with mandates to conserve the Nation's unique coastal and marine Arctic ecosystems under Interior's stewardship. A significant portion of the Nation's undiscovered oil and gas potential and a vast proportion of the Nation's endowment of wildlife, biodiversity, and wild places can be found in the U.S. Arctic. It is a place where native peoples must also thrive through sustainable economies, infrastructures, and culturally important subsistence foods. The Arctic is not static; its changing climate is increasing access to exploitable resources, bringing the world to the Arctic through polar navigation routes, and shifting fish, wildlife, and plant habitats in ways that are not fully understood. The increase will support new understanding in several major areas important to current and future energy and natural resource decisions in the Arctic.

The proposal will support new coastline vulnerability assessments to define risks of seawater inundation, barrier island loss, shoreline change, and forecasts of likely landscapes under current and future climate scenarios. Products will inform coastal infrastructure considerations and integrate with ongoing USGS Arctic North Slope wildlife habitat forecasting to help support community decisions on means to sustain public safety, economic development, and subsistence and other natural resources. Specifically, the USGS will produce:

- Improved geological and geophysical data to refine understanding of oil and gas resources (through acquisition and interpretation of about 9,000 line-kilometers of seismic data pertaining to both the fundamental geology and petroleum potential of Chukchi shelf, the northwest Beaufort shelf, and the marine slope of the deep Canada Basin), improving understanding of the petroleum potential across EEZ and ECS.
- Sea floor and habitat maps and analyses to inform resource management and development using bathymetric sonar and sea floor video surveys resulting in a comprehensive sea floor map for some 100 square kilometers of priority habitat. These maps will be designed in consultation with key partners and management agencies to support existing environmental and energy development programs in the Arctic Outer Continental Shelf and statistical analyses of habitats.
- Geochemical surveys to map vulnerability of priority marine species to ocean acidification by completing and disseminating seawater analyses of archived ocean acidification samples; developing predictive models to link benthic habitat change to ice cover change and increased atmospheric carbon dioxide; and acquiring additional baseline data in sensitive areas.
- Shoreline vulnerability assessments and coastline projections from high resolution digital coastal maps which inform forecasts of likely erosion patterns under current and future climate scenarios and inundation vulnerability assessments under recurring and extreme storm events.
- Enhanced data access and community involvement through metadata produced according to Federal and Alaska Data Integration Working Group standards; delivery of new and existing data to science portals such as the Alaska Ocean Observing System, Alaska Emergency Response Management Application, and the CMSP National Information Management System; and engaging native communities through training

youth in USGS project efforts, designing community protocols for information sharing, and piloting approaches to incorporate local knowledge into project efforts.

Integrated Resource and Coastal Vulnerability Assessments – Pacific Island Communities

Accelerated sea level rise in low lying Pacific Islands threatens coastal communities by impacting groundwater supplies and agro-forestry production; and exposes coastal ecosystems and communities to erosion, storm inundation, and groundwater salinization. Recent storm events, combined with extreme high tides, have highlighted the vulnerability of these communities, resulting in widespread coastal flooding, erosion, and groundwater contamination in the Republic of the Marshall Islands and the Federated States of Micronesia, in which the Interior has a vested interest. The extreme vulnerability of these communities to changing sea level and ocean conditions represents a serious potential threat through impacts to public safety, environmental health, and food and water security. The USGS will focus on selected vulnerable population centers in the Pacific Islands to develop assessments, forecasts, and decision-support tools to anticipate consequences of more frequent, persistent, and extreme wave run-up, overwash, and coastal inundation on communities and the resources on which they depend.

Products developed will include assessments of resource status and vulnerability, including coral reef ecosystems, groundwater, and agricultural resources; forecasts of changing ecosystem and community vulnerability as a consequence of future scenarios including sea level rise, changes in storm climatology, and alteration of natural features (corals, coastal landscapes and vegetation) that mitigate impacts; and integrated models that augment forecasts to understand consequences in terms of community and ecosystem vulnerability and facilitate the development and evaluation of alternative approaches to resource management and adaptation to climate change.

Hydraulic Fracturing

Hydraulic Fracturing						
		2011 Actual	2012 Enacted	Program Changes (+/-)	2013 Budget Request	Change from 2012 Enacted (+/-)
Fisheries: Aquatic & Endangered Resources		99	108	2,200	2,308	2,200
	FTE	1	1	10	11	10
Wildlife: Terrestrial & Endangered Resources		161	0	0	0	0
	FTE	0	0	0	0	0
Energy Resources		4,600	4,600	3,000	7,600	3,000
	FTE	23	23	12	35	12
Earthquake Hazards		0	300	1,100	1,400	1,100
	FTE	0	1	2	3	2
Groundwater Resources		135	520	2,100	2,620	2,100
	FTE	1	1	0	1	0
Hydrologic Research and Development		357	50	2,000	2,050	2,000
	FTE	1	0	1	1	1
Science Synthesis, Analysis and Research		105	0	600	600	600
	FTE	1	0	1	1	1
National Cooperative Geologic Mapping Program		0	0	2,000	2,000	2,000
	FTE	0	0	3	3	3
Total Requirements		**5,457**	**5,578**	**13,000**	**18,578**	**13,000**
	Total FTE	**27**	**26**	**29**	**55**	**29**

Justification of 2013 Program Changes

The 2013 budget request for hydraulic fracturing research is $18,578,000 and 55 FTE, a net program change of +$13,000,000 and +29 FTE from the 2012 Enacted level.

Overview

In March 2011, the White House released a "Blueprint for a Secure Energy Future," a comprehensive plan to reduce America's oil dependence, save consumers money, and make the United States a leader in clean energy industries. The Blueprint supports responsible development of the Nation's oil and natural gas, with the specific goals of promoting safe practices and reducing energy imports. The Interior, the U.S. Department of Energy (DOE), and the Environmental Protection Agency (EPA) each have a critical role to play in this mission.

With appropriate safeguards, shale gas and other unconventional resources can play an important role in the onshore domestic energy mix of the United States to meet its current and future energy needs. Shale and other gas formations are found throughout much of the United States and occur beneath Federal, State, tribal and private lands. Development and extraction of these unconventional oil and gas resources is increasingly accomplished through hydraulic fracturing, a technique that entails horizontal drilling, perforation of steel casing and cement grout using explosive charges, and expansion of fractures using fluids and proppants under high pressure. Concerns over potential environmental, health, and safety impacts of hydraulic fracturing are increasing, while our understanding of these impacts is not well-developed, as evidenced by a lack of peer-reviewed literature and agency reports on such effects. Potential effects may include impacts to water resources, including contamination of aquifers and surface waters from drilling and hydraulic fracturing chemicals; cross-contamination of aquifers through faulty well construction and casing installation, release of methane and other greenhouse gases into aquifers, contamination from radioactive elements and other toxic chemicals in waters recovered during gas production, and impacts to the water supply. Other potential impacts may

include unintended seismic events from the subsurface injection of recovered drilling and rock formation fluids; deleterious effects on terrestrial and aquatic wildlife and ecosystems, landscape changes including soil erosion and habitat fragmentation, airborne pollutants, and socio-economic impacts to communities.

Program Performance

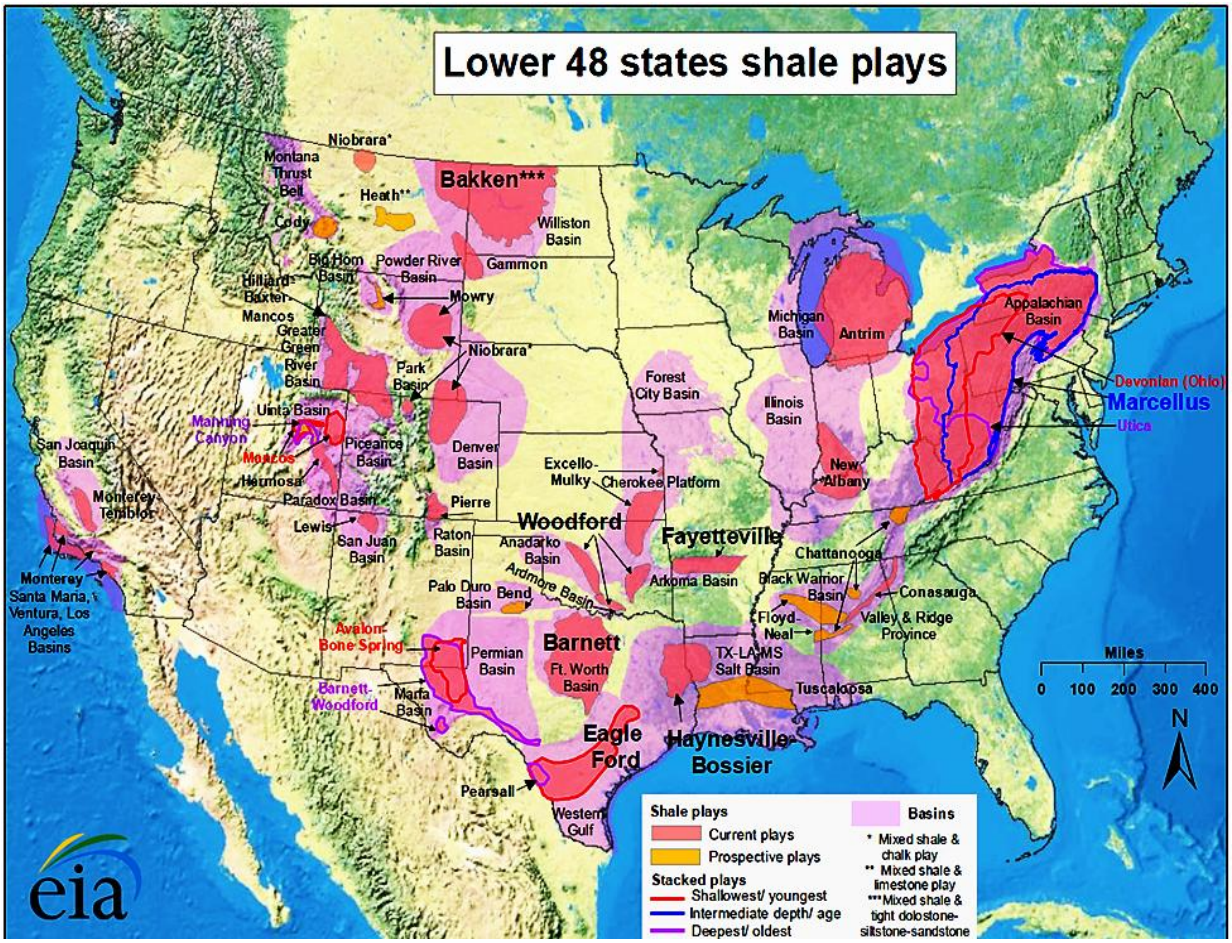
Hydraulic Fracturing (+$13,000,000/+29 FTE)

The 2013 budget supports a collaborative interagency research and development effort by the USGS, DOE, and EPA to address the highest priority challenges associated with safely and prudently developing unconventional oil and gas resources. The goal of this effort is to understand and minimize potential environmental, health, and safety impacts of energy development through hydraulic fracturing. Through this effort, the three agencies will build on current work, and collaboratively identify and coordinate priority research and development activities that support sound management and policy decisions by Federal, State, tribal, and local entities responsible for ensuring prudent development of energy resources and protecting human health and the environment.

In 2012, USGS research efforts are focused on the following: protecting water supply and water quality; obtaining background water quality measurements; studying effects on land use, terrestrial wildlife, and aquatic resources; studying induced seismicity; and conducting research and assessment on domestic unconventional oil and gas resources. These efforts are designed to understand the unconventional resource base, conditions of water quality and availability, and habitat conditions prior to land disturbance, drilling, and hydraulic fracturing (baseline studies). Studies are underway in several shale gas basins. In the Marcellus Shale gas area, for example, the USGS is studying the potential impact of hydraulic fracturing and gas production on water quality and the occurrence of natural gas in private water wells (the occurrence of so-called “stray gas”). The presence of gas in private water wells is of significant concern to citizens living in areas where shale gas production is underway.

The budget increase in 2013 will support priority research in eight areas: water quality and supply; monitoring and characterization of stray gas; characterizing the gas resource and related geologic framework; impacts on landscapes, habitats, and living resources; induced seismicity and earthquake triggering; socioeconomics of community changes; air emissions and pollutants; and comprehensive data integration. Research efforts will include assessments of undiscovered, technically recoverable, unconventional resources, evaluation of the potential for induced seismicity, development of groundwater flow models, new groundwater tracer techniques to detect the movement of hydraulic fracturing fluids, and water budget studies.

Deliverables include an atlas of U.S. unconventional hydrocarbon resource distributions based on current assessments; landscape-level maps that portray effects of land fragmentation; maps and databases of geochemical characteristics of formation fluids; sources of marginal-quality (e.g., brackish) water to replace fresh water used in hydraulic fracturing; three-dimensional geologic models to better understand rock structures to characterize the hydro-geologic framework; estimates of water use and hydrologic budgets; databases and reports characterizing surface water and groundwater quality; tables, databases and maps showing occurrence and distribution of naturally occurring radioactive elements; reports outlining effects of hydraulic fracturing and associated activities on terrestrial and aquatic species; and a draft protocol for evaluating the potential for earthquakes from the subsurface injection of fluids.



Map prepared by the Energy Information Agency showing locations of shale gas plays in the United States

USGS science for hydraulic fracturing will be conducted in collaboration with partners at the Federal, State, tribal and local levels to address their issues and concerns and to provide stakeholders with the basis for making policy, planning, regulatory, and resource management decisions.

Ecosystem Priorities

Ecosystems Priorities						
		2011 Actual	2012 Enacted	Program Changes (+/-)	2013 Budget Request	Change from 2012 Enacted (+/-)
Chesapeake Bay *		5,860	7,349	2,500	9,849	2,500
	FTE	24	29	10	39	10
Columbia River		12,907	12,537	1,100	13,637	1,100
	FTE	50	48	4	52	4
Florida Everglades		6,893	6,882	1,000	7,882	1,000
	FTE	30	30	2	32	2
Puget Sound		6,406	6,396	1,000	7,396	1,000
	FTE	26	26	5	31	5
California Bay-Delta *		6,012	6,002	2,000	8,002	2,000
	FTE	12	12	4	16	4
Upper Mississippi River		4,870	4,862	200	5,062	200
	FTE	23	23	1	24	1
Klamath Basin		2,631	2,631	901	3,532	901
	FTE	0	0	5	5	5
Upper Mississippi - Asian Carp		0	0	1,000	1,000	1,000
	FTE	0	0	3	3	3
Asian Carp Control and Great Lakes Framework**		121	2,617	2,000	4,617	2,000
	FTE	1	6	6	12	6
Sustaining Environmental Capital		0	0	2,000	2,000	2,000
	FTE	0	0	3	3	3
Information Synthesis and Management		0	0	1,000	1,000	1,000
	FTE	0	0	5	5	5
DOI Climate Science Center - Tribes		0	0	500	500	500
	FTE	0	0	0	0	0
Land Use Science		0	0	1,000	1,000	1,000
	FTE	0	0	4	4	4
Total Requirements		**45,700**	**49,276**	**16,201**	**65,477**	**16,201**
	Total FTE	**166**	**174**	**52**	**226**	**52**

* Updates from the BIB Corsscut Table includes: $110,000 for Land Remote Sensing that was added back into the 2013 Request, the reduction of $22,000 for Hydrologic Networks and Analysis is taken Information Management and Delivery, and $634,000 for Land Remote Sensing that was added back into the 2013 Request.

** Does not include 2012 $4,000 across the board reduction

Justification of Program Change (+$16,201,000/+52 FTE)

The 2013 budget request for Ecosystem Priorities is $65,477,000 and 226 FTE, a net program change of +$16,201,000 and +52 FTE from the 2012 Enacted.

Overview

Ecosystems support life on Earth. Knowledge of ecosystems is critical to the well-being of the Nation because ecosystems supply the natural resources and other goods and services that humans require. The scope of science needed to improve conservation and restoration of ecosystems is complex. Impartial scientific information is needed to improve societal understanding of the importance and function of ecosystems. Regional environmental resource issues in many ecosystems are at critical decisionmaking junctures as they are challenged with balancing human needs with ecosystem health. The multidisciplinary approach applied by the USGS is necessary to develop an understanding both of individual ecosystem processes as

well as holistic ecosystem-level evaluations of responses to actual and proposed restoration alternatives and plans. Science enables resource managers to make informed decisions, to help resolve and prevent resource management conflicts, and to support Interior's public trust stewardship responsibilities for the Nation's lands and waters.

Increases in 2013 will support research and development efforts focused in the California Bay-Delta, the Chesapeake Bay, the Columbia River, the Everglades, the Klamath Basin, and Puget Sound. They will also support critical invasive species research, including research on Asian carp control in the Great Lakes and the Upper Mississippi River Basin. These studies are designed to serve local ecosystem management needs and provide knowledge and approaches transferable to similar ecosystems across the Nation. Specific research efforts will focus on invasive brown tree snakes and white-nosed syndrome in bats. Actions will be implemented to support the Administration's efforts in sustaining environmental capital.

Program Performance

Chesapeake Bay **(+$2,500,000/+10 FTE)**

Terrestrial, Freshwater, and Marine Environments	(+$1,300,000/+5 FTE)
Geographic Analysis and Monitoring	(+$500,000/+2 FTE)
Contaminant Biology	(+$100,000/+0 FTE)
Toxic Substances Hydrology	(+$100,000/+1 FTE)
National Water Quality Assessment	(+$500,000/+2 FTE)

The USGS provides critical science to restore the Nation's largest estuary and carry out the President's Chesapeake Bay (Bay) Executive Order (EO) strategy and associated action plan. The Interior, through the USGS, the U.S. Fish and Wildlife Service (FWS), and the National Park Service (NPS), is providing leadership, expertise, and resources to meet the major goals of the Chesapeake Bay Program (CBP) partnership and the associated EO to restore water quality, recover habitat, sustain fish and wildlife, and conserve lands and increase public access. The USGS has lead responsibility under the EO, in collaboration with NOAA, to strengthen science to support all of these goals. In 2013, the requested increase will enhance research to restore two key species in the EO strategy—brook trout and black ducks. The USGS will:

- Coordinate with agencies addressing the impact of shale-gas drilling to identify potential impacts on brook trout and develop predictive habitat models for native brook trout using landscape analysis and environmental DNA to assist in the siting of well pads and supporting infrastructure. The USGS will enhance efforts to identify potential impacts of land use and climate change on stream temperatures to help the FWS and the U.S. Forest Service plan for protection and restoration of brook trout populations. In addition, the USGS will continue development of science necessary to identify landscape sources of endocrine disrupting compounds and the specific pathways by which these emerging contaminants enter the Susquehanna and Potomac basins and threaten fisheries, wildlife, and human health.
- The USGS will enhance studies of black ducks to support the FWS and the Black Duck Joint Venture in achieving the EO goal to increase black duck populations. Additional funding will be used to improve an energetics model for wintering black ducks within the refuge system. A new effort would start to couple the energetics model with new models

of sea level rise and land use change to predict future impacts on coastal wetland and help identify the best areas for restoration of black duck habitats.

- Enhance monitoring and assessment of progress toward the water quality goals of the total maximum daily load. The USGS will work with partners to add critical monitoring sites in the watershed and improve techniques to assess and explain progress toward reducing nutrients and sediment. The USGS will work with the U.S. Department of Agriculture (USDA) to evaluate the effect of agricultural practices implemented as part of the 2008 Farm Bill Chesapeake Initiative and with Environmental Protection Agency and States to assess both agricultural and urban practices.
- Expand the Chesapeake land conservation prioritization system, which is considered a prototype by Secretary Salazar for the America's Great Outdoors initiative. The system, being developed with the NPS and NatureServe, will be used to help States, Federal agencies, and nongovernmental organizations identify areas to focus land conservation funding.
- Increase research on the effectiveness of winter cover crops in reducing both soil erosion and nitrogen runoff from agricultural fields into the Chesapeake Bay. Research is conducted in collaboration with the USDA Agricultural Resource Service, the Maryland Department of Agriculture, and local Soil Conservation Districts. Project scientists will use satellite-based remote sensing data products with site specific, privacy protected conservation program farm data records to measure cover crop success in preventing sediment and nutrients from reaching the Bay.

Columbia River **(+$1,100,000/+4 FTE)**

Terrestrial, Freshwater, and Marine Environments	(+$300,000/+1 FTE)
Contaminant Biology	(+$100,000/+0 FTE)
Toxic Substances Hydrology	(+$100,000/+0 FTE)
National Streamflow Information Program	(+$100,000/+1 FTE)
National Geospatial Program	(+$500,000/+2 FTE)

The Columbia River is the largest river in the Pacific Northwest, and plays an important role in the Region's culture and economy through tribal fisheries, irrigation, power production, and recreation, among other goods and services. This system has been affected by a number of anthropogenic changes, including altered flows, environmental contaminants, and invasive species that have degraded the ecosystem. Managers and policymakers require scientific information to prevent the decline of critical species such as salmon, which are a valued tribal trust species; to manage ecological flows in this engineered river system; and to reduce risks from habitat degradation, changes in species composition, and climate change. With the proposed increase, the USGS will provide critical results to managers and decisionmakers on forage fish, which are a critical part of the Columbia River food web that supports a suite of important fish, bird and mammal species. The USGS will address forage fish life histories, invasive species, related climate impacts, chemical and physical habitat degradation, and effects on economic and trust species. USGS scientists will conduct research on the effect of altered flow regimes due to climate change and dam operations on habitats. A new Columbia River Treaty with Canada, which will take effect in 2025, could potentially affect flow regimes. USGS researchers will characterize ecological tradeoffs related to alternative flow regimes, as they affect physical habitat features, food webs, and ecological interactions influencing the sustainability of salmon, sturgeon and other key species populations. The increase in 2013 will address early detection and risk reduction of aquatic invasives in the Columbia River system.

USGS researchers will determine conditions in mainstem, estuarine, and tributary systems that increase the risk of invasion of invasive species, and identify requirements for reliable early detection and adaptation/restoration actions by resource managers.

Everglades **(+$1,000,000/+2 FTE)**

Invasive Species (+$1,000,000/+2 FTE)

In support of restoring the south Florida ecosystem and in partnership with the Comprehensive Everglades Restoration Plan and the South Florida Ecosystem Restoration Task Force (SFERTF), the USGS conducts scientific investigations to fill key science information gaps and to assist in the sustainable use, protection, and restoration of the South Florida ecosystem. South Florida is particularly vulnerable to the introduction and spread of invasive plants and animals and is highly colonized by a wide variety of exotic species such as water hyacinth, melaleuca, old world climbing fern, Brazilian pepper, and the Burmese python. The SFERTF recognizes the challenges that invasive species pose to the success of overarching ecosystem restoration efforts as well as achieving particular performance measures regarding plant and animal community sustainability and survivorship and distribution of species such as crocodiles and alligators. Funding will support high priority research needs identified by the interagency invasive species working group of the SFERTF including quantifying ecosystem effects of invasive species to assist partnering agencies in deciding where best to allocate management and control efforts; filling key biological and ecological information gaps of invasive species to better inform early detection efforts of partnering agencies; and to improve methods to better detect and control species such as Burmese pythons for which ecosystem effects have been documented.

Puget Sound **(+$1,000,000/+5 FTE)**

Terrestrial, Freshwater, and Marine Environments (+$500,000/+3 FTE)
Hydrologic Research and Development (+$300,000/+1 FTE)
National Geospatial Program (+$200,000/+1 FTE)

The Puget Sound (Sound), the second largest estuary in the United States, provides diverse benefits to a growing regional human population. It provides a home, recreation and economic opportunity to millions of people. The Sound is a natural resource treasure, supporting hundreds of species of fish, sea birds, and marine mammals, many of which are of enormous economic and cultural importance to the region. Human development and land use changes, as well as climate change, likely will affect the future sustainability of the Sound, particularly watershed and shoreline alterations that are likely to reduce critical habitat for species and reduce water quality. More than 20 Indian Tribes are protected in perpetuity in their uses of salmon. However, salmon are in decline due to reductions in habitat quantity and quality. The USGS is providing critical science to a major ecosystem restoration effort involving tribal, local, State, and Federal entities. The proposed increase will support managers and decisionmakers by developing process-based monitoring and models at the ecosystem scale to identify and address risks to salmon. In addition, USGS researchers will investigate the status of forage fish populations—some of which are in decline—and identify linkages between population dynamics, bioenergetics, predation, habitat alterations, disease, and food availability. In support of the restoration, this work will result in new molecular tools and sampling methods. Finally, the recent removal of two major dams on the Elwha River is one of the largest river restoration projects in history, requiring active management of former submerged reservoir lands, use of hatcheries to supplement wild fish populations, and monitoring of specific aquatic, terrestrial,

and near-shore marine responses of the ecosystem. USGS science will provide managers with information on ecosystem responses to specific post-removal restoration actions, to ensure that restoration is effective.

California Bay-Delta **(+$2,000,000/+4 FTE)**

Terrestrial, Freshwater, and Marine Environments	(+$1,000,000/+3 FTE)
National Water Quality Assessment	(+$1,000,000/+1 FTE)

The California Bay-Delta Ecosystem (Delta) is recognized as one of the world's threatened treasures of biodiversity, supporting unique native species and their critical tidal and wetland habitats. Like other urban estuaries, this system has a history of anthropogenic changes involving multiple stressors including altered hydrodynamics, environmental contaminants, and invasive species that have degraded the ecosystem. The native fish fauna has been much reduced and key species are now protected by the Endangered Species Act. Among these species, the threatened Delta smelt most prominently impacts human decisions about the movement of water through the system. The recovery of this species requires an improved understanding of habitat and ecosystem functions within the Delta. Policymakers now must plan for systemic changes that influence all stressors and parts of the system, including watersheds, rivers, deltas, bays, and the ocean. To assist policymakers, USGS scientists have developed a network of real-time flow monitoring stations in the Delta. These stations will be augmented to assist with determining the causes and rates of decreased sediment supply and to monitor turbidity fields in the Delta, which may have implications for Delta smelt survival and movement. The USGS will expand its research efforts to understand how flow conditions, water quality, and fish behavior affect fish survival, particularly Delta smelt survival. In doing so, the USGS will advance fundamental understanding, and the interactions among, the physical, chemical, biological, human components and multiple stressors of the Delta system, to improve knowledge of system impacts to the Delta smelt and its critical habitat. Using this advanced understanding, USGS scientists will improve and develop advanced models of the Delta system to represent more comprehensively and predict more realistically Delta ecosystem component responses to management and restoration, including effects of climate change and potential seismic events. The USGS will advance the capability to collect, store, access, visualize, and share data and information about the Delta system, the vulnerabilities of Delta ecosystem components to change, and the potential responses to these vulnerabilities.

Upper Mississippi River **(+$200,000/+1 FTE)**

National Streamflow Information Program	(+$200,000/+1 FTE)

This initiative builds on ongoing USGS activities in the Upper Mississippi River Basin (Basin). The Basin contains a wide diversity of landscape types that include major agricultural operations headwaters with major urban landscapes. Both landscape types may impact aquatic ecosystem health of the Mississippi River and connecting rivers downstream resulting in maintaining or expanding hypoxia conditions in the Gulf of Mexico. Existing USGS programs in this region are developing a better understanding of water resources through critical streamflow measurement stations that characterize water quality. The USGS has been collecting samples of contaminants of emerging concern and learning about the potential effects of these contaminants on aquatic organisms living in the streams and rivers. Data collections and interpretive studies addressing water quality concerns are also shared with State and local partners in this five-State region (Minnesota, Wisconsin, Illinois, Iowa and Missouri).

Klamath Basin Restoration Agreement **(+$901,000/+5 FTE)**

Fisheries: Aquatic and Endangered Resources (+$901,000/+5 FTE)

The Klamath Basin Restoration Agreement was signed on February 18, 2010, and engages Federal, State and local government agencies, Tribes and non-governmental organizations with the intention of restoring natural production and providing for full participation in harvest opportunities of fish species throughout the basin, establishing reliable water and power supplies which sustain agricultural uses and communities and national wildlife refuges, and contributing to the public welfare and the sustainability of all basin communities through these and other measures. With this funding, the USGS will determine relationships between water availability, fish habitats, and water quality on sucker growth, condition, and survival in Upper Klamath and Clear lakes; investigate aquatic productivity with special attention to intensity, magnitude, and composition of plankton blooms; investigate production of blue green algae and transfer of cyanotoxins through food webs to endangered suckers; and assess the biological effects of exposures of cyanotoxins in leading to a possible bottleneck in population recovery. If these agreements are implemented, the application of research results would extend to the possible reintroduction of Chinook salmon in the Upper Klamath Basin and to enhanced understanding of the effects of harmful algal blooms throughout the basin.

Asian Carp **(+$3,000,000/+9 FTE)**

Invasive Species ($3,000,000/+9 FTE)

The ability of Asian carp to grow large, spread quickly, and become abundant has prompted national and regional planning efforts to prevent further introductions and to contain and manage existing populations. In 2009, the administration established the Asian Carp Regional Coordinating Committee (ACRCC), which consists of Federal, State, and local agencies and other private stakeholder entities, to protect and maintain the integrity and safety of the Great Lakes ecosystem from an Asian carp invasion. The USGS, a charter member of this group, has been conducting research to provide critical information to the ACRCC since 2010. Also a charter member of the Minnesota-Wisconsin Asian Carp Task Force, the USGS was instrumental in helping to produce the 2011 Asian Carp Action Plan that assesses the threat posed by Asian carp and actions needed to minimize their impact in Minnesota and has unique capabilities in the region to provide research critical to its implementation.

Upper Mississippi River [+$1,000,000/+3 FTE]

Funding will support new research using priorities identified for the Upper Mississippi River System (UMRS) in the 2007 “Management and Control Plan for Bighead, Black, Grass, and Silver Carps in the United States,” as well as those identified in the newly released “Asian Carp Action Plan” developed by the Minnesota-Wisconsin Asian Carp Task Force. The increase will target specific research gaps identified in these planning efforts, including creating and improving methods to detect Asian carp at low population levels; identifying potential spawning locations in the UMRS; identifying habitats and locations most vulnerable to colonization by these invasive fishes; and improving and developing methods for targeted containment and control of Asian carp in UMRS habitats.

Great Lakes [+$2,000,000/+6 FTE]

Funding will augment current support of the ACRCC's Asian Carp Control Strategy Framework. This research focuses on providing scientific information and methodologies to better prevent, detect, and control Asian carp. Specific research activities include developing methods for the oral delivery of registered fish toxicants; estimating minimum river length and water temperature to predict potential spawning locations of Asian carp in the Great Lakes Basin; identifying and developing attractant pheromones to aid in targeted removal of Asian carp from infested waters; and testing seismic technology as a means to affect the distribution of Asian carp and to restrict their passage through lock and dam structures. The proposed increase will enable research to accelerate beyond the "proof of concept" stage and focus on transferring technology to managers for field use.

Sustaining Environmental Capital **(+$2,000,000/+3 FTE)**

Terrestrial, Freshwater, and Marine Environments (+$2,000,000/+3 FTE)

The recent President's Council of Advisors on Science and Technology (PCAST) report, titled *Sustaining Environmental Capital: Protecting Society and the Economy* (January 2012) notes that "Ecosystems and the biodiversity they embody constitute 'environmental capital' on which human well-being heavily depends." This "capital" includes clean water, storm protection, pollution prevention and mitigation and many other goods and services. Management decisions and actions such as ecosystem restoration, climate adaptation plans, or long term monitoring and assessments should take into account biodiversity and ecosystem services so that trade-offs between management alternatives can be understood and incorporated into decisionmaking. Questions such as, "Which management action will yield the greatest economic benefit to communities from restoration of commercial fisheries, prevention of floods or protection of at-risk species?" can be answered through such an approach. An ongoing assessment of the value of ecosystem services inherent in management options and decisions enhances our ability to make science-based decisions that reduce the risk and uncertainty of management and that best enhance the well-being of communities. Development of a framework that allows ongoing national assessment of biodiversity and ecosystems services will be a key first step in promoting sustainability in this project. This effort will require development of effective methods for incorporating the results of these assessments into management decisions as well as an enhanced informatics and a broad data integration system coordinated across Federal agencies.

The project will evaluate existing USGS, Interior, and partner data and information from monitoring and ecosystem restoration programs to identify candidates for assessment of biodiversity and ecosystem services. Potential examples include Gulf of Mexico and other ecosystem restoration efforts; the Bureau of Land Management's Assessment, Inventory and Monitoring (AIM) Strategy; and USGS assessment efforts such as WaterSMART pilots and National Water-Quality Assessment (NAWQA) study units. Funding dedicated to this project will permit the USGS to provide assessments in selected pilot areas, leading to the development of better methods and approaches to integrating assessments of biodiversity and ecosystem services with monitoring and research that is ongoing within existing programs. Development of a scalable national assessment framework may inform activities such as assessments of biodiversity and ecosystems services driven by the National Climate Assessment and provide a national example that could be used by the International Science-Policy Platform of Biodiversity and Ecosystem Services. While other agencies have incorporated ecosystem services into

mapping (EPA's National Atlas of Ecosystem Services) and for environmental markets in rangeland, forests and agriculture (USDA), this initiative would build on these efforts to support the first coordinated multidepartmental effort of its kind in the Federal Government to develop a standardized ecosystem services framework.

Ecosystem Information Management **(+$1,000,000/+5 FTE)**

Science Synthesis, Analysis, and Research (+$1,000,000/+5 FTE)

In response to the President's Council on Science and Technology Advisors (PCAST) report on *Sustaining Environmental Capital: Protecting Society and the Economy*, the USGS proposes to provide tools, models and applications that allow ecosystems resource managers and users to access and interact meaningfully with ecological data from a broad range of sources, improve data documentation through complete and standardized metadata, and apply data to aid in ecological forecasting in priority regions where ecosystems are vulnerable to change. Researchers will apply their expertise in standards, data synthesis and interoperability, and information discovery to accomplish these activities by assembling a robust and flexible data service for ecosystem activities in critical areas including the Chesapeake Bay, the Columbia River, the Puget Sound, and the Upper Mississippi River, with a focus on key management issues including the spread of invasive species, secure water supply, and energy development. The newly developed data service for ecosystems activities would be used to aid data discovery, provide improved accessibility, and increase understanding of relevant data.

In 2013, researchers will work closely with all of the USGS mission areas and other Interior bureaus to move forward in developing a national monitoring framework. This framework will be a standards-based, integrated capability for management of, and access to, data and information critical to ecosystems management and restoration. It will include high quality data, curated in consistent, standard formats that can be modeled for ecosystem forecasting, visualized, or downloaded and integrated into models or other applications. The framework will be augmented by related USGS efforts, including the Integrated Taxonomic Information System, which provides the scientific and common nomenclature for species; the Protected Areas Database of the United States, which contributes information about the status of land designated for conservation across the Nation; and the Gap Analysis Program national datasets for land cover and species distributions. The framework will allow comparisons of environmental responses at broader scales for better planning decisions.

Partnerships with the data.gov initiative in other subject areas such as the Ocean and Energy portals will be leveraged to provide public portal access to the data service. Integrated assessment decision-support tools currently being developed and tested in various habitat conservation and ecosystem restoration initiatives will be linked to the foundational data service to inform planning and management groups and facilitate exploration of multiple restoration scenarios and resource tradeoffs.

Department of the Interior Climate Science Centers – Tribes (+$500,000/0 FTE)

National Climate Change and Wildlife Science Centers/Department of the Interior Climate Science Centers (+$500,000/0 FTE)

A key effort identified in Secretarial Order 3289, in the development of the DOI CSCs was to partner with local Tribes to satisfy their climate science needs. The proposed increase will support the Northwest DOI CSC and the Northeast DOI CSC in working closely with tribal partners to identify key resource management endpoints in the Columbia River and Great Lakes ecosystems, respectively. USGS researchers will then develop climate driven, ecosystem based models that will allow tribal managers to project impacts to natural resources of concerns. Results from this work will be used to develop adaptation management strategies to help ensure long-term sustainability of these resources.

Land Use Science (+$1,000,000/+4 FTE)

Geographic Analysis and Monitoring (+$1,000,000/+4 FTE)

The Geographic Analysis and Monitoring Program (GAM) conducts research on the land changes occurring in the United States to better assess the causes and consequences of land cover change. The program will assess ecosystem changes due to a variety of external drivers, such as climate change, invasive species and land cover-land use change (including those resulting from resource extraction techniques) and identify their impacts on conservation objectives and local communities. Building from current projects, GAM researchers will analyze how these ecosystem changes impact the services provided by the ecosystems, including water filtration and storage, carbon sequestration, fisheries, and recreation. Research will be conducted in collaboration with other Interior bureaus, the DOI CSCs, the LCCs, other Federal agencies, and State and local governments. Research products will include journal articles, geospatial datasets of both current and possible future ecosystem conditions and decision-support tools allowing resource managers to assess the impacts of various ecosystem conservation and restoration activities.

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Other Program Changes

Program Increases

Ecosystems

White-Nose Syndrome (+$1,000,000/+1 FTE)

White-nose syndrome (WNS) is a wildlife disease that has resulted in the loss of approximately six million bats of six different species in eastern North America. Since first described in 2007, WNS has been detected in 16 States and four Canadian provinces, and the disease continues to spread. The disease is caused by a recently discovered fungus, *Geomyces destructans*, which may have been accidentally introduced to North America by a tourist who visited a cave in Europe. Bats are the primary predators of night-flying insects, and the natural pest-control services that they provide are valued at an average of $22.9 billion to agriculture in the continental United States each year (*SCIENCE, Volume 332, April 1, 2011)*. WNS research and monitoring programs continue to provide critically needed science information to Interior, State, and tribal wildlife management agencies. Ongoing USGS research and monitoring activities are geared toward providing enhanced disease surveillance, improved diagnostic tools, and a better understanding of WNS disease ecology with the ultimate goal of developing practical management solutions to reduce the impacts of this devastating disease. The increase in the Wildlife Program would be used to enhance surveillance and diagnostic capacity to detect the continued spread of WNS; bolster research on environmental factors controlling persistence of the fungus in the environment; develop management tools, particularly the development of a vaccine; and conduct research on mechanisms by which WNS causes mortality in bats, focused on immunology and pathogenesis.

Coral Reef Ecosystem Research (+$500,000/+1 FTE)

Coral reefs are among the most diverse and biologically complex ecosystems on Earth. They support more species per unit area than any other marine environment; provide important fishery habitat, economic and environmental services to millions of people for recreation, sources of food, jobs, chemicals, pharmaceuticals; and offer unparalleled shoreline protection. Under threat from multiple stressors that are overwhelming their natural resilience, an estimated 27 percent of reefs have already been lost and 60 percent are threatened by ocean warming, disease and anthropogenic activities including coastal development, polluted runoff from unsustainable land use practices, over-harvesting, destructive fishing, and global climate change.

In 2013, the increase in Terrestrial, Freshwater, and Marine Environments will enable USGS investigators to increase research in support of the NOP and the U.S. Coral Reef Task Force (CRTF) in collaboration with the Office of Insular Affairs. The USGS will provide the science to better understand how corals respond to natural and anthropogenic changes in the environment by increasing the understanding of how stressors affect the physiologic processes of coral reef organisms and reef structure; provide state-of-the-art science to support development of effective, science-based methodologies for quantifying lost ecosystem services from degraded coral reefs as well as the potential environmental benefits associated with coral reef restoration; and support a rapid response team to assess extreme coral events (e.g., heating or cooling events, disease outbreak).

Expected products include developing, with interagency collaboration through the CRTF, a reef manager's resource guide to coral reef impacts; contributing to the scientific basis for developing a functional assessment methodology for quantifying reef ecosystem services; and assessing coral reefs undergoing extreme events. This information will provide insight into how corals are actively responding to stressors and enable reef managers to make better decisions for managing in and around the watershed where the reef is located.

Brown Tree Snakes – Detection and Control **(+$500,000/0 FTE)**

Shortly after World War II, the brown tree snake (BTS) was accidentally transported from its native range in the South Pacific to Guam. As a result of abnormally abundant prey on Guam and the absence of natural predators and other population controls, BTS populations reached extraordinarily high numbers. Snakes caused the extinction of most of the native forest vertebrate species; thousands of power outages affecting private, commercial, and military activities; and widespread loss of domestic birds and pets. The highest priority needs for control and management of BTS are development of landscape scale methods to suppress or eradicate snakes on Guam and to detect and eradicate incipient populations of snakes accidentally transported to other islands such as Hawaii and the Northern Mariana Islands. The military expansion on Guam will raise the profile of these issues because military construction will result in mitigation actions that include snake suppression in areas of high ecological value, and because increased military cargo transport and off-Guam training exercises will increase the odds of transporting snakes to other islands, such as Hawaii. With the increase, the Invasive Species Program will focus on high-priority research to validate the population-level efficacy of aerially-delivered toxicants for snake control at landscape scales; predict the results of snake suppression on Guam in terms of recovery rates of snake populations as well as recovery of potentially problematic species (such as non-native rats) that would benefit from snake suppression; develop novel methods for detection and control of juvenile snakes, which are not susceptible to the attractant used to deliver toxicants; and revive the USGS "Dogs in the Woods" program, to assess the utility of detector dogs for detecting snakes on recipient islands and for eliminating snakes that escaped poisoning in areas that have received toxicant applications.

Climate and Land Use Change

Climate Research and Development **(+$1,000,000/0 FTE)**

The USGS Climate Research and Development (R&D) Program's long-standing and globally respected expertise in studies of past climate, geology, hydrology, geography, and biology provides the opportunity to document patterns of climate and land use change on daily to millennial timescales and to assess the impacts of changes on local, regional, and national scales. Climate R&D activities are designed to advance 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 the Earth system to these changes. Climate R&D data contributions improve model performance and the ability to forecast likely changes under a range of climate and land use scenarios.

This increase will support priority climate research in areas such as studies of the paleoclimate records and studies on sea level rise and its impact on ecosystems, including coastal wetlands and estuaries, mountain habitats, deserts, and marine ecosystems.

Carbon Sequestration (+$250,000/0 FTE)

The 2013 proposed increase will be used to complete the biologic and geologic national assessments as well as publish the assessment reports, journal papers, and models. The program will continue to collaborate with other Interior bureaus, Federal agencies, State Geological Surveys, universities, and user communities on future carbon research.

Science Support for DOI Bureaus (+$6,450,000/4 FTE)

The USGS continues to support the Landscape Conservation Cooperatives (LCC), as well as other Federal, State, tribal, academic and private ecoregional fish, wildlife and land conservation efforts by delivering integrated ecological and population modeling science across national efforts. USGS climate science support takes a variety of forms, depending upon the LCC and USGS bureau needs. USGS climate change research, data management, modeling, and tool development can be employed to inform new Federal, State, tribal, and private management strategies for terrestrial and freshwater fish and wildlife species. The USGS has provided both dedicated research scientists and access to a full range of expertise within USGS science centers to respond to USGS bureau and LCC identified priorities. In addition, USGS efforts to support the LCCs include funding for development of database tools to deliver necessary information to LCC staff easily, inexpensively, and quickly. The FWS, the Bureau of Land Management (BLM), and NPS have identified a number of high priority issues that transcend specific LCCs which include science support for adaptive management and structured decisionmaking and other strategic and tactical research to meet the priority information needs identified by the FWS; NPS priority research on climate change adaptation and ecosystem change in parks, and other high priority biological research, monitoring, and technical assistance; and BLM priorities on non-forest fire research and ecoregional assessments of western systems.

Energy Minerals and Environmental Health

Rare Earth Elements Research (+$1,000,000/+5 FTE)

The USGS Mineral Resources Program (MRP) will conduct research on rare earth element (REE) resources to understand the geologic processes that concentrated known REE resources at specific localities in the Earth's crust in order to assess quantities, qualities, and areas of undiscovered REE resources for potential future supply. Geologic, geochemical, and geophysical characterization studies of domestic REE districts and deposits will provide criteria to be applied in the assessment of undiscovered REE resources, both domestically and internationally. REE resources in more unconventional geologic environments will be evaluated as new sources of potential REE supply. Research on mineral environmental pathways and biogeochemical behavior of REE and associated metals will be conducted to better understand potential impacts of REE resource development on human and ecosystem health, providing critical information for sustainable development or REE resources.

New Energy Frontier – Wind Energy (+$1,000,000/+2 FTE)

USGS research, modeling, and monitoring are already being applied to evaluate the impacts to fish and wildlife associated with the widespread development of wind energy. The infrastructure needed for energy capture and transmission includes wind turbines as well as towers, cables, roads, and sea bed corridors, and with an impact of increased boat traffic. This increase will allow the USGS to increase efforts directed toward understanding and assessing the impacts of

existing and projected large-scale development of wind farms. The Energy Resources Program will work toward developing an assessment methodology for impacts of wind energy development that can be applied nationwide. To that end, the USGS will hold several workshops to bring together multidisciplinary expertise in the field of wind energy impacts, to develop a consensus of what an impact assessment should include, review what science is already robust, and identify what further science needs to be conducted. The workshops will be held throughout 2012, the results of which will direct the research needed and guide development of the assessment methodology in 2013 and 2014.

Natural Hazards

Eastern U.S. Earthquake Hazard Research and Assessment (+$1,600,000/-4 FTE)

The magnitude 5.8 earthquake in central Virginia on August 23, 2011, was felt by approximately 30 million people in 20 States, shut down a nuclear power plant for several months, and resulted in over $100 million in property damages. This event provided new and dramatic evidence of the earthquake hazard in the Eastern United States and the potential for widespread disruption and damage this threat poses. This event also provides an exceptional opportunity to advance understanding of the causes of earthquakes in the Eastern United States, to refine our assessments of future seismic shaking intensity and distribution, and to promote the implementation of this new knowledge in building codes and other public safety measures.

It is generally thought that Eastern earthquakes occur on ancient geologic faults that have been re-activated in the current stress conditions in the Earth's crust. The scientific approach in the Earthquake Hazards Program will be to examine in detail the geologic and tectonic setting of the Virginia earthquake and then use this information as a guide to identify similar locations in the Eastern United States that may be susceptible to earthquakes. Target regions of interest are eastern South Carolina, eastern Tennessee, western Ohio, northeastern New Jersey (New York City area), northern New York, and central New Hampshire; all areas with low level but persistent seismicity. Particular attention will be given to areas near large urban centers.

In 2013, work will be directed toward geological reconnaissance of target areas for evidence of prehistoric earthquakes, airborne geomagnetic and gravity surveys, high resolution Light Detecting and Ranging (LiDAR) imaging, three-dimensional seismic exploration surveys to identify buried faults, seismic analyses of attenuation of seismic shaking with distance, and analyses of amplification of shaking due to soft soils within urban centers. Outcomes will include improvement of seismic hazard criteria used in building codes to reflect regional earthquake potential and local near-surface sediment and soil conditions. This work will lead to detailed urban seismic hazard maps for Boston, MA; Philadelphia, PA; Charleston, SC; Washington, D.C.; and New York City, NY.

A continental scale, transportable seismic array under project EarthScope, sponsored by the NSF, will move into the Eastern United States during 2013. Many of the studies proposed in the USGS effort will make use of or complement the dramatic increase of instrumentation that the EarthScope project will bring to the area. Additionally, the requested support will be used to take advantage of local knowledge and expertise through targeted grants to State geological surveys and academic institutions. The geophysical and remote sensing surveys will be done under contracts with qualified private firms.

In 2013, the Earthquake Hazards Program expects the FTE estimate to decrease as a result of attrition and implementation of workforce plans.

Water Resources

Hydrologic Research and Development (+$1,300,000/0 FTE)

Understanding Organic Matter for Cleaner Water

Characteristics and fluxes of natural organic matter determine the transport of carbon, nutrients, and contaminants in surface water. Recently developed techniques for continuous in-situ fluorescent measurements of organic matter have been demonstrated to substantially improve understanding of the fate of organic matter, as well as mercury and other toxic metals that bind to natural organic matter. Development of an extensive, continuous monitoring network for organic matter will inform development of cost effective best practices to reduce exposure to contaminants in lakes and streams and promote safer water supplies and healthier aquatic ecosystems.

The National Hydrologic Model

Accurate estimates of total water availability, changes in the timing and source of flow, and measures of the uncertainty of these estimates are essential in assessing the response of the Nation's watersheds and ecosystems to climate and land use changes. These models are widely used by resource managers concerned with water availability for domestic, agricultural, industrial, and recreational use as well as the health of aquatic and riparian ecosystems. The National Hydrologic Model will support coordinated, comprehensive, and consistent hydrologic model development for numerous programs within the USGS, as well as water resource managers in other bureaus, Federal agencies, and States.

Fire and Water: Hydrologic Impacts of Wildfire

Wildfires have increased in size and severity in the United States in the last 30 years. Over 60 million people are supplied with water from mountain river basins that contain vegetation susceptible to burning by wildfires. Large fires and post-fire consequences in the watersheds of major population centers like Denver have increased awareness of fire effects on water supplies and ecosystem services. Fire affects the timing, quantity, and quality of water from watersheds and has impacts on several provisioning, regulating, and cultural components of ecosystem services. Fire science research in the USGS is of vital importance to the Nation and the USGS leads the national effort to measure and predict the effects of fire on water supplies. However gaps remain in our capability to understand and predict the timing and magnitude of fire effects on water supplies, including flooding, sediment impacts from erosion and debris flows, the form and fate of contaminants and other chemicals entrained in the water during post-fire flows, and effects on water treatment processes including the assessment of risk of the formation of disinfection byproducts. The proposed increase will enable the USGS to strengthen our capability to assess the resiliency of the Nation's water supply to natural hazards and will increase our ability to respond to pressing issues of climate variability and ecosystem change.

Understanding and Adapting to Warming in Northern Alaska

Interior Alaskan ecosystems are responding to dramatic warming that has persisted for several decades, resulting in measurable changes in temperature, moisture, vegetation, streamflow, and permafrost distribution. Accurate predictions of future system responses are critical to understanding and forecasting the effects of climate change on the Nation's northern resources and providing objective information necessary for the public and policymakers to derive informed decisions for adaptation strategies. The USGS has established a research and observation project within the Yukon River Basin (YRB) of interior Alaska, with research components that link changes in climate and water to their effects on wildlife, human subsistence, and climate regulation.

Increased funding in 2013 will support development of integrated empirical and mechanistic based forecasting models of changing permafrost, hydrology, vegetation dynamics, terrestrial wildlife habitat and diversity, and aquatic productivity. Beneficiaries of the USGS work include: the tribal Watershed Council; tribal and local governments and the communities they represent; the FWS; and Alaska State agencies including the Departments of Community and Economic Development, Environmental Conservation, Fish and Game, Natural Resources, and Transportation and Public Facilities. Products developed will include, baseline permafrost mapping and incorporation into hydrologic models with imposed climate variation to evaluate consequences of warming and a multidiscipline assessment of lake drying and related effects on wildlife and ecosystems. Publications would include maps, modeled results, USGS reports, and journal articles. The modeling will also be critical for managing infrastructure, as well as natural resources in Alaska in the future.

Core Science Systems

Data Preservation **(+$1,000,000/+3 FTE)**

In 2013, the USGS proposes to move the National Geological and Geophysical Data Preservation Program (NGGDPP) to a new budget subactivity: Science Synthesis, Analysis, and Research (SSAR) in Core Science Systems. This request does not reflect an actual increase in the overall USGS budget request for this effort; it moves the funding and functions to the SSAR subactivity as part of an internal transfer of funds (see the associated decrease for Data Preservation). Efforts are dedicated to preserving physical and analog geoscience data including rock and ice cores, fossils, fluid samples of oil, gas, and water, and geochemical samples that represent potentially beneficial or harmful chemical compounds in the rocks. To accomplish this work, the USGS cooperates with State geological surveys and other Interior bureaus.

Program Decreases

Climate and Land Use Change

Landsat Development (-$1,750,000/0 FTE)

The USGS received $2.0 million in the 2012 Omnibus appropriations bill to support program development activities for Landsat satellites 9 and 10. In 2012, these funds are being used to consider options to obtain, characterize, manage, maintain, and prioritize land remote sensing data and to support the evaluation of alternatives for a Landsat 9 mission and other means for acquiring data. This evaluation of alternatives will help inform the 2014 budget formulation process. In 2013, this activity will be decreased by $1.75 million, providing $250,000 to continue these efforts. The USGS will continue to work with the Office of Science and Technology Policy, the National Aeronautics and Space Administration (NASA), and the NOAA to examine alternatives for providing land remote sensing data in a cost effective manner.

Energy Minerals and Environmental Health

Mineral Resources (-$5,000,000/-39 FTE)

The MRP supports data collection, analysis, and research to better understand the nature and availability of domestic and global mineral resources. Recognizing fiscal constraints, difficult choices resulted in targeted reductions of this program to support priorities, such as research on rare earth elements, as well as advancing priorities elsewhere in the budget request. Reductions in this program will result in elimination of research on the relationship between minerals and human health, and reduction in support for other mineral environmental work. The reduction will impact collection of geologic and mineral deposit data in Alaska; collection, analysis, and dissemination of international minerals information and material flow studies; and reduce analytical capabilities, resulting in the consolidation of analytical facilities supported by the MRP. The reduction will also require a phased initiation of the new domestic mineral resource assessment in 2013, which will proceed with stepwise implementation, extending the time required to complete the assessment. This reduction will reduce the MRP's ability to assist other Federal agencies who rely on timely, accurate, and unbiased mineral resource data and information for land management and policy decisionmaking.

Mineral Resources External Research Program (-$250,000/0 FTE)

The Mineral Resources External Research Program (MRERP) is the only Federal source of grant funding for research outside of the Federal Government to address key problems related to nonfuel mineral resources. The proposed funding reduction will terminate the MRERP in 2013, and end support to States and universities to conduct this research. Recognizing fiscal constraints, difficult choices resulted in targeted reductions, such as funding for grants, so funds could be used to support departmental and Administration priorities elsewhere in the budget.

Energy Resources – Conventional Energy (-$1,000,000/-2 FTE)

Since 1975, the Energy Resources Program's (ERP) State Cooperative Project has developed and funded cooperative agreements with more than 30 State geological agencies, focused primarily on the collection of coal resource data. State agency geologists collect and evaluate geologic data that are used by States and the USGS for resource evaluation. The States enter

the information into the National Coal Resources Data System, which is used for the USGS coal resource assessments. Funding to many of the States would be eliminated. Agreements would be continued only with those States for which information is needed on current assessments. The ERP also conducts research, assessment, and environmental impacts of oil shale. The ERP recently released in-place assessments of the richest oil shale deposits in the country, estimating 4.2 trillion barrels of oil. Reductions will slow work to determine how much of that oil is technically recoverable within these basins, as well as environmental impacts of potential oil shale development. Fiscal constraints resulted in difficult choices to target reductions so that funds could be used to support priorities elsewhere in the budget, including priorities such as New Energy Frontier.

Impact of Environmental Contaminants **(-$500,000/-3 FTE)**

Contaminant Biology activities focus on understanding the role of environmental drivers key to sustaining human and animal health. The proposed funding decrease would reduce research to assess impacts of environmental contaminants (including endocrine disrupting chemicals) on human, animal, and ecosystem health. The decrease would reduce support for technical assistance on emerging issues and environmental disasters, such as the Deepwater Horizon Oil Spill. This funding reduction will eliminate monitoring and data collection used by States to meet national water quality criteria under the Clean Water Act. Research activities would continue at a reduced level. Fiscal constraints resulted in difficult choices to target reductions so that funds could be used to support priorities elsewhere in the budget, such as WaterSMART.

Methods Development and Assessments **(-$2,000,000/-11 FTE)**

Toxic Substances Hydrology activities address emerging environmental contamination problems that pose significant risk to human, ecological, and environment health by conducting research which provides reliable scientific information and tools that explain the occurrence, behavior, and effects of toxic substances in the Nation's natural environments. The proposed reduction would substantially decrease activities that characterize environmental contamination by pharmaceuticals, endocrine-active chemicals, pesticides, and other priority and emerging environmental contaminants. The proposed decrease would substantially limit developing new laboratory methods to measure previously unmeasured emerging contaminants; quantifying relative contributions of contaminants from various industrial, agricultural, and human and animal waste sources; identifying adverse ecological health effects; and assessing human exposure through drinking water from both domestic and public water supplies. The proposed decrease would terminate plans to initiate studies on environmentally friendly approaches to uranium resource extraction and shale gas development. Other Federal agencies would rely on existing information to protect the environment and drinking water, and to approve the safe use of pesticides, pharmaceuticals, and other industrial chemicals. Fiscal constraints resulted in difficult choices to target reductions so that funds could be used to support priorities elsewhere in the budget, such as WaterSMART.

Natural Hazards

Great Lakes Beach Health **(-$600,000/-1 FTE)**

This study implements the Coastal Ecosystems near-term priority of the Ocean Research Priorities Plan. Working collaboratively with NOAA, EPA and State and local public health agencies, the USGS has expanded the use of beach health predictive models to over 40

recreational beaches in five Great Lake States; developed new rapid field technology to determine bacteria concentrations at beaches; and expanded understanding of the occurrence of true, rather than indicator, pathogens and viruses. This work provides beach managers the ability to issue warnings and closures, which have substantial public health and economic consequences, with greater certainty of risk. Reductions would terminate efforts to expand the availability of such tools and end research efforts to mitigate the occurrence and consequence of pathogen "events" and better understand the controls of such events and their consequences for ecosystem and human health. Sustained application of tools previously provided, and migration of model enhancements into the decisionmaking framework, will only be supported as resources from end users (local and regional public health agencies) allow. Fiscal constraints resulted in difficult choices to target reductions so that funds could be used to support other coastal and ocean priorities.

Multi-Hazards - National Volcano Early Warning System (-$700,000/-2 FTE)

This decrease reduces the second phase of the National Volcano Early Warning System under Multi-Hazards Initiative (NVEWS) enhancements, which were focused on monitoring infrastructure in Alaska and on programwide observatory interoperability. The first phase of NVEWS implementation was applied programwide with funding through American Recovery and Reinvestment Act of 2009. With NVEWS funds first introduced to the base program in 2011 and increased in 2012, the monitoring network at Makushin Volcano was enhanced to NVEWS standards and network improvements were made at Newberry Volcano, Oregon. Observatory interoperability was achieved with respect to exchange and analyses of seismic data. Work will continue on other aspects of data management, on partnering with the National Earthquake Information Center (NEIC) to provide 24/7 backup alerting of seismic unrest, and on other monitoring-related enhancements, however the pace of progress will be slowed. Fiscal constraints resulted in difficult choices to target reductions so that funds could be used to support priorities elsewhere in the budget, including Rapid Disaster Response.

Volcanic Observatory Assessments (-$300,000/-1 FTE)

Geologic and geophysical investigations that provide a volcanic hazards framework will be reduced or slowed with an impact on the capabilities of USGS volcano observatories. These investigations typically consist of geologic mapping (in conjunction with geochemical, geochronological, and petrological studies) or geophysical surveys to best understand the processes that built the volcano over time, and that continue. Scientific background, updated hazard assessments and the ability to provide local land managers, emergency managers, and communities with scientific information utilized to assess vulnerability and likely scenarios would be impacted by this reduction. Fiscal constraints resulted in difficult choices to target reductions so that funds could be used to support priorities elsewhere in the budget, including priorities such as Rapid Disaster Response.

Water Resources

Availability Studies (-$2,000,000/-11 FTE)

The Groundwater Resources Program (GWRP) is currently conducting multidisciplinary regional studies of groundwater availability that are the building blocks for a national assessment and is the principal government entity examining this important national resource. Reductions would result in the following regional groundwater evaluation studies being terminated: the Floridan

aquifer system (AL, FL, GA, and SC); the Northern Atlantic Coastal Plain aquifer system (DE, MD, NJ, NY, and VA); and the Lower Tertiary/Upper Cretaceous aquifer system of the Northern Great Plains (MT, ND, SD, and WY). The regional assessment of groundwater status and trends in the Hawaiian volcanic-rock aquifers that was scheduled to begin in 2013 would not be started. These reductions are proposed in order to address priorities identified in the WaterSMART initiative and specifically to establish a National Groundwater Monitoring Network (NGWMN) as authorized by the SECURE Water Act. In 2013, the USGS will begin implementation and development of this national network, which will provide some support for existing GWRP activities (Climate Response Network) and WaterSMART (indices) but will not replace the regional groundwater availability assessments.

Methods Development and Monitoring **(-$6,049,000/-35 FTE)**

The National Water-Quality Assessment Program (NAWQA) is responsible for providing nationally consistent descriptions of current water quality conditions and changes in these conditions for the Nation's freshwater streams and aquifers. With proposed decreases the NAWQA Program would begin making changes to prepare for restoring the national stream and groundwater quality monitoring networks to levels specified in the Cycle 3 Science Plan for the period 2013-2022, but would not accomplish major restoration of a number of long term water quality monitoring sites at this level. NAWQA will not be able to meet the 2013 planned performance measure—to complete 10 percent of the decadal national assessment (as specified in the Cycle 3 Science Plan) of streams and groundwater in support of water resource decisionmaking. Instead, 2.3 percent and 3.3 percent of the decadal assessments for streams and groundwater, respectively, would be completed in 2013. This represents an overall reduction of about 75 percent from the 2013 assessment activity called for in the Cycle 3 Science Plan. The decrease allows for a redirection of funds to address the priority issues identified in WaterSMART, which provides an additional $3.5 million to the NAWQA Program.

Federal Network Operations **(-$2,847,000/0 FTE)**

This reduction is for the increase in the National Streamflow Information Program's 2012 enacted appropriation, which was used to support the federally funded backbone of the streamgaging network. The decrease allows for a redirection of funds to address the priority issues identified in the Rapid Disaster Response, which funds NSIP at $5.5 million.

Information Management and Delivery **(-$3,300,000/-19 FTE)**

Targeted reductions to this program are proposed to fund priorities identified in the WaterSMART initiative, including information management and synthesis of water quality influences on water availability. The proposed reduction to the Hydrologic Networks and Analysis program would limit the availability of information on climate variability on water availability, particularly throughout the Western United States. Capacity to conduct watershed modeling that is conducted in support of the Bureau of Reclamation water management programs would be curtailed. The USGS water quality partnership with the NPS, which supports water quality management in the Nation's parks, would be reduced. Research on the effects of coal-bed methane production on water resources of the West will be inhibited. Because of a decrease in personnel to upgrade NWIS software, to keep real time systems running, and to archive streamed data in a timely manner, the proposed reduction would curtail the USGS's ability to provide real-time and archived water resources data and information to all users. HNA support of the activities of the Advisory Committee on Water Information (ACWI), a

Presidential Federal Advisory Committee Action team (FACA), and its subcommittees, will be reduced, including possible support of the annual meeting.

Interpretive Studies (-$4,963,000/-16 FTE)

The proposed reduction to the interpretative side of the Cooperative Water Program (CWP) reduces available science funding that supports foundational, and often long-term, assessments and research on water availability and water census issues, including on water use, environmental flows, groundwater and surface water relations, and water budgets; emerging topics first identified at local and State levels; quality assurance that ensures that information collected across State boundaries are consistent and comparable so that individual assessments inform and are integrated with key regional and national priorities, including water use, energy development, and sustainable ecosystems; and management decisions at local, State, and tribal levels. The number of the CWP water projects supporting the above science and research would be reduced by approximated 150 from 700 supported in 2012.

The proposed reduction affects both the interpretative side (as described above) and data collection activities, which currently support more than 75 percent of the Nation's streamgaging (6,000 gages), monitoring at 8,000 groundwater sites, and about 4,000 water quality sites. The number of data collection sites would decrease by 1,300 to about 16,200. In the current fiscally austere climate, the decrease in Cooperative Water funding allows the USGS to use scarce resources to address other Bureau priority issues.

Elimination - Water Resources Research Act (WRRA) (-$6,490,000/-2 FTE)

Established in 1984, by the Water Resources Research Act, the WRRA Program provides funding to 54 Water Resources Research Institutes at land grant universities—one in each State, the District of Columbia, Puerto Rico, the U.S. Virgin Islands, and Guam for the Federal-State partnership in water resources research, education, and information transfer. The elimination of this program allows the USGS to redirect scarce funds to other priority issues, such as WaterSMART.

Core Science Systems

Ecosystems Science Centers (-$700,000/-6 FTE)

The proposed reduction in Science Synthesis, Analysis, and Research impacts data and information management, and information technology efforts at USGS ecosystems research science centers, including managing and documenting data and data integration projects. Ecosystems science center staff provide credible, applicable, unbiased information for science-based decisionmaking, particularly as it pertains to the conservation, management, and use of the Nation's biological resources. The proposed decrease would reduce staff scientists and data managers who perform Geographic Information System (GIS) analyses; build Web applications; and manage, document, and share scientific research and monitoring data related to invasive species, wildlife disease, bird conservation, restoration ecology, endangered species, fisheries and fish habitat, and other important science topics. As a result, resource managers will not have access to this information when making decisions regarding habitat restoration. The proposed decrease allows for a redirection of funds for priority ecosystem issues found particularly in the Chesapeake Bay, the Columbia River, the Puget Sound, and the Upper Mississippi River.

National Geological and Geophysical Data Preservation (-$996,000/-3 FTE)

The USGS proposes to move the funding and functions for this effort to Science Synthesis, Analysis and Research (see the associated increase for Data Preservation).

National Cooperative Geologic Mapping Program – Federal and State Partnerships (-$1,500,000/-2 FTE)

This program provides geologic maps and three-dimensional framework models that are used in planning, resource management, and mitigation of hazards. The USGS proposes to reduce funding in the NCGMP using the formula provided in the National Geologic Mapping Act. The NCGMP would continue to provide geologic maps of subsurface data important for developing models that conceptualize groundwater flow, mineral deposition, and earthquake shaking, but at a reduced level. Documenting landscape change for evaluating geologic hazards such as flash floods, dust storms, and drought would continue in 2013. The proposed decrease allows for a redirection of funds to focus on the WaterSMART and hydraulic fracturing priorities.

Administrative Services – Science Synthesis, Analysis, and Research (-$446,000/-3 FTE)

The proposed internal transfer, which would eliminate the Information Resources budget line, includes moving library services and information synthesis to Science Synthesis, Analysis, and Research. In 2013, the USGS proposes to reduce library services available at the Menlo Park and Flagstaff locations to basic support for onsite collections. These reductions are necessary to maintain the overall information capabilities of the entire bureau. The cuts are targeted in ways that maintain the investment in scientific research capabilities as provided by the USGS Libraries Program. The services being reduced in Menlo Park, CA and Flagstaff, AZ will be augmented by enhanced support bureauwide from the remaining full-service libraries in Denver, CO; Reston, VA; and Lafayette, LA.

Administration and Enterprise Information

Administrative Services – Science Support (-$2,369,000/-8 FTE)

The Science Support Subactivity includes science quality and integrity, communications, bureau leadership and budget formulation and analysis. The 2013 budget request required difficult choices including reductions in which administrative support will be impacted. Functions affected could include support services in acquisitions, policy analysis and accounting and financial management oversight. Acquisition and grant services necessary for conducting science projects could be delayed and could result in reducing the number of awards that can be made in a fiscal year. A reduction in Human Capital services could impact the ability to maintain existing levels of service to Interior, Office of Personnel Management, and USGS customers. Further, cooperative science projects and training with Native American Tribes will be reduced, resulting in less science conducted by students on tribal lands and the elimination of important natural resources management training for hundreds of tribal members.

The reduction will also eliminate participation in professional conferences and trade show programs, which may impact the USGS's partnerships with the larger scientific community. These typically involve the USGS presence at major national events, including annual meetings of the Geological Society of America, the American Geophysical Union, and others. These

national meetings are a core outlet where USGS scientists build and share knowledge by presenting findings, which are the result of Federal investment in science, and by participating in panels with their peers. The decrease allows for a redirection of funds to advance administration and departmental priorities.

Administrative Services – Security and Technology (-$1,322,000/-10 FTE)

Security and Technology facilitates science through technologies that enable collaboration and knowledge and information sharing between scientists across the landscape, in addition to providing the communications and data management backbone. The proposed level of funding will require reductions to the Enterprise Geospatial Information Services support effort that works with mission programs to leverage GIS software and services to visually communicate natural science information to improve scientific understanding. Science programs may have to share the costs to maintain critical systems. The decrease allows for a redirection of funds to address administration and departmental priorities.

Facilities

Operations and Maintenance Efficiencies (-$4,390,000/0 FTE)

The proposed reduction will degrade the condition and performance of the USGS real property portfolio by impairing the bureau's ability to complete annual operations and maintenance responsibilities, and deferring custodial and maintenance work that will add to the bureau's existing backlog of deferred maintenance. In turn, the USGS expects to see an increase in the frequency with which equipment and facility components will need more costly emergency repairs and replacements, as well as a shortening of the overall life cycle of our real property assets. Ultimately, emergency repairs have an impact on the science mission of the USGS through unplanned additional costs and unexpected outages.

The reduction will inhibit the USGS's ability to meet requirements of statutory energy goals; diminish efforts toward energy reduction, water conservation, and waste reduction; and inhibit meeting the environmental requirements in Executive Order (EO) 13423, Strengthening the Federal Environmental Energy and Transportation Management, and EO 13514, Federal Leadership in Environmental Energy and Economic Performance, and to efficiently and economically maintain its real property assets as required by EO 13327, Federal Real Property Asset Management.

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Internal Transfers

National Geological and Geophysical Data Preservation Program

In 2013, the NGGDPP is proposed to move to SSAR in Core Science Systems. This is accomplished through decreases to the NGGDPP and an increase to SSAR. Please refer to the program increases and decreases narratives for details.

Information Resources

Internal Transfer From:

		2013			
		Fixed Costs and Related Changes (+/-)	Program Change	Base Funding	Total
		162	-821	15,802	15,143
Information Resources($000)	FTE	0	-6	63	57

Information Resources **(-$15,143,000/-57 FTE)**

The 2013 budget request eliminates the Information Resources component of AEI and shows a program change for Administrative Services of -$821,000 and -6 FTE. The request realigns the program's funding to Science Support (-$4,293,000/-16 FTE), and Security and Technology (-$2,617,000/-10 FTE) in AEI, and the Science Synthesis, Analysis, and Research program (-$8,233,000/-31 FTE), in the Core Science Systems Mission Area.

Internal Transfer To:

		2013			
		Fixed Costs and Related Changes (+/-)	Program Change	Base Funding	Total
Science Synthesis, Analysis, and		88	-446	8,591	8,233
Research ($000)	FTE	0	-3	34	31
		46	-232	4,479	4,293
Science Support ($000)	FTE	0	-2	18	16
		28	-143	2,732	2,617
Security and Technology ($000)	FTE	0	-1	11	10
		162	**-821**	**15,802**	**15,143**
Internal Transfers Total	**FTE**	**0**	**-6**	**63**	**57**

Core Science Systems

Science Synthesis, Analysis, and Research Program **(+$8,233,000/+31 FTE)**

The USGS proposed to consolidate Biological Information Management and Delivery, National Geological and Geophysical Data Preservation and the USGS Libraries and information synthesis functions from Information Resources into a new budget line named Science Synthesis, Analysis, and Research (SSAR). The consolidation will bring together complementary functions and resources and with increases proposed in Ecosystem Priorities, hydraulic fracturing, and science for coastal and ocean stewardship will advance new information and knowledge synthesis and management tools.

Administration and Enterprise Information

Science Support **(+$4,293,000/+16 FTE)**

The USGS proposes to eliminate the Information Resources budget line and consolidate its communication, publishing, Web, and youth activities in Science Support.

Security and Technology **(+$2,617,000/+10 FTE)**

The USGS proposes to eliminate the Information Resources budget line and consolidate its enterprise infrastructure functions in Enterprise Security and Technology.

Budget at a Glance
(Dollars in Thousands)

	2011 Actual	2012 Enacted	FC or Related Costs	Program Changes	Internal Transfer	2013 Request
Appropriation: Surveys, Investigations and Research						
ECOSYSTEMS						
Status and Trends	22,403	21,999	171			22,170
Fixed Costs			171			
Bureau Fixed Costs			171			
Fisheries: Aquatic & Endangered Resources	23,693	22,576	184	4,351		27,111
Fixed Costs			184			
Bureau Fixed Costs			184			
WaterSMART				1,250		
WaterSMART: Water Quality Enhancement				1,250		
Hydraulic Fracturing				2,200		
Hydraulic Fracturing				2,200		
Ecosystem Priority				901		
Ecosystem Priority: Klamath Basin Agreement				901		
Wildlife: Terrestrial & Endangered Resources	49,078	48,169	245	1,000		49,414
Fixed Costs			245			
Bureau Fixed Costs			245			
White Nose Syndrome				1,000		
White-Nose Syndrome				1,000		
Terrestrial, Freshwater & Marine Environments	35,763	36,735	226	5,600		42,561
Fixed Costs			226			
Bureau Fixed Costs			226			
Coral Reefs				500		
Coral Reefs				500		
Ecosystem Priority				5,100		
Ecosystem Priority: California Bay Delta				1,000		
Ecosystem Priority: Chesapeake Bay				1,300		
Ecosystem Priority: Columbia River				300		
Ecosystem Priority: Puget Sound				500		
Ecosystem Priority: Sustaining Environmental Capital				2,000		
Invasive Species	10,795	13,043	132	4,500		17,675
Fixed Costs			132			
Bureau Fixed Costs			132			
Brown Tree Snakes				500		
Brown Tree Snakes				500		
Ecosystem Priority				4,000		
Ecosystem Priority: Everglades				1,000		
Ecosystem Priority: Great Lakes Asian Carp Control Framework				2,000		
Ecosystem Priority: Upper Mississippi River Asian Carp Control				1,000		
Cooperative Research Units	19,105	18,756	165			18,921
Fixed Costs			165			
Bureau Fixed Costs			165			
Subtotal: Ecosystems	**160,837**	**161,278**	**1,123**	**15,451**	**0**	**177,852**

Budget at a Glance
(Dollars in Thousands)

	2011 Actual	2012 Enacted	FC or Related Costs	Program Changes	Internal Transfer	2013 Request
CLIMATE AND LAND USE CHANGE						
Climate Variability						
NCCWSC/DOI Climate Science Centers (DOI CSC)	20,921	25,490	160	500		26,150
Fixed Costs			160			
Bureau Fixed Costs			160			
Ecosystem Priority				500		
Ecosystem Priority: Department of the Interior Climate Science Centers - Tribes				500		
Climate Research and Development	28,468	22,049	199	1,000		23,248
Fixed Costs			199			
Bureau Fixed Costs			199			
DOI CSC R&D				1,000		
DOI CSC R&D				1,000		
Carbon Sequestration	9,955	8,986	148	250		9,384
Fixed Costs			148			
Bureau Fixed Costs			148			
Program Increase				250		
Carbon Sequestration				250		
Science Support for DOI Bureaus	4,990	2,396	113	6,450		8,959
Fixed Costs			113			
Bureau Fixed Costs			113			
Program Increase				6,450		
Science Support for DOI Bureaus				6,450		
Subtotal: Climate Variability	**64,334**	**58,921**	**620**	**8,200**	**0**	**67,741**
Land Use Change						
Land Remote Sensing	62,387	73,699	182	-1,750		72,131
Fixed Costs			182			
Bureau Fixed Costs			182			
Landsat Development				-1,750		
Land Remote Sensing				-1,750		
Geographic Analysis and Monitoring	11,420	11,470	157	2,250		13,877
Fixed Costs			157			
Bureau Fixed Costs			157			
Rapid Disaster Response				750		
Disaster Response: Scenarios and Crisis Response				750		
Ecosystem Priority				1,500		
Ecosystem Priority: Chesapeake Bay				500		
Ecosystem Priority: Land Use Science				1,000		
Subtotal: Land Use Change	**73,807**	**85,169**	**339**	**500**	**0**	**86,008**
Subtotal: Climate and Land Use Change	**138,141**	**144,090**	**959**	**8,700**	**0**	**153,749**

Budget at a Glance
(Dollars in Thousands)

	2011 Actual	2012 Enacted	FC or Related Costs	Program Changes	Internal Transfer	2013 Request
ENERGY, MINERALS, AND ENVIRONMENTAL HEALTH						
Mineral Resources	52,168	49,231	290	-4,250		45,271
Fixed Costs			290			
Bureau Fixed Costs			290			
Rare Earth Elements Research				1,000		
Rare Earth Elements Research				1,000		
Mineral Grants				-250		
Minerals External Research Program				-250		
Mineral Resources				-5,000		
Mineral Resources				-5,000		
Energy Resources	27,750	27,292	200	3,000		30,492
Fixed Costs			200			
Bureau Fixed Costs			200			
Hydraulic Fracturing				3,000		
Hydraulic Fracturing				3,000		
New Energy Frontier - Wind Energy				1,000		
New Energy Frontier - Wind Energy				1,000		
Energy Resources - Conventional Energy				-1,000		
Energy Resources - Conventional Energy				-1,000		
Contaminant Biology	9,216	9,062	138	700		9,900
Fixed Costs			138			
Bureau Fixed Costs			138			
WaterSMART				1,000		
WaterSMART: Water Quality Enhancement				1,000		
Ecosystem Priority				200		
Ecosystem Priority: Chesapeake Bay				100		
Ecosystem Priority: Columbia River				100		
Impact of Environmental Contaminants				-500		
Impact of Environmental Contaminants				-500		
Toxic Substances Hydrology	10,778	10,628	136	700		11,464
Fixed Costs			136			
Bureau Fixed Costs			136			
WaterSMART				2,500		
WaterSMART: Predictive Modeling				500		
WaterSMART: Water Quality Enhancement				2,000		
Ecosystem Priority				200		
Ecosystem Priority: Chesapeake Bay				100		
Ecosystem Priority: Columbia River				100		
Methods Development and Assessments				-2,000		
Methods Development and Assessments				-2,000		
Subtotal: Energy, Minerals, and Environmental Health	**99,912**	**96,213**	**764**	**150**	**0**	**97,127**

Budget at a Glance
(Dollars in Thousands)

	2011 Actual	2012 Enacted	FC or Related Costs	Program Changes	Internal Transfer	2013 Request
NATURAL HAZARDS						
Earthquake Hazards	55,979	55,125	241	3,551		58,917
Fixed Costs			241			
Bureau Fixed Costs			241			
Hydraulic Fracturing				1,100		
Hydraulic Fracturing				1,100		
Rapid Disaster Response				851		
Disaster Response: Robust Monitoring Networks				851		
Eastern US Earthquake Research and Assessment				1,600		
Eastern US Earthquake Research and Assessment				1,600		
Volcano Hazards	24,464	24,770	198	0		24,968
Fixed Costs			198			
Bureau Fixed Costs			198			
Rapid Disaster Response				1,000		
Disaster Response: Robust Monitoring Networks				1,000		
Volcano Observatory Assessments				-300		
Volcano Observatory Assessments				-300		
Multi-Hazards				-700		
National Volcano Early Warning System				-700		
Landslide Hazards	3,318	3,266	142	500		3,908
Fixed Costs			142			
Bureau Fixed Costs			142			
Rapid Disaster Response				500		
Disaster Response: Robust Monitoring Networks				500		
Global Seismographic Network	5,379	5,312	139			5,451
Fixed Costs			139			
Bureau Fixed Costs			139			
Geomagnetism	2,097	2,066	139			2,205
Fixed Costs			139			
Bureau Fixed Costs			139			
Coastal and Marine Geology	44,727	43,941	238	5,150		49,329
Fixed Costs			238			
Bureau Fixed Costs			238			
Science for Coastal and Ocean Stewardship				5,750		
Science for Coastal and Ocean Stewardship				5,750		
Great Lakes Beach Health				-600		
Great Lake Beach Health Study				-600		
Subtotal: Natural Hazards	**135,964**	**134,480**	**1,097**	**9,201**	**0**	**144,778**
WATER RESOURCES						
Groundwater Resources	8,481	8,916	141	2,600		11,657
Fixed Costs			141			
Bureau Fixed Costs			141			
WaterSMART				2,500		
WaterSMART: Groundwater Network				2,500		
Hydraulic Fracturing				2,100		
Hydraulic Fracturing				2,100		
Availability Studies				-2,000		
Availability Studies				-2,000		

Budget at a Glance
(Dollars in Thousands)

	2011 Actual	2012 Enacted	FC or Related Costs	Program Changes	Internal Transfer	2013 Request
WATER RESOURCES (CON'T)						
National Water Quality Assessment	64,234	62,909	318	-1,049		62,178
Fixed Costs			318			
Bureau Fixed Costs			318			
WaterSMART				3,500		
WaterSMART: National/Regional Synopsis & Surveys				500		
WaterSMART: Predictive Models				500		
WaterSMART: Program & Information Management				500		
WaterSMART: Water Quality Enhancement				2,000		
Ecosystem Priority				1,500		
Ecosystem Priority: California Bay Delta				1,000		
Ecosystem Priority: Chesapeake Bay				500		
Methods Development and Monitoring				-6,049		
Methods Development and Monitoring				-6,049		
National Streamflow Information Program	27,100	29,358	159	2,953		32,470
Fixed Costs			159			
Bureau Fixed Costs			159			
Rapid Disaster Response				5,500		
Disaster Response: Robust Monitoring Networks				5,500		
Ecosystem Priority				300		
Ecosystem Priority: Columbia River				100		
Ecosystem Priority: Upper Mississippi River				200		
Federal Network Operations				-2,847		
Federal Network Operations				-2,847		
Hydrologic Research and Development	11,932	11,665	228	3,600		15,493
Fixed Costs			228			
Bureau Fixed Costs			228			
Hydraulic Fracturing				2,000		
Hydraulic Fracturing				2,000		
Ecosystem Priority				300		
Ecosystem Priority: Puget Sound				300		
Program Increase				1,300		
Hydraulic Research and Development				1,300		
Hydrologic Networks and Analysis	30,719	31,329	201	-2,800		28,730
Fixed Costs			201			
Bureau Fixed Costs			201			
WaterSMART				500		
WaterSMART: Ecological Water Science				100		
WaterSMART: Estimating Water Budget				100		
WaterSMART: Program & Information Management				300		
Information Management and Delivery				-3,300		
Information Management and Delivery				-3,300		
Cooperative Water Program	63,471	63,985	278	-4,963		59,300
Fixed Costs			278			
Bureau Fixed Costs			278			
Interpretative Studies				-4,963		
Interpretative Studies				-4,963		
Water Resources Research Act Program	6,486	6,490	0	-6,490		0
Elimination				-6,490		
Water Resources Research Act				-6,490		
Subtotal: Water Resources	**212,423**	**214,652**	**1,325**	**-6,149**	**0**	**209,828**

Budget at a Glance
(Dollars in Thousands)

	2011 Actual	2012 Enacted	FC or Related Costs	Program Changes	Internal Transfer	2013 Request
CORE SCIENCE SYSTEMS						
Science Synthesis, Analysis, and Research	18,563	15,052	228	2,454	8,591	26,325
Ecosystem Science				-700		
Data Management				-700		
Fixed Costs			228			
Bureau Fixed Costs			140			
Bureau Fixed Costs - IR			88			
Internal Transfer					8,591	
Internal Transfer from Information Resources					8,591	
Hydraulic Fracturing				600		
Hydraulic Fracturing				600		
Science for Coastal and Ocean Stewardship				1,000		
Science for Coastal and Ocean Stewardship				1,000		
Ecosystem Priority				1,000		
Ecosystem Priority: Information Synthesis and Management				1,000		
Administrative Services				-446		
Administrative Services - IR				-446		
Data Preservation				1,000		
Internal Transfer from Data Preservation				1,000		
Nat'l Geological & Geophysical Data Preservation Pgm	998	996		-996		0
NGGDP				-996		
National Geological and Geophysical Data Preservation				-996		
Program Increase				1,000		
Data Preservation				1,000		
Data Preservation				-1,000		
Internal Transfer to SSAR				-1,000		
National Cooperative Geologic Mapping	27,713	26,300	191	1,500		27,991
Fixed Costs			191			
Bureau Fixed Costs			191			
WaterSMART				1,000		
WaterSMART: Information Management				500		
WaterSMART: National Groundwater Monitoring Network				500		
Hydraulic Fracturing				2,000		
Hydraulic Fracturing				2,000		
NCGMP Federal and State Partnerships				-1,500		
NCGMP Federal and State Partnerships				-1,500		
National Geospatial Program	65,755	64,330	294	1,450		66,074
Fixed Costs			294			
Bureau Fixed Costs			294			
WaterSMART				750		
WaterSMART: Information Management				750		
Ecosystem Priority				700		
Ecosystem Priority: Columbia River				500		
Ecosystem Priority: Puget Sound				200		
Subtotal: Core Science Systems	**113,029**	**106,678**	**713**	**4,408**	**8,591**	**120,390**

Budget at a Glance
(Dollars in Thousands)

	2011 Actual	2012 Enacted	FC or Related Costs	Program Changes	Internal Transfer	2013 Request
ADMINISTRATION AND ENTERPRISE INFORMATION						
Science Support	77,229	73,427	219	-2,369	4,479	75,756
Fixed Costs			219			
Bureau Fixed Costs			173			
Bureau Fixed Costs - IR			46			
Internal Transfer					4,479	
Internal Transfer from EIR					4,479	
Administrative Services				-2,369		
Administrative Services				-2,137		
Administrative Services - IR				-232		
Security and Technology	23,430	20,991	894	-1,322	2,732	23,295
Fixed Costs			894			
Bureau Fixed Costs			866			
Bureau Fixed Costs - IR			28			
Internal Transfer					2,732	
Internal Transfer from IR					2,732	
Administrative Services				-1,322		
Administrative Services				-1,179		
Administrative Services - IR				-143		
Information Resources	17,988	15,802			-15,802	0
Internal Transfer Decrease					-15,802	
Internal Transfer to Science Support					-4,479	
Internal Transfer to Security and Technology					-2,732	
Internal Transfer to SSAR					-8,591	
Subtotal: Administration and Enterprise Information	**118,647**	**110,220**	**1,113**	**-3,691**	**-8,591**	**99,051**
FACILITIES						
Rental Payments and Operations & Maintenance	97,427	93,141	3,686	-4,390		92,437
Fixed Costs			3,686			
Bureau Fixed Costs			3,686			
Operations and Maintenance Efficiencies				-4,390		
O&M Efficiencies				-4,390		
Deferred Maintenance and Capital Improvements	7,292	7,280				7,280
Subtotal: Facilities	**104,719**	**100,421**	**3,686**	**-4,390**	**0**	**99,717**
Total: USGS	**1,083,672**	**1,068,032**	**10,780**	**23,680**	**0**	**1,102,492**

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Analysis By Account and Activity
(Dollars in Thousands)

Activity/Subactivity/Program Element	2012 Enacted		Fixed Costs & Related Changes (+/-)		Program Changes (+/-)		Internal Transfers		2013 Budget Request		Inc. (+) Dec. (-) from 2012	
	FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount
Appropriation: Surveys, Investigations, and Research												
Ecosystems	1,069	161,278	0	1,123	48	15,451	0	0	1,117	177,852	48	16,574
Climate and Land Use Change	432	144,090	0	959	14	8,700	0	0	446	153,749	14	9,659
Energy, Minerals, and Environmental Health	614	96,213	0	764	-20	150	0	0	594	97,127	-20	914
Natural Hazards	678	134,480	0	1,097	14	9,201	0	0	692	144,778	14	10,298
Water Resources	1,482	214,652	0	1,325	-45	-6,149	0	0	1,437	209,828	-45	-4,824
Core Science Systems	571	106,678	0	713	1	4,408	34	8,591	606	120,390	35	13,712
Administration and Enterprise Information	560	110,220	0	1,113	-18	-3,691	-34	-8,591	508	99,051	-52	-11,169
Facilities	60	100,421	0	3,686	0	-4,390	0	0	60	99,717	0	-704
Total, USGS	5,466	1,068,032	0	10,780	-6	23,680	0	0	5,460	1,102,492	-6	34,460

United States Geological Survey

Federal Funds

General and special funds:

SURVEYS, INVESTIGATIONS, AND RESEARCH

For expenses necessary for the United States Geological Survey to perform surveys, investigations, and research covering topography, geology, hydrology, biology, and the mineral and water resources of the United States, its territories and possessions, and other areas as authorized by 43 U.S.C. 31, 1332, and 1340; classify lands as to their mineral and water resources; give engineering supervision to power permittees and Federal Energy Regulatory Commission licensees; administer the minerals exploration program (30 U.S.C. 641); conduct inquiries into the economic conditions affecting mining and materials processing industries (30 U.S.C. 3, 21a, and 1603; 50 U.S.C. 98g(1)) and related purposes as authorized by law; and to publish and disseminate data relative to the foregoing activities; [$1,069,744,000] *$1,102,492,000*, to remain available until September 30, [2013] *2014;* of which [$51,569,700] *$53,337,189* shall remain available until expended for satellite operations; and of which [$7,292,000] *$7,280,000* 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.

Appropriation Language and Citations

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

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

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

Web site: *http://www.usgs.gov/budget/resources_tools.asp*

Expiring Authorizations

Program	Citation	Title of Legislation	Last Year of Auth.	Amount Authorized (000s)	Appropriation in Last Year of Authorization (000s)	2012 Budget Request (000s)	Explanation of Authorization Requirement for 2012	Description of Authority
National Earthquake Hazards Reduction Program	P.L. 108-360; 42 U.S.C. Sec. 7701-7709	National Earthquake Hazards Reduction Program Reauthorization Act of 2004	2009	$88,900	$55,128	$58,917	No individual programmatic authorization is necessary for the USGS to continue this effort	Monitoring, research, assessment and character-ization of earthquake hazards
Water Resources Research Act Program	P.L. 109-471; U.S.C. Sec. 10301-10309	Water Resources Research Act Amendments of 2006	2011	$12,000	$6,490	0	Although no individual programmatic authorization is necessary for this effort to continue; funding is not requested in 2012	Federal/State partnership in water resources research, education, and information transfer (matching grant program)
Carbon Sequestration Program	P.L. 110-140; 42 U.S.C. 17271	Energy Independence and Security Act of 2007	2012	$30,000	$8,986	$9,384	No individual programmatic authorization is necessary for the USGS to continue	National assessments of geologic and biologic carbon sequestration

Administrative Provisions

From within the amount appropriated for activities of the United States Geological Survey such sums as are necessary shall be available for reimbursement to the General Services Administration for security guard services; 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 and observation wells; expenses of the United States National Committee on Geology; and payment of compensation and expenses of persons on the rolls of the Survey duly appointed to represent the United States in the negotiation and administration of interstate compacts: Provided, That activities funded by appropriations herein made may be accomplished through the use of contracts, grants, or cooperative agreements as defined in section 6302 of title 31, United States Code: Provided further, That the United States Geological Survey may enter into contracts or cooperative agreements directly with individuals or indirectly with institutions or nonprofit organizations, without regard to 41 U.S.C. 5, 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

Justification of Proposed Administrative Provisions Language Change

The USGS does not propose any administrative provisions language changes to the administrative provisions language in the Department of the Interior, Environment, and Related Agencies Appropriations Act, of 2012

Administrative Provisions Language and Citations

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

Web site: *http://www.usgs.gov/budget/resources_tools.asp*

Summary of Requirements

(Dollars in Thousands)

Activity/Subactivity/Program Element	2011 Actual		2012 Enacted Budget		Fixed Costs & Related Changes		Program Changes (+/-)		Internal Transfers (+/-)		2013 President's Budget Request		Changes from 2012 Enacted Amount	
	FTE	Amount	FTE	Amount	FTE Changes	Amount	FTE Changes	Amount	FTE Changes	Amount	FTE	Amount	FTE Changes	Amount
Appropriation: Surveys, Investigations, and Research														
ECOSYSTEMS														
Status and Trends	140	22,403	140	21,999	0	171	*0*	*0*	*0*	*0*	*140*	22,170	*0*	171
Fisheries: Aquatic & Endangered Resources	171	23,693	165	22,576	0	184	*20*	*4,351*	*0*	*0*	*185*	27,111	*20*	4,535
Wildlife: Terrestrial & Endangered Resources	308	49,078	308	48,169	0	245	*1*	*1,000*	*0*	*0*	*309*	49,414	*1*	1,245
Terrestrial, Freshwater & Marine Environments	266	35,763	272	36,735	0	226	*16*	*5,600*	*0*	*0*	*288*	42,561	*16*	5,826
Invasive Species	52	10,795	57	13,043	0	132	*11*	*4,500*	*0*	*0*	*68*	17,675	*11*	4,632
Cooperative Research Units	127	19,105	127	18,756		165	*0*	*0*	*0*	*0*	*127*	18,921	*0*	165
TOTAL	***1,064***	**160,837**	***1,069***	**161,278**	**0**	**1,123**	***48***	**15,451**	***0***	**0**	***1,117***	**177,852**	***48***	**16,574**
CLIMATE AND LAND USE CHANGE														
Climate Variability														
NCCWSC/DOI Climate Science Centers (DOI CSC)	59	20,921	70	25,490	0	160	*0*	*500*	*0*	*0*	*70*	26,150	*0*	660
Climate Research and Development	147	28,468	127	22,049	0	199	*0*	*1,000*	*0*	*0*	*127*	23,248	*0*	1,199
Carbon Sequestration	32	9,955	32	8,986	0	148	*0*	*250*	*0*	*0*	*32*	9,384	*0*	398
Science Support for DOI Bureaus	8	4,990	8	2,396	0	113	*4*	*6,450*	*0*	*0*	*12*	8,959	*4*	6,563
Subtotal	*246*	64,334	*237*	58,921	0	620	*4*	8,200	*0*	0	*241*	67,741	*4*	8,820
Land Use Change														
Land Remote Sensing	125	62,387	127	73,699	0	182	*0*	*-1,750*	*0*	*0*	*127*	72,131	*0*	-1,568
Geographic Analysis and Monitoring	68	11,420	68	11,470	0	157	*10*	*2,250*	*0*	*0*	*78*	13,877	*10*	2,407
Subtotal	*193*	73,807	*195*	85,169	0	339	*10*	500	*0*	0	*205*	86,008	*10*	839
TOTAL	***439***	**138,141**	***432***	**144,090**	**0**	**959**	***14***	**8,700**	***0***	**0**	***446***	**153,749**	***14***	**9,659**
ENERGY, MINERALS, AND ENVIRONMENTAL HEALTH														
Mineral Resources	356	52,168	346	49,231	0	290	*-34*	*-4,250*	*0*	*0*	*312*	45,271	*-34*	-3,960
Energy Resources	151	27,750	150	27,292	0	200	*12*	*3,000*	*0*	*0*	*162*	30,492	*12*	3,200
Contaminant Biology	65	9,216	65	9,062	0	138	*1*	*700*	*0*	*0*	*66*	9,900	*1*	838
Toxic Substances Hydrology	53	10,778	53	10,628	0	136	*1*	*700*	*0*	*0*	*54*	11,464	*1*	836
TOTAL	***625***	**99,912**	***614***	**96,213**	**0**	**764**	***-20***	**150**	***0***	**0**	***594***	**97,127**	***-20***	**914**
NATURAL HAZARDS														
Earthquake Hazards	246	55,979	246	55,125	0	241	*-1*	*3,551*	*0*	*0*	*245*	58,917	*-1*	3,792
Volcano Hazards	147	24,464	148	24,770	0	198	*0*	*0*	*0*	*0*	*148*	24,968	*0*	198
Landslide Hazards	21	3,318	21	3,266	0	142	*4*	*500*	*0*	*0*	*25*	3,908	*4*	642
Global Seismographic Network	13	5,379	13	5,312	0	139	*0*	*0*	*0*	*0*	*13*	5,451	*0*	139
Geomagnetism	13	2,097	13	2,066	0	139	*0*	*0*	*0*	*0*	*13*	2,205	*0*	139
Coastal and Marine Geology	237	44,727	237	43,941	0	238	*11*	*5,150*	*0*	*0*	*248*	49,329	*11*	5,388
TOTAL	***677***	**135,964**	***678***	**134,480**	**0**	**1,097**	***14***	**9,201**	***0***	**0**	***692***	**144,778**	***14***	**10,298**

Summary of Requirements

(Dollars in Thousands)

Activity/Subactivity/Program Element	2011 Actual		2012 Enacted Budget		Fixed Costs & Related Changes		Program Changes (+/-)		Internal Transfers (+/-)		2013 President's Budget Request		Changes from 2012 Enacted Amount	
	FTE	Amount	FTE	Amount	FTE Changes	Amount	FTE Changes	Amount	FTE Changes	Amount	FTE	Amount	FTE Changes	Amount
WATER RESOURCES														
Groundwater Resources	64	8,481	64	8,916	0	141	-1	2,600	0	0	63	11,657	-1	2,741
National Water Quality Assessment	467	64,234	467	62,909	0	318	-13	-1,049	0	0	454	62,178	-13	-731
National Streamflow Information Program	106	27,100	106	29,358	0	159	2	2,953	0	0	108	32,470	2	3,112
Hydrologic Research and Development	262	11,932	262	11,665	0	228	2	3,600	0	0	264	15,493	2	3,828
Hydrologic Networks and Analysis	201	30,719	204	31,329	0	201	-17	-2,800	0	0	187	28,730	-17	-2,599
Cooperative Water Program	377	63,471	377	63,985	0	278	-16	-4,963	0	0	361	59,300	-16	-4,685
Water Resources Research Act Program	2	6,486	2	6,490	0	0	-2	-6,490	0	0	0	0	-2	-6,490
TOTAL	***1,479***	**212,423**	***1,482***	**214,652**	**0**	**1,325**	***-45***	**-6,149**	***0***	**0**	***1,437***	**209,828**	***-45***	**-4,824**
CORE SCIENCE SYSTEMS														
Science Synthesis, Analysis, and Research	71	18,563	59	15,052	0	228	0	2,454	34	8,591	93	26,325	34	11,273
Nat'l Geological & Geophysical Data Preservation Pgm	3	998	3	996	0	0	-3	-996	0	0	0	0	-3	-996
National Cooperative Geologic Mapping	131	27,713	130	26,300	0	191	1	1,500	0	0	131	27,991	1	1,691
National Geospatial Program	379	65,755	379	64,330	0	294	3	1,450	0	0	382	66,074	3	1,744
TOTAL	***584***	**113,029**	***571***	**106,678**	**0**	**713**	***1***	**4,408**	***34***	**8,591**	***606***	**120,390**	***35***	**13,712**
ADMINISTRATION AND ENTERPRISE INFORMATION														
Science Support	437	77,229	419	73,427	0	219	-8	-2,369	18	4,479	429	75,756	10	2,329
Security and Technology	84	23,430	78	20,991	0	894	-10	-1,322	11	2,732	79	23,295	1	2,304
Information Resources	77	17,988	63	15,802	0	0	0	0	-63	-15,802	0	0	-63	-15,802
TOTAL	***598***	**118,647**	***560***	**110,220**	**0**	**1,113**	***-18***	**-3,691**	***-34***	**-8,591**	***508***	**99,051**	***-52***	**-11,169**
FACILITIES														
Rental Payments and Operations & Maintenance	60	97,427	60	93,141	0	3,686	0	-4,390	0	0	60	92,437	0	-704
Deferred Maintenance and Capital Improvements	0	7,292	0	7,280	0	0	0	0	0	0	0	7,280	0	0
TOTAL	***60***	**104,719**	***60***	**100,421**	**0**	**3,686**	***0***	**-4,390**	***0***	**0**	***60***	**99,717**	***0***	**-704**
Total, USGS	***5,526***	**1,083,672**	***5,466***	**1,068,032**	**0**	**10,780**	***-6***	**23,680**	***0***	**0**	***5,460***	**1,102,492**	***-6***	**34,460**

USGS

Justification of Fixed Costs

(Dollars in Thousands)

Pay Raise and Pay-Related Changes	2011 Actual	2012 Change	2013 Change
Calendar Year 2010 Quarter 4	-		
Calendar Year 2011 Quarters 1-3	-		
Calendar Year 2011 Quarter 4		+0	
Calendar Year 2012 Quarters 1-3		+0	
Calendar Year 2012 Quarter 4			+0
Calendar Year 2013 Quarters 1-3			+1,996
Non-Foreign Area COLA Adjustment to Locality Pay		549	
Change in Number of Paid Days			+2,209
Employer Share of Federal Health Benefit Plans	4,600	+2,498	+2,433

Other Fixed Cost Changes and Projections	2011 Actual	2012 Change	2013 Change
Worker's Compensation Payments	3,100	+142	-204
The adjustment is for changes in the costs of compensating injured employees and dependents of employees who suffer accidental deaths while on duty. Costs for the BY 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	711	+9	+90
The adjustment is for 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.			
GSA Rental Payments	69,558	+3,336	+3,555
The adjustment is for changes in the costs payable to General Services Administration (GSA) and others resulting from changes in rates for office and non-office space as estimated by GSA, as well as the rental costs of other currently occupied space. These costs include building security; in the case of GSA space, these are paid to DHS. Costs of mandatory office relocations, i.e. relocations in cases where due to external events there is no alternative but to vacate the currently occupied space, are also included.			
Departmental Working Capital Fund	17,492	-2,225	+701
The change reflects expected changes in the charges for centrally billed Department services and other services through the Working Capital Fund. These charges are displayed in the Budget Justification for Departmental Management.			

Activity: Ecosystems

		2011 Actual	2012 Enacted	2013				Change from 2012 Enacted (+/-)
				Fixed Costs and Related Changes (+/-)	Program Changes (+/-)	Internal Transfers	Budget Request	
Status and Trends ($000)		22,403	21,999	171	0	0	22,170	171
	FTE	140	140	0	0	0	140	0
Fisheries: Aquatic & Endangered Resources ($000)		23,693	22,576	184	4,351	0	27,111	4,535
	FTE	171	165	0	20	0	185	20
Wildlife: Terrestrial & Endangered Resources ($000)		49,078	48,169	245	1,000	0	49,414	1,245
	FTE	308	308	0	1	0	309	1
Terrestrial, Freshwater & Marine Environments ($000)		35,763	36,735	226	5,600	0	42,561	5,826
	FTE	266	272	0	16	0	288	16
Invasive Species ($000)		10,795	13,043	132	4,500	0	17,675	4,632
	FTE	52	57	0	11	0	68	11
Cooperative Research Units ($000)		19,105	18,756	165	0	0	18,921	165
	FTE	127	127	0	0	0	127	0
Total Requirements ($000)		**160,837**	**161,278**	**1,123**	**15,451**	**0**	**177,852**	**16,574**
Total FTE		**1,064**	**1,069**	**0**	**48**	**0**	**1,117**	**48**

Summary of Program Changes

Request Component	($000)	FTE	Page
Fisheries: Aquatic & Endangered Resources	**4,351**	**20**	
WaterSMART: Water Quality Enhancement	1,250	5	B-7
Hydraulic Fracturing	2,200	10	B-19
Ecosystem Priority: Klamath Basin Agreement	901	5	B-26
Wildlife: Terrestrial & Endangered Resources	**1,000**	**1**	
White-Nose Syndrome	1,000	1	B-31
Terrestrial, Freshwater & Marine Environments	**5,600**	**16**	
Ecosystem Priority: Chesapeake Bay	1,300	5	B-22
Ecosystem Priority: Columbia River	300	1	B-23
Ecosystem Priority: Puget Sound	500	3	B-24
Ecosystem Priority: California Bay Delta	1,000	3	B-25
Ecosystem Priority: Sustaining Environmental Capital	2,000	3	B-27
Coral Reefs	500	1	B-31
Invasive Species	**4,500**	**11**	
Ecosystem Priority: Everglades	1,000	2	B-24
Ecosystem Priority: Upper Mississippi River Asian Carp Control	1,000	3	B-26
Ecosystem Priority: Great Lakes Asian Carp Control Framework	2,000	6	B-27
Brown Tree Snakes	500	0	B-32
Total Program Change	**15,451**	**48**	

Justification of Program Changes

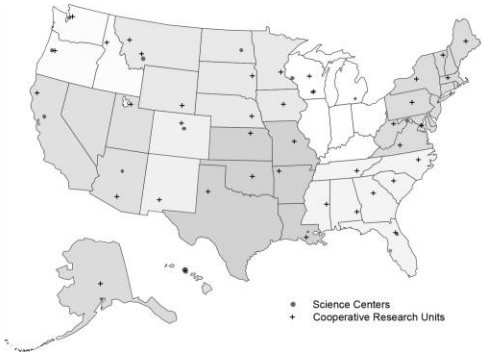
The 2013 Budget Request for Ecosystems is $177,852,000 and 1,117 FTE, a net program change of +$15,451,000 and +48 FTE from the 2012 Enacted Budget. For more information on the Ecosystems Program Changes, please see Section B, Program Changes as referenced in the table.

Activity Summary

The Ecosystems activity is comprised of six subactivities:

- Status and Trends (S&T);
- Fisheries: Aquatic and Endangered Resources (FAER);
- Wildlife: Terrestrial and Endangered Resources (Wildlife Program);
- Terrestrial, Freshwater, and Marine Environments (TFME);
- Invasive Species; and
- Cooperative Research Units.

Ecosystems
Science Centers and CRUs



The Ecosystems activity conducts research and monitoring on living resources and the ecosystems upon which they depend. These plants, animals, and the physical systems that constitute their habitats produce clean water, flood and other hazard mitigation, energy, biomass, and many other goods and services that enhance society's well-being. The Ecosystems Activity develops scientific tools and models to understand and predict response of ecosystems and populations to human-caused and natural changes. The Ecosystems Mission Area underpins the other five USGS science mission areas, providing information needed for understanding the impacts to natural systems of changes in water use, climate, energy exploration and production, and natural hazards.

> *"The scientific research performed by the USGS in the Detroit River International Wildlife Refuge is essential to understanding ecosystem processes, setting priorities, and selecting restoration and conservation actions within an adaptive management context."*
>
> John H. Hartig
> Refuge Manager
> Detroit River
> September 23, 2011

The Ecosystem Activity generates and distributes information needed for conservation and management of the Nation's fish, wildlife, and other biological resources by Federal, tribal, State, local, and nongovernmental entities. Information generated by the Ecosystems Activity helps improve management of the Nation's rich natural resources. This Activity serves as the Department of the Interior's (Interior) biological and ecosystem research arm and leads the DOI Strategic Plan goal to identify and predict ecosystem changes. Core scientific capability is located at 17 research centers and associated field stations and 40 Cooperative Research Units. The Cooperative Research Units provide additional research capability for State governments.

USGS ecosystem science spans a wide range of critical issues:

- Individual species, population and community science to provide critical information to decisionmakers;

- Understanding and responding to stressors such as wildlife disease, reductions in water quantity and quality, invasive species and fire;
- Landscape-scale research, assessment and monitoring to provide cutting-edge science to ecosystem conservation and restoration activities; and
- New technologies that reduce the costs, risks and uncertainties of natural resource management, such as genomics and remote sensing.

Some examples of this research include:

Burmese Python – The USGS is conducting research on the salinity tolerance of hatchling Burmese pythons to determine potential for invasion using ocean and estuarine corridors with implications to sea level rise.

Renewable Energy Development – The USGS is providing science and technical support to public agencies and private industries to assist managers and developers in balancing energy and conservation interests. Major considerations are the effects of wind-energy on birds and bats, solar energy on desert ecosystems, and hydrokinetic energy on migratory fish.

Ecosystem Restoration – The USGS has a unique role in delivering vital information to managers and policymakers involved in ecosystem restoration. Research, monitoring and assessment modeling, and forecasting capabilities are used to identify critical habitats, guide restoration activities, evaluate the effectiveness of conservation actions, and allow for incorporation of adaptive management scenarios and alternatives.

Pacific Walrus – The USGS has placed satellite radio tags on 35 Pacific walrus in Northwestern Alaska to learn about their response to changing sea ice conditions in the Arctic Basin in late summer and fall. Data to date show that walruses are now hauling out on land instead of ice during summer months due to warming ocean temperatures.

Hawaiian Birds – The USGS is studying transmission of non-native mosquito-borne disease among native Hawaiian birds. Data indicate that transmission of avian malaria may be increasing due to climate warming, and high-altitude refuges are decreasing in size.

Sea Lamprey – Efforts to control sea lamprey over the last 25 years have contributed to the Great Lakes restoration efforts; specifically the restoration of lake trout populations, which also directly impacted jobs for recreational and commercial fisheries. Controlling sea lamprey helps protect sport and commercial fisheries in the Great Lakes, valued at $7.5 billion annually.

Remote Sensing – USGS scientists are adapting and applying new technologies to track animal movements, determine migration routes, count individuals, and monitor habitat in response to a changing environment. This use of remote sensing can provide cost effective alternatives to once-costly field monitoring and can greatly improve the accuracy of monitoring.

Genetics and Genomics – The USGS is using molecular science including DNA sequencing to conduct genetics to resolve taxonomic questions, identify species at greatest risk, and estimate population persistence and evolutionary potential for adaptation. To determine physiological thresholds and tipping points, The USGS is using advanced genomics techniques to determine species response to stressors such as disease and environmental contaminants.

End Outcome Goal 4.2: Provide Science for Sustainable Resource Use, Protection, and Adaptive Management									
Strategy #1: Identify and Predict Ecosystem Change									
Performance Measure	**2008 Actual**	**2009 Actual**	**2010 Actual**	**2011 Operating Plan**	**2011 Actual**	**2012 Enacted**	**2013 Budget Request**	**Change from 2012 Enacted to 2013**	**Long-term Target 2016**
Status and Trends									
Percent of targeted species for which monitoring and decision support information on their status and trends are available (SP)	**27.18%**	**27.18%**	**27.18%**	**28.24%**	**28.24%**	**28.55%**	**28.55%**	**0.00%**	**29.77%**
	(178 / 655)	**(178 / 655)**	**(178 / 655)**	**(185 / 655)**	**(185 / 655)**	**(187 / 655)**	**(187 / 655)**		**(195 / 655)**
Comments: Budget increases for 2013 will result in performance increases in outyears (2014 and beyond).									
Fisheries: Aquatic and Endangered Resources									
Percent of targeted fish and aquatic populations and their habitats for which information is available regarding limiting factors such as migratory barriers, habitat, and effects of disturbance (fire, flood, nutrient enhancement) (SP)	**41%**	**41%**	**41%**	**42%**	**42%**	**43%**	**43%**	**0%**	**44%**
	(49 / 119)	**(49 / 119)**	**(49 / 119)**	**(50 / 119)**	**(50 / 119)**	**(51 / 119)**	**(51 / 119)**		**(52 / 119)**
Comments: Budget increases for 2013 will result in performance increases in outyears (2014 and beyond).									
Wildlife: Terrestrial and Endangered Species									
Percent of targeted wildlife populations for which science information is provided for management decision making to inform and improve conservation (SP)	**47.03%**	**51.56%**	**54.39%**	**57.79%**	**57.79%**	**61.2%**	**61.2%**	**0.0%**	**72.24%**
	(166 / 353)	**(182 / 353)**	**(192 / 353)**	**(204 / 353)**	**(204 / 353)**	**(216 / 353)**	**(216 / 353)**		**(255 / 353)**
Comments: Budget increases for 2013 will result in performance increases in outyears (2014 and beyond).									
Terrestrial, Freshwater and Marine Environments									
Percent of targeted ecosystems with information products forecasting ecosystem change (SP)	**11%**	**11%**	**22%**	**22%**	**22%**	**27.8%**	**33.3%**	**+5.6%**	**44%**
	(1 / 9)	**(1 / 9)**	**(2 / 9)**	**(2 / 9)**	**(2 / 9)**	**(2.5 / 9)**	**(3 / 9)**		**(4 / 9)**
Comments: Budget increases for 2013 will result in performance increases in 2013 and outyears (2014 and beyond).									
Invasive Species									
Percent of targeted science information products available for successful control and management of priority groups of invasive species (SP)	**44.7%**	**44.7%**	**44.7%**	**45.0%**	**45.0%**	**45.7%**	**45.7%**	**0%**	**47.2%**
	(26.8 / 60)	**(26.8 / 60)**	**(26.8 / 60)**	**(27 / 60)**	**(27 / 60)**	**(27.4 / 60)**	**(27.4 / 60)**		**(28.3 / 60)**
Comments: Budget increases for 2013 will result in performance increases in outyears (2014 and beyond).									
Cooperative Research Units									
Number of students complete degree requirements for MS, PhD, and post-doctoral program under the direction and mentorship of Unit Scientists (CRU)	**83**	**110**	**89**	**90**	**84**	**85**	**85**	**0**	**85**
All Ecosystem Programs									
Number of systematic analyses and investigations completed (Ecosystems)	**1,211**	**1,267**	**1,169**	**1,041**	**1,273**	**1,011**	**1,031**	**+20**	**1,062**
Comments: Budget increases for 2013 will result in performance increases in 2013 and outyears (2014 and beyond).									
Number of formal workshops or training provided to customers (Ecosystems)	**154**	**112**	**113**	**104**	**142**	**85**	**95**	**+10**	**97**

Activity: Ecosystems
Subactivity: Status and Trends

2011 Actual: $22.4 million (140 FTE)
2012 Enacted: $22.0 million (140 FTE)
2013 Request: $22.2 million (140 FTE)

Overview

The Nation's living resources are undergoing dramatic changes from human and natural influences. Land and resource managers need basic information on the health of biological resources and their habitats in order to make scientifically informed decisions. Accurate information on resource status can improve the cost-effectiveness of actions because it identifies which management actions are most effective. The S&T Resources Subactivity measures, predicts and reports the status and trends of the Nation's biological resources. S&T also supports the development of statistically rigorous methods for monitoring these resources and provides training and support for their use. S&T activities advance research, facilitate resource management, and promote the public's understanding and appreciation of the Nation's living resources.

Program Performance

Integrated Monitoring at Multiple Spatial and Temporal Scales: Research and Monitoring on Public Lands

National Park Monitoring – USGS scientists assist national parks with development of inventory and monitoring methods from study design to statistical data analysis. USGS scientists address priority issues identified by the National Park Service (NPS) that typically benefit several parks and require multiyear efforts. USGS scientists have worked with the NPS, two sovereign tribes, and Washington State to develop a suite of scientifically rigorous procedures for monitoring elk for the NPS North Coast and Cascades Network. Elk are recreationally important to the public, culturally important to Indian tribes, and important agents of ecological change. USGS research improved the methods for monitoring this species and provided a scientific foundation for an effort between Federal, State, and tribal biologists to pool scarce resources to monitor elk populations in the region.

Inventory and Monitoring Methods, Tools, and Technologies: Monitoring the Status of Taxonomic Groups

Bird Banding Laboratory – Applying leg bands to birds is a universal technique for studying the movement and survival of birds. The USGS Bird Banding Laboratory (BBL) manages all marking and recovery information for migratory birds in the United States, Canada and Mexico. Bands spotted on live birds or recovered from dead ones (i.e., hunting) are reported to the BBL, which provides data to Federal and State agencies for use in developing bird conservation and management strategies throughout North America. BBL data are critical for setting annual regulations for migratory bird hunting.

Collecting and Delivering Critical, High-Quality Monitoring Data

Breeding Bird Survey – The North American Breeding Bird Survey (BBS) collects broad data on breeding birds in the United States and Canada. In 2011, the USGS implemented new methods to analyze BBS data to improve the precision of population trend estimates. Thirty-two

years of legacy BBS data will be available in 2012, to allow an evaluation of historic climate and land use change on birds. BBS is developing statistical tools to account for more of the variation that exists in bird population data across space. These methodologies, expected in 2013, will improve our ability to ask new questions about new factors that influence bird populations.

Synthesizing Information on the Nation's Flora, Fauna, and Ecosystems: Monitoring Impacts of Management

Great Lakes – In coordination with the Fisheries: Aquatic and Endangered Resources (FAER) Program, USGS scientists conduct deepwater research on long-term dynamics of native and non-native aquatic species and the sustainability of Great Lakes fisheries. Complimenting other Interior activities supporting the Great Lakes, this research provides consistent assessments of fish stocks that support sport and commercial fishing, monitors invasive species, and develops monitoring to assess aquatic species status. This research also supports national and international fishery management to restore and maintain economically important aquatic species and habitats in the Great Lakes.

Science-support for Fish and Wildlife Service (FWS) National Wildlife Refuges – The USGS partners with the National Wildlife Refuge System (NWRS) to improve science-based management on refuges. This project leverages USGS expertise in modeling, decision analysis and monitoring to develop adaptive management frameworks; an effective means for making transparent defensible decisions. The ultimate aim of this collaboration is to improve decisionmaking and resource delivery over time. An example is the “Native Prairie Adaptive Management (NPAM)” program for managing invasive plants on native grasslands in the northern Great Plains, which integrates scattered information into a single system to improve the outcomes of repeated decision. The NPAM is currently improving decisionmaking on 120 FWS-owned native prairies in four states, but is fully portable to prairies managed by other public and private conservation organizations.

Sustainable Energy Development – The Wyoming Landscape Conservation Initiative (WLCI) is a long-term science based partnership to assess and enhance wildlife management while facilitating energy development. This partnership includes States, Interior, and private landowners in the Green River Basin. The USGS provides the science framework and information for partners to use in making decisions on mitigation, restoration and conservation efforts.

Training and Knowledge Transfer to Scientists and Natural Resource Managers – The USGS uses online courses to provide training and knowledge transfer to over 11,000 people. Many scientists and natural resource managers are unable to travel to gain the knowledge needed to carry out their roles in research and resource management. Courses conducted in 2011 and proposed for 2012 include: adaptive management of natural resources; designing natural resource monitoring surveys; and learning and applying new programming language (“R”) for statistical analysis of wildlife survey data. Webinars are also used for internal management matters such as providing training for supervisors and teaching the Research Grade Evaluation procedures.

Web Site

For more information about the Status and Trends Program, please go to: *http://biology.usgs.gov/status_trends.*

Activity: Ecosystems
Subactivity: Fisheries: Aquatic and Endangered Resources

2011 Actual:	$23.7 million (171 FTE)
2012 Enacted:	$22.6 million (165 FTE)
2013 Request:	$27.1 million (185 FTE)

Overview

The USGS FAER Subactivity conducts biological investigations on fish and aquatic resources of national importance. The purpose of these investigations is to provide a scientific understanding of both natural and human induced changes to the size, distribution, and health of aquatic populations and to develop management strategies for conservation, enhancement, and restoration of these resources. The FAER is a national leader in providing robust science on all components of aquatic ecology, including genetics, disease, life-history, behavior, physiology, toxicology, distribution, landscape analysis, and habitat requirements. This science is essential to the management of Interior lands and trust species, and to other Federal, tribal, and State partners engaged in fisheries and aquatic resource conservation and restoration for the Nation.

Scientific Foundation for Conservation of Aquatic Species – The USGS conducts studies on basic life history and ecological processes responsible for healthy aquatic function. Scientists forecast causes of change based on scientific information about diversity, life history, and species interactions that affect the condition and dynamics of aquatic communities. The USGS provides information and expertise to assist resource managers who are developing techniques to restore species, populations, habitats, and ecosystems. By conducting basic research on ecosystem structure, functions and processes, this science links biology, population genetics, and organism health for fish, native mussels, and other aquatic organisms.

Scientific Foundation for Conservation of Aquatic Habitats – The USGS studies functional relationships among aquatic species and habitats to describe aquatic community structure, function, adaptation, and sustainability. The science contributes to understanding ecological processes and patterns of diversity through coordination, development, and standardization of geospatial classification models and maps. FAER research identifies ecosystems vulnerable to changes in land use, climate, and contamination. Additional work is conducted on connectivity (fish passage) and ecological flow needs of species in rivers and streams.

Techniques for Managing, Protecting, and Restoring High Priority Ecosystems – The USGS develops and contributes scientific expertise, research technologies, and analytical methods to permit adaptive management and scientifically informed fisheries restoration by natural resources managers.

- **Klamath Basin** – The Klamath Basin is the focus of multi-agency endangered species and habitat restoration efforts, proposed dam removals, re-establishment of ecological flows, and competing water use. The FAER is collaborating with scientists from other parts of the USGS to determine effects of changing water availability, water quality, climate, and management actions on population dynamics and aquatic habitat requirements for important endangered fishes.
- **Great Lakes –** The USGS conducts fisheries research in support of a $7.0 billion fishing industry in the Great Lakes basin and facilitates information transfer across jurisdictional

boundaries. Research focuses on ecology of deepwater fishes, maintenance of long-term datasets on fish populations, links between fish communities and nearshore areas, predicting changes due to stressors, restoration of economically important fish such as Atlantic salmon, lake trout, lake sturgeon, and herring, and control of invasive species such as sea lamprey.

- **National Fish Habitat Action Planning –** As part of a broad coalition of Federal, non-Federal, and local partners, the USGS is providing high level direction as well as on-the-ground scientific support for conserving and restoring this Nation's important aquatic habitats for native fish, mussels, and other species. Nationally, the USGS provides coordination for the science and data needs for the national inventory of fish habitats and overall condition assessment.

Program Performance

Trout and Climate Change – USGS and U.S. Forest Service (USFS) scientists, along with Trout Unlimited and other partners, used models to forecast the effects of altered stream flow and increased stream temperature due to climate and land change on four species of trout in the Western United States. Native cutthroat were predicted to lose more than half of their habitat because of increasing stream temperatures and competition from other fish species. Habitat for brook trout is predicted to decline by nearly three-fourths, brown trout habitat by nearly half, and rainbow trout habitat by about one-third. Such information is critical for resource managers to plan conservation strategies for now and the future.

WaterSMART – With new funding in 2011, the USGS initiated projects to provide policymakers tools to resolve conflict between human and ecological water needs. Initial studies focused on developing decision support tools to understand ecological flow needs of important fish and freshwater mussels in three priority watersheds: Delaware River, Apalachicola Chattahoochee Flint Basin, and Colorado River. This work provides Federal and State water resource management agencies information regarding the impacts of water management alternatives or water availability limits to help define ecosystem stressors.

Huron-Erie Corridor Initiative Partnership – USGS scientists work to fill critical fisheries information gaps as part of the Huron-Erie Corridor (HEC) Initiative, an international, collaborative partnership with Federal, tribal, State, provincial, local, and nongovernmental participants. The HEC Initiative develops science to assist in restoration of native aquatic species and their habitats. In 2011, USGS scientists developed a blueprint for habitat restoration that will help managers prioritize fish spawning habitat sites for restoration. This science planning tool will be released and made available online in 2012.

Web Site

For more information about the Fisheries: Aquatic & Endangered Resources Program, please go to: *http://biology.usgs.gov/faer*.

Activity: Ecosystems
Subactivity: Wildlife: Terrestrial and Endangered Resources

2011 Actual: $49.1 million (308 FTE)
2012 Enacted: $48.2 million (308 FTE)
2013 Request: $49.4 million (309 FTE)

Overview

USGS wildlife research focuses on meeting the information needs of Interior's natural resource management bureaus and other partners. The program conducts basic and applied biological research to determine factors influencing the distribution, abundance, and condition of wildlife populations, habitats, and their associated ecosystems. Scientists develop tools and methods for wildlife management such as models of alternative management scenarios, statistical techniques, genetics applications, and identification of emerging diseases. Scientists also perform research that links the physical, chemical, and biological factors that impact biodiversity and ecosystem resilience through coordinated responses to issues such as land use, climate change, and alternative energy development.

Program Performance

Scientific Foundation for Conservation and Management Activities

High Priority Research for DOI Bureaus – The USGS conducts research on species, populations and habitats to support conservation and land use decisions required by the NPS, FWS, and other Interior bureaus. Increasingly, the focus is on understanding ecosystem response to the cumulative impacts of factors such as climate change, invasive species, and energy development on public lands.

Tools and Techniques for Effective, Science-Based Management

Wildlife Disease – Managing wildlife losses and minimizing disease outbreaks depends on effective diagnostic and technical support, knowledgeable guidance, and timely intervention. The USGS has a unique mission to provide information, technical assistance, and research on State, national, and international wildlife health issues such as White-nose Syndrome (WNS) in bats, highly pathogenic avian influenza, plague, and chronic wasting disease. Like the Center for Disease Control (CDC), the infrastructure and interagency partnerships built around wildlife disease provide a critical foundation and template for emergency disease response to future zoonotic diseases of wildlife. The USGS will continue partnerships to develop strategies for protecting human, wildlife, and domestic animal health.

Genetics and Genomics in Wildlife Research – Rapid advances in genetic technologies have led to the development of a broad suite of tools and methodologies. Researchers are determining genetic diversity at the individual and population levels, identifying population boundaries, evaluating the status of imperiled species determining the presence of invasive species, identifying disease agents and developing vaccines. The USGS has embraced next generation genomics that allow efficient detection of the presence of rare or elusive wildlife. This technology also allows for early detection of wildlife responses to changing environmental conditions.

Factors Affecting Conservation and Recovery Efforts

Threatened, Endangered, and At-risk Terrestrial Wildlife – USGS species research provides biological information needed to restore currently listed populations, estimate the status of species proposed for listing, support delisting wherever possible, and preclude future listings by clarifying species' status or suggesting timely preventive actions.

Amphibian Research and Monitoring Initiative (ARMI) – Worldwide declines of amphibian populations prompted the development of the ARMI to monitor the status of amphibians on Interior lands, determine causes for their decline, and work with partners to develop management options to reverse declines. ARMI research has included pioneering work on the effects of contaminants, habitat loss, diseases (chytrid fungus, rana virus), invasive species, fire and climate change on individual amphibians and populations. The USGS is working with Federal and State partners to develop an adaptive management program for the federally endangered Shenandoah salamander, a species found only in the Shenandoah National Park. Research on a population viability analysis and experimental data on competition with other salamanders will be completed in 2012. A framework to help inform management decisions for this endangered species that incorporates this information and downscaled climate models will be delivered in 2013.

Migratory Birds – USGS research on migratory birds is international in scope and coordinated with the FWS, State and tribal wildlife agencies, and Canadian and Mexican Federal wildlife agencies. USGS scientists are developing and testing tools to better describe long distance movements of individual birds, determine the quality and distribution of populations, and develop potential hypotheses for variation in survival during different stages of life. Information from research on migratory birds is applied to conservation and management of individual species, avian communities, and habitats.

Helping Partners Respond to Emerging Wildlife Issues

The New Energy Frontier – Solar and wind energy research addresses issues faced by Federal, tribal, and State natural resource agencies related to the placement and permitting of renewable energy sources and transmission lines. The USGS is conducting research on the potential impacts of wind and solar farms on wildlife species and their habitats. The USGS is working closely with the FWS to develop an adaptive framework approach for permitting and managing “take” of eagles associated with wind energy development. USGS scientists developed a predictive model and a monitoring design at the site level for pre- and post-construction surveys designed to reduce the uncertainty associated with predictions of take. A regional population model for golden eagles will be developed to assess the impact of total regional take of golden eagles by 2012, and will be used within an adaptive decision framework for managing and allocating the total take of golden eagles at the regional level.

Arctic Ecosystems Research Initiative – The Arctic Ecosystems Research initiative is a multidisciplinary research program that began in 2010 to enhance biological data collection, modeling, forecasting and molecular biology research. Information from the Initiative will reduce uncertainty about the future status of ice and permafrost dependent species and their habitats. The new research investigates the relationship between habitats and ecosystems, identifies species responses to change, creates decision-support frameworks to aid forecasting of physical environment and wildlife responses, improves monitoring of polar bear and walrus, and enhances worldwide capabilities to predict impacts to arctic species. Many of the approaches are also applicable to other latitudes and ecosystems.

Web Site

For more information about the Wildlife: Terrestrial & Endangered Resources Program, please go to: *http://biology.usgs.gov/wter*.

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Activity: Ecosystems
Subactivity: Terrestrial, Freshwater, and Marine Environments

2011 Actual:	$35.8.million (266 FTE)
2012 Enacted:	$36.7 million (272 FTE)
2013 Request:	$42.6 million (288 FTE)

Overview

The USGS Terrestrial, Freshwater, and Marine Environments (TFME) research program provides information, models, and tools that managers and others can use to understand how management alternatives will affect ecosystems and the services they provide under a variety of climate, land use, and other change scenarios. Informed forecasting requires understanding factors that control the structure, function, composition, and condition of terrestrial, freshwater, and marine ecosystems; their variability in space and time; and the services they provide to benefit human communities and economies. Research results provide the basis for developing forecasting models and decision support tools that integrate ecological knowledge with management options, predict future changes to ecosystems and natural resources, and develop frameworks and approaches for mitigating and restoring terrestrial, freshwater, and marine ecosystems impaired by natural hazards and human actions. Research activities also focus on understanding ecosystem vulnerability and sensitivity to change and stressors.

Scientific approaches include studies of ecosystem productivity, food-web relationships and energy flow, cycling of nutrients and other biogeochemical processes, and the diversity of biological communities. Topical areas include the ecology of various ecosystems, disturbances and landscape ecology, modeling ecological systems and quantifying ecosystem services, restoration ecology, fire ecology, and global change.

Program Performance

Research on How Ecosystems Work and How and Why They Change

Sea Level Rise, Subsidence, and Wetland Loss in the Mississippi River Delta – The Mississippi River Delta contains vast areas of marshes, swamps, and barrier islands—important habitat for wildlife, as nursery grounds for marine life and rich fisheries, and as protective buffers against storms and hurricanes. However, rapid land subsidence due to sediment compaction and dewatering, construction of levees, and periodic hurricanes has contributed to increases the rate of submergence in this deltaic system. The USGS is studying how these factors combined with global processes such as sea level rise are causing wetland loss in the region—these studies are vital to land managers making important decisions that affect not only ecosystems, but also tourism, human safety, and fisheries. No area of the Nation is more impacted by vanishing coastal wetland than the State of Louisiana, which experiences about 90 percent of the total coastal marsh loss in the contiguous United States. The USGS has released a new map of Louisiana illustrating wetland losses and gains from 1932-2010. This product improves the understanding of the timing and causes of wetland loss, which are critical for forecasting landscape changes in the future. Land managers can use it to manage this national treasure and have it become a more resilient ecosystem. Coastal Louisiana wetlands support the largest commercial fishery in the lower 48 States and provide critical habitat to many threatened and endangered species.

Understanding Biological and Non-Biological Components of Ecosystems

Managing Wildfire Risks in Southern California – Southern California is a center of industrial, cultural, and natural landmarks. Since the mid-20th century, it has seen one or more massive wildfires each decade, with about 500 homes destroyed per year—and fire impacts are becoming worse. In 2001-2010 alone, southern California saw nearly 10,000 residential structures damaged or destroyed. USGS research not only addresses wildfire risks at the urban-wildland interface to inform community planners, but also addresses the ecosystem impacts of these wildfires for Federal, State, and local land managers. USGS landscape ecology and wildlife ecology strengths help southern California manage its natural and urban landscapes as it continues to face the ever-present threat of wildfires. USGS efforts are contributing to a National Cohesive Wildfire Management Strategy in support of the Federal Land Assistance, Management, and Enhancement (FLAME) Act Of 2009. The USGS completed phase 2 of the strategy by developing regional goals, objectives and portfolios of actions and activities. In 2012, the final phase of the process will be started that involves a quantitative analysis that will help inform management actions on the ground.

Chesapeake Bay Executive Order (E.O.) – In May of 2010, the Chesapeake Bay Strategy was released and called for the USGS and NOAA to co-lead Federal activities to “strengthen science for decisionmaking” and "responding to climate change" that would support major goals of the E.O. strategy, which include restoring clean water and habitats, conserving treasured lands, and sustaining fish and wildlife. In 2011, the USGS conducted enhanced activities to support the new Federal Chesapeake E.O. strategy including:

- Develop a GIS-based, land-conservation targeting system, which is considered a prototype for the America’s Great Outdoors initiative;
- Determine the extent and sources of endrocrine-disrupting chemicals impacting fish and wildlife in the Potomac basin;
- Explain the factors affecting nutrient changes on the Delmarva Peninsula; and
- Conduct small watershed monitoring and assessment to evaluate the effect of actions to reduce nutrients and sediment.

Management Techniques for Managing, Protecting, and Restoring Ecosystems

North America’s Prairie Potholes Vulnerable to Warming Climates – A warmer and drier climate poses unprecedented challenges to wetland and bird conservation, as well as the ecosystem services associated with carbon sequestration, water quality improvement, and the recharge of groundwater systems that supply water to farmlands across North American prairie landscapes. Changes to the climate of north-central North America will also negatively affect millions of waterfowl that depend on the region for food, shelter and raising young. Recent USGS research shows the region is likely much more sensitive to climate warming and drying than previously thought. USGS efforts project major reductions in water volume, shortening of the time water remains in wetlands and changes to wetland vegetation dynamics in this 800,000-square kilometer region in the United States and Canada. Advance knowledge of such changes will enable water, agricultural, and resource managers to formulate strategies for preserving key ecosystem services associated with these wetlands.

Coral Reefs – The USGS conducts research on issues facing resource managers, including understanding conditions needed for productive and healthy reef communities, effects of land

use on reef health and disease in support of the Coral Reef Task Force, and evaluating management options for human activities and how they influence reef integrity and biodiversity.

Web Site

For more information about the Terrestrial, Freshwater, & Marine Environments Program, please go to: *http://biology.usgs.gov/ecosystems*.

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Activity: Ecosystems
Subactivity: Invasive Species

2011 Actual:	$10.8 million (52 FTE)
2012 Enacted:	$13.0 million (57 FTE)
2013 Request:	$17.7 million (68 FTE)

Overview

Nonindigenous invasive plants and animals cause increasing harm to native species and significant economic losses by reducing productivity and diminishing opportunities for beneficial uses of forests, croplands, rangelands, and aquatic resources. Many species introduced decades ago spread rapidly in U.S. ecosystems and pose increasing threats to lands and waters managed by the Interior. They harm native ecosystems and are "contributing factors" in listing 40 percent of threatened and endangered species.

The USGS plays an important role in Federal efforts to combat invasive species in natural and semi-natural areas by providing information on early detection and assessment of newly established invaders; monitoring invading populations; improving understanding of the ecology of invaders and factors in resistance of habitats to invasion; and developing and testing prevention and alternative management and control approaches. USGS researchers help provide the information, methods, technologies, and technical assistance needed for effective responses to terrestrial and aquatic invaders threatening U.S. ecosystems and native species.

Program Performance

Prevention, Early Detection and Rapid Assessment

Forecasting and Predicting Invasions – Early detection efforts help resource managers identify and report new invasive species and assess risks to natural areas. The USGS researchers are developing spatial models and data management and decision support tools to assist land managers to detect and predict potential ranges and effects of harmful invasive plants and animals. USGS scientists recently evaluated distributional changes and developed range predictions of cheatgrass in the Rocky Mountain National Park. This effort provided information to the park to focus control on the outside edges of the invasions to limit the spread of cheatgrass into the park.

Nonindigenous Aquatic Species Database – The USGS hosts the National Non-indigenous Aquatic Species Database, which provides the latest information on distribution of introduced aquatic species across the Nation. This publicly available, online database contains illustrated fact files on species' biology, allows users to interactively map sightings, and e-mails alerts when a species is sighted in a geographic area. It is a primary source of invasive species information and early alert system for managers and the public with over 56,000 visits per day. Species of particular concern recently have included Asian carp, zebra mussels, quagga mussels, and lionfish.

Effects and Risks Posed by Invasive Species

Understanding both the potential and realized effects of invasive species on invaded ecosystems helps managers allocate resources for control and management efforts. In addition

to filling information gaps regarding on-the-ground effects of invasive species, USGS researchers also provide methods and information to assess vulnerability of native species and habitats and identify and manage risks associated with invasive species.

Control and Management of Invasive Species

Buffelgrass in the Southwest

Role of Buffelgrass in Fire Management – In 2012 and 2013, USGS scientists will continue to work cooperatively with Interior partners to develop an integrated approach to mitigating the impacts of buffelgrass invasion in the Sonoran Desert. In 2011, USGS scientists developed a data management system and decision support model that was used to make decisions and manage buffelgrass in and around the Ironwood National Monument. For this work, the USGS received the prestigious Interior Partners in Conservation Award. The approach the USGS developed will continue to be refined and utilized in other areas where management of buffelgrass is critical.

Assessment, Monitoring, and Control of Invasive Species – USGS research supports cooperative efforts in the Great Lakes region to prevent and control the spread of invasive fish, such as Asian carp, reduce the pervasive impacts of zebra and quagga mussels on U.S. waterways, and manage or mitigate adverse ecological and economic impacts of the invaders. USGS research also supports development of novel techniques and methods to control aquatic invasive species. In 2011, the USGS began conducting research as part of the Asian Carp Regional Coordinating Committee (RCC), which is the Federal response to the threat of Asian carps becoming established in the Great Lakes. Predicting tributaries that might provide suitable habitat for Asian carp spawning is a critical step toward focusing monitoring and control efforts. On the basis of models developed using hydrological data and the results of egg and larval fish development experiments, USGS scientists predicted that six of eight tributaries to Lake Erie could support spawning of bighead and silver carps. Further research to better understand spawning requirements for Asian carp will continue into 2012.

Restoration of Invaded Habitats

Initiating control efforts without restoring components of the invaded ecosystem can leave the ecosystem vulnerable to additional species invasions. USGS scientists work with managers to develop strategies and techniques to understand and facilitate restoration of native species and habitats impacted by invasive species. USGS researchers are conducting research to develop post-control restoration strategies and techniques to facilitate the restoration of native species and habitats in areas invaded by species such as tamarisk, cheatgrass, leafy spurge, and yellow star thistle

Web Site

For more information about the Invasive Species Program, please go to: *http://biology.usgs.gov/invasive/.*

Activity: Ecosystems
Subactivity: Cooperative Research Units

2011 Actual:	$19.1 million (127 FTE)
2012 Enacted:	$18.8 million (127 FTE)
2013 Request:	$18.9 million (127 FTE)

Overview

The Cooperative Research Units (CRU) program is a unique cooperative relationship among the USGS, State fish and wildlife agencies, host universities, and the Wildlife Management Institute. The FWS is a formal cooperator in most of the individual Units. Since 1935, this cooperative relationship has provided a strong connection between the USGS, State and Federal management agencies, and academic communities. Individual cooperator resources 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 Units Act of 1960, 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 research, teaching, and technical assistance that is responsive to information needs of State and Federal resource agencies;
- Science capabilities responsive to resource management needs of Interior bureaus; and
- A premiere program for graduate education and training of future natural resources professionals having skills to successfully serve the broad natural resources management community.

The CRU Program is comprised of 40 CRUs located at universities in 38 States, with a headquarters office in Reston, VA. The program leverages cooperative partnerships with Federal and State agencies to address mutual science needs. 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 of university graduate students; and provide Federal and other natural resource managers access to university expertise and facilities. Federal support is multiplied by State and university cooperator contributions of expertise, equipment, and project funding. Through university affiliations, CRU scientists train future natural resource professionals who contribute to the natural resources conservation and management workforce.

Each CRU is directed by a Coordinating Committee comprised 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 cooperator needs and available funding. Program accountability measures, performance 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.

University and State agency contributions to the program remain strong, as does Federal, State, and local government reimbursable funding for research and technical assistance. Regular cooperator-focused satisfaction surveys continue to indicate a high satisfaction rate of 95 percent or greater with CRU program execution.

Program Performance

In 2011, Unit scientists and their cooperators advanced the mission of the CRU program through joint research, education, technical assistance, and science support. Unit scientists completed 793 projects for Federal and State partners. Unit scientists and their students remained actively engaged in service to professional societies delivering 662 presentations. Many of these presentations were invited seminars, indicating that Unit scientists and their research are held in high regard by the scientific and management communities. The CRU's service to university cooperators continued to be strong, with 75 academic classes taught in 2011, and additional workshops and short courses delivered to partners and cooperators.

Productivity Summary	2010	2011
Peer reviewed publications	297	349
Invited Seminars	63	56
Workshops and Short Courses	35	25
Total Projects (State+Fed+other)	790	793
Papers Presented	662	684
Academic Courses Taught	87	75
Total number of students	541	582
Master's degrees awarded	72	61
Doctoral degrees awarded	22	23

Each year, over 500 students engage in graduate education and training in natural resources conservation through the CRU program. About 15 percent of these students matriculate each year and enter the natural resources management workforce as employees of State and Federal agencies, nongovernmental organizations, and universities. The number of advanced graduate degrees awarded to Unit students in 2011 was 84 and is consistent with the long-term trend.

In 2011, the CRU program continued to provide strong leadership in research to support Interior trust species and habitats, such as migratory birds and threatened and endangered fish and wildlife. In 2011, the CRU program advanced an initiative to develop new collaborations in science-based decisionmaking. Additionally, in 2011, the CRU program supported technical assistance and outreach to State cooperators to solve natural resource based problems using structured decisionmaking and adaptive management.

The CRU traditionally invests over 90 percent of program funding in scientists salaries, with all funding for research projects supplied by program partners. Therefore, improvements in program performance in the form of increased publications, presentations, courses taught, and other product-oriented elements of scientific outreach will occur over the subsequent years once science staff are hired and initiate their research programs. Reinvesting in science capacity is estimated to result in a 15–20 percent increase in the numbers of M.S. and PhD students graduated within 5-7 years.

Web Site

For more information about the Cooperative Research Units Program, please go to: *www.coopunits.org/cooptor/coopunits.html.*

Activity: Climate and Land Use Change

		2011 Actual	2012 Enacted	2013				Change from 2012 Enacted (+/-)
				Fixed Costs and Related Changes (+/-)	Program Changes (+/-)	Internal Transfers	Budget Request	
Climate Variability								
National Climate Change & Wildlife Science Center/DOI Climate Science Centers ($000)		20,921	25,490	160	500	0	26,150	660
	FTE	59	70	0	0	0	70	0
Climate Research and Development ($000)		28,468	22,049	199	1,000	0	23,248	1,199
	FTE	147	127	0	0	0	127	0
Carbon Sequestration ($000)		9,955	8,986	148	250	0	9,384	398
	FTE	32	32	0	0	0	32	0
Science Support for DOI Bureaus ($000)		4,990	2,396	113	6,450	0	8,959	6,563
	FTE	8	8	0	4	0	12	4
Subtotal: Climate Variability ($000)		**64,334**	**58,921**	**620**	**8,200**	**0**	**67,741**	**8,820**
	FTE	**246**	**237**	**0**	**4**	**0**	**241**	**4**
Land Use Change								
Land Remote Sensing ($000)		62,387	73,699	182	-1,750	0	72,131	-1,568
	FTE	125	127	0	0	0	127	0
Geographic Analysis and Monitoring ($000)		11,420	11,470	157	2,250	0	13,877	2,407
	FTE	68	68	0	10	0	78	10
Subtotal: Land Use Change ($000)		**73,807**	**85,169**	**339**	**500**	**0**	**86,008**	**839**
	FTE	**193**	**195**	**0**	**10**	**0**	**205**	**10**
Total Requirements ($000)		**138,141**	**144,090**	**959**	**8,700**	**0**	**153,749**	**9,659**
Total FTE		**439**	**432**	**0**	**14**	**0**	**446**	**14**

Summary of Program Changes

Request Component	($000)	FTE	Page
Climate Variability	**8,200**	**4**	
NCCWSC/DOI Climate Science Centers (DOI CSC)	**500**	**0**	
Ecosystem Priority: Department of the Interior Climate Science Centers - Tribes	500	0	B-29
Climate Research and Development	**1,000**	**0**	
Climate Research and Development	1,000	0	B-32
Carbon Sequestration	**250**	**0**	
Carbon Sequestration	250	0	B-33
Science Support for DOI Bureaus	**6,450**	**4**	
Science Support for DOI Bureaus	6,450	4	B-33
Land Use Change	**500**	**10**	
Land Remote Sensing	**-1,750**	**0**	
Land Remote Sensing	-1,750	0	B-37
Geographic Analysis and Monitoring	**2,250**	**10**	
Disaster Response: Scenarios and Crisis Response	750	4	B-13
Ecosystem Priority: Chesapeake Bay	500	2	B-22
Ecosystem Priority: Land Use Science	1,000	4	B-29
Total Program Change	**8,700**	**14**	

Justification of Program Changes

The 2013 Budget Request for Climate and Land Use Change (CLU) is $153,749,000 and 446 FTE, a net program change of +$8,700,000 and +14 FTE from the 2012 Enacted Budget. For more information on the CLU Program Changes, please see Section B, Program Changes as referenced in the table.

Activity Summary

Climate change is one of the greatest natural resource challenges the world faces and is a top priority for the Administration and the Department of the Interior (Interior). Climate change and its impacts on natural resources are a key concern for Interior resource managers and their partners at the Federal, State, tribal, and local level. Key components of the CLU Mission Area include:

- National Climate Change and Wildlife Science Center (NCCWSC)/Department of the Interior Climate Science Centers (DOI CSCs);
- Landsat satellites;
- Land Remote Sensing (LRS) activities;
- Geographic Analysis and Monitoring (GAM);
- Biological and geological carbon sequestration assessments;
- Data management; and
- Continuation of rigorous scientific research that provides the data and new knowledge that is required to understand, assess, adapt to, and mitigate the impacts of climate change.

The CLU Mission Area supports Interior's strategic plan goal to assess and forecast climate change and its effects. The goal of CLU programs is to be the primary provider of scientific information on the impacts of climate and land use change on Earth and human systems. The understanding of these impacts is used to provide a scientific perspective for policymakers and to support land and resource managers in their decisionmaking.

CLU Mission Area projects also support the goals of the U.S. Global Change Research Program (USGCRP) to:

- Advance scientific knowledge of the integrated natural and human components of the Earth system;
- Provide the scientific basis to inform and enable timely decisions on adaptation and mitigation;
- Build sustained assessment capacity that improves the Nation's ability to understand, anticipate, and respond to global change impacts and vulnerabilities; and
- Advance communications and education to broaden public understanding of global change, and empower the workforce of the future.

Recent Climate and Land Use Change achievements:

- Established the entire network of the eight DOI CSCs (Alaska, Northwest, Southeast, South Central, North Central, Northeast, Southwest, and Pacific Islands).
- Continued innovative application of GAM research to improve the scientific basis for vulnerability and risk assessments, as well as disaster mitigation, response, and recovery activities.
- Supported over two and a half million Landsat images downloaded free-of-charge by users around the world.

- Continued land change science efforts that will result in the development of models, spatial metrics, and assessment tools that can be used to evaluate the consequences of landscape change at a range of scales.
- Fostered additional partnerships, particularly with the Landscape Conservation Cooperatives (LCCs), to develop tools that increase natural resource managers' abilities to apply science-based adaptation programs to better understand the effects of global change on their landscapes, the uncertainties associated with that change, and how future scenarios might unfold.
- Continued to further increase collaboration with Native American Tribes on climate change research in each of the DOI CSCs and with the use of Landsat data.
- Completed and released the first in a series of regional studies measuring the amount of carbon stored in U.S. ecosystems. The study examines the current and projected future carbon storage in the Great Plains region as part of a nationwide assessment. This is the first regional report applying a comprehensive methodology designed by the USGS in 2010 to assess how much carbon is stored in various ecosystems, such as wetlands, forests and rangelands. The study covers an area of the United States that includes parts of fourteen States from eastern Montana to southern Texas and eastern Iowa.
- Completed the 2006 iteration of the National Land Cover Data Set (NLCD), providing consistent public domain information on the Nation's land cover characteristics. It is the standard land cover map of the Nation and is critical for identifying and assessing climatic changes and water quality and quantity, biodiversity conservation efforts, and reducing the risks from natural hazards.

USGS researchers install time lapse cameras that are used to study ice dynamics at the Columbia Glacier, Prince William Sound, Alaska. Glacier monitoring in the Alaska DOI CSC and the CLU Climate Research Development Program provides critical documentation of past and current rates of ice melting and the potential contribution to sea level rise.

End Outcome Goal 4.2: Provide Science for Sustainable Resource Use, Protection, and Adaptive Management									
Strategy #2: Identify and Model Causes and Impacts of Changes to the Earth and Ocean Systems									
Performance Measure	**2008 Actual**	**2009 Actual**	**2010 Actual**	**2011 Operating Plan**	**2011 Actual**	**2012 Enacted**	**2013 Budget Request**	**Change from 2012 Enacted to 2013**	**Long-term Target 2016**
Geographic Analysis and Monitoring									
Percent of U.S. surface area with contemporary land cover data needed for major environmental monitoring and assessment programs (SP)	**99.3%**	**46%**	**95%**	**100%**	**100%**	**15%**	**65%**	**+50%**	**0.0%**
	(298 / 300)	**(213 / 463)**	**(440 / 463)**	**(463 / 463)**	**(463 / 463)**	**(69 / 463)**	**(301 / 463)**		**(0 / 463)**
Comments: In 2012 initiate land cover mapping for NLCD 2011 product. In 2016 begin research for NLCD 2016 product.									
Land Remote Sensing									
Number of terabytes managed cumulatively (LRS)	**3,840.60**	**3,010.90**	**2,873.40**	**2,876.90**	**3,723.00**	**4,734.00**	**6,504.00**	**+1770**	**8,447.00**
Number of remote sensing products distributed (LRS)	**417,029**	**3,127,040**	**5,600,000**	**5,795,503**	**4,710,757**	**4,852,080**	**4,997,642**	**+145562**	**5,461,058**
Percent of critical milestones successfully reached to support the Landsat 8 (LDCM) launch schedule	**35%**	**52%**	**70%**	**78%**	**67%**	**83%**	**100%**	**+17%**	**N/A**
	(8 / 23)	**(12 / 23)**	**(16 / 23)**	**(18 / 23)**	**(16 / 24)**	**(19 / 23)**	**(23 / 23)**		
Comments: Landsat 8 is lauched January 2013.									
Land Use Change Programs									
Number of systematic analyses and investigations completed (Land Use Change)	**93**	**90**	**79**	**90**	**92**	**85**	**85**	**0**	**85**

End Outcome Goal 4.2: Provide Science for Sustainable Resource Use, Protection, and Adaptive Management									
Strategy #3: Assess and Forecast Climate Change and its Effects									
Performance Measure	**2008 Actual**	**2009 Actual**	**2010 Actual**	**2011 Operating Plan**	**2011 Actual**	**2012 Enacted**	**2013 Budget Request**	**Change from 2012 Enacted to 2013**	**Long-term Target 2016**
National Climate Change and Wildlife Science Center									
Number of fish and wildlife climate based habitat and population models developed by scientists and in cooperation with land managers (SP)	N/A	1	3	6	6	10	14	+4	14
Number of DOI Climate Science Centers formed (HPPG)	N/A	N/A	3	5	5	8	Measure to be completed in 2012.		Measure to be completed in 2012.
Number of DOI Climate Science Center research priority documents completed (HPPG)	N/A	N/A	N/A	5	3	8	Measure to be completed in 2012.		Measure to be completed in 2012.
Climate Research and Development									
Percent climate research and development studies of which interpretive and synthesis products are cited by partners and users within three years of study completion (R&D)	N/A	N/A	N/A	80%	80%	80%	80%	0%	80%
Percent of targeted land cover trends national assessment syntheses, research plans, or science strategies that are published (R&D)	N/A	20%	40%	60%	60%	100%	Measure to be completed in 2012.		Measure completed in 2012.
		(1 / 5)	(2 / 5)	(3 / 5)	(3 / 5)	(5 / 5)			
Percent of Climate Effects Network established relative to current target (R&D)	11.5%	20%	25%	25%	25%	Measure discontinued due to funding.	Measure discontinued due to funding.		Measure discontinued due to funding.
	(2.3 / 20)	(4 / 20)	(5 / 20)	(5 / 20)	(5 / 20)				
Carbon Sequestration									
Percent of the baseline, reference projection, and mitigation evaluation units completed for a national biological carbon sequestration assessment (Bio Carbon)	N/A	N/A	N/A	14%	14%	64%	100%	+36%	N/A
				(45 / 330)	(45 / 330)	(210 / 330)	(330 / 330)		
Comments: Project completed in 2013.									
Climate Variability Programs									
Number of systematic analyses and investigations completed (Climate Variability)	7	93	121	100	130	100	105	+5	110

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Activity: Climate and Land Use Change
Subactivity: Climate Variability
Program Element: National Climate Change and Wildlife Science Center/ Department of the Interior Climate Science Centers

2011 Actual: $20.9 million (59 FTE)
2012 Enacted: $25.5 million (70 FTE)
2013 Request: $26.2 million (70 FTE)

Overview

The NCCWSC and a network of eight DOI CSCs are charged with responding to high priority adaptation related science needs identified by managers and delivering high quality, integrated and efficiently-implemented science that meets these needs. In 2012, the USGS is establishing the final three DOI CSCs, completing the planned suite of eight DOI CSCs. All are partnerships with universities and other public entities and are designed to foster government-university science collaboration.

DOI CSC (date established)	**Host Institution**
Alaska (2010)	University of Alaska
Northwest (2010)	Multi-institution consortium headed by Oregon State University
Southeast (2010)	North Carolina State University
Southwest (2011)	Multi-institution consortium headed by University of Arizona
North Central (2011)	Multi-institution consortium headed by Colorado State University
South Central (2012)	Multi-institution consortium headed by University of Oklahoma
Northeast (2012)	Multi-institution consortium headed by University of Massachusetts, Amherst
Pacific Islands (2012)	Multi-institution consortium headed by University of Hawaii, Manoa

Each DOI CSC will have a stakeholder advisory committee with representation from the LCCs as well as other public sector resource management and science partners. These partners, with input from resource users, nongovernmental organizations, and the public, will provide guidance on annual project identification, to ensure that DOI CSC science is directed to the highest priority regional management needs. The DOI CSCs have ready access to university and Federal scientific expertise and will prioritize science collaborations that include multi-party collaborations or leverage external resources.

Each DOI CSC will have a 5-year strategic science plan that identifies the key scientific issues arising from high priority conservation and management challenges in the region and provides guidance on establishing annual priorities to address these needs. Both 5-year and annual plans are the subject of consultation with regional partners. The NCCWSC will use these plans as the basis for its national-level scientific activities. Initial planning confirms the original NCCWSC focus on assessing and synthesizing the state-of-knowledge on climate change impacts on fish, wildlife, habitat and other natural and cultural resources; working with managers to develop and assess adaptation methods that minimize impacts; and understanding how climate and other factors influence ecosystem structure and the goods and services they provide.

Program Performance

Delivering Scientific Support – In keeping with its mission to provide fundamental science for decisionmaking, each DOI CSC will:

- Develop one or more large-scale regional science initiatives that will significantly deepen the fundamental basis for future science and management. For example, in Alaska, the DOI CSC is creating an integrated ecosystem model that links projected changes in fire, water, vegetation, and permafrost, and will serve as the basis for more-specific studies, such as the combined effects of these changes on caribou or geese. Another large-scale regional example is the Southeast Regional Assessment Pilot, which is nearing completion and which links sea level rise projections, climate-driven changes in freshwater habitat quality, and combined effects of climate and land use on terrestrial vegetative habitat.
- Undertake regional-scale research efforts that address key management concerns, such as wide range vulnerability assessments (for example, the species range for bull trout) or development of key knowledge (such as the thermal tolerances for macro-invertebrates) which is needed to evaluate the vulnerability of these key ecosystem components).
- Continue to develop regional data management initiatives, in collaboration with the NCCWSC, the LCC network, and others. The goal is to ensure that regionally important data are made available in ways that meet local needs and enable broad sharing and aggregation of data.
- Expand collaboration with key science partners. For example, the National Oceanic and Atmospheric Administration (NOAA) and the North Central DOI CSC are developing a joint project to evaluate downscaled regional climate projections and their applicability for ecological modeling in the Prairie Pothole and sage-steppe regions. In this regard, NOAA, National Aeronautics and Space Administration (NASA), and U.S. Forest Service (USFS) research units are formal partners in the DOI CSCs.

NCCWSC/DOI CSC collaboration with Tribes

Tribes are key partners in the management of fish and wildlife, and NCCWSC and the DOI CSCs are working to engage tribal leaders and resource managers. A tribal chairman co-chairs the Stakeholder Advisory Committee for the Northwest DOI CSC, the first such committee established in the new program. In addition, the DOI CSCs will conduct government to government consultation with Tribes on engagement with and priorities for individual DOI CSCs, and tribal members will be included on the Federal advisory committee being established to provide input to the initiative.

Learn more about the Northwest DOI CSC at *http://www.doi.gov/csc/northwest/index.cfm*

Federal Advisory Committee – Interior and the USGS are creating an advisory committee under the Federal Advisory Committee Act for the NCCWSC. This entity will provide external constituents an opportunity to provide input, and will serve as a vehicle for ensuring that scientific activities are high quality, responsive to partners' needs, and being implemented efficiently and in a collaborative manner. A key product of this committee will be a national science agenda outlining a broad suite of priorities on which fundamental progress is needed to improve management.

For more information about the NCCWSC/DOI CSC Program, please go to *http://nccwsc.usgs.gov/*.

Activity: Climate and Land Use Change
Subactivity: Climate Variability
Program Element: Climate Research and Development

2011 Actual: $28.5 million (147 FTE)
2012 Enacted: $22.0 million (127 FTE)
2013 Request: $23.2 million (127 FTE)

Overview

The USGS Climate Research and Development (R&D) Program has the unique capability to conduct fundamental multidisciplinary research needed to address complex issues associated with climate and land use change. The long-standing and globally respected expertise in studies of past climate, geology, hydrology, geography, and biology provides the opportunity to document patterns of climate and land use change on daily to millennial timescales and to assess the impacts of changes on local, regional, and national spatial scales. This breadth of knowledge and experience allows the Climate R&D Program to tailor research efforts to address the needs of multiple stakeholders across the Nation.

Climate R&D research is designed 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 the Earth system to such changes. USGS researchers conduct observations of these components over time and space and provide the basic data needed to understand the rates and patterns of Earth system response to a range of climate and land use changes. Integration of these data with modeling efforts provides a means to improve understanding of the impacts of change and feedback between the Earth and climate systems. Climate R&D data contributions improve model performance and our ability to forecast likely changes under a range of climate and land use scenarios.

USGS research serves the Nation, Interior, tribal, and State and local entities by providing a scientific basis for decisionmaking and adaptive management of natural ecosystems, Federal lands, and infrastructure. In addition, Climate R&D research supports national and international efforts to address climate change, such the U.S. National Assessment of Climate Change, the USGCRP, and the Intergovernmental Panel on Climate Change (IPCC).

Program Performance

The Climate R&D Program will continue conducting research to advance the scientific knowledge of the Earth system and its response to climate and land use change.

Priority topics for 2013 include:

- Improve the understanding of baseline levels of climate variability across the Nation by examining and generating high-resolution climate records that span the last 2,000 years. Regional studies of long-term trends in Rocky Mountain snowpack, Arctic sea ice, Gulf of Mexico oceanography, Pacific coast temperature, and Eastern U.S. wetland hydrology are dramatically improving our understanding of climate impacts on temperature variability, water quality and availability, and ecosystem health. Such baseline data extend existing instrumental records to document landscape and ecosystem response

both to natural climate variability and anthropogenic change, guiding management efforts to forecast responses to a range of environmental conditions.

- Improve understanding of patterns and controls on sea level rise and its impacts on coastal ecosystems. Geologic studies of past intervals of high sea level are providing analogs for the potential magnitude and rates of sea level rise associated with projected intervals of extended warmth. Research on the West Antarctic Ice Sheet and North American glaciers is providing critical documentation of past and current rates of ice melting and the potential contribution to sea level rise. Research on coastal wetland response to rising sea level is providing critical data to help forecast impacts of different sea level scenarios and assist resource managers in devising sustainable management strategies to protect critical coastal habitats.

Paleoclimate Research Helped to Produce Historical Temperature and Precipitation Patterns

In 2011, USGS paleoclimate researchers used multiple lines of evidence to produce an initial synthesis of temperature and precipitation patterns across the Nation and adjacent oceans for the last 2,000 years. This effort is using available data records to develop regional climate reconstructions during key time periods, such as the Little Ice Age (~AD 1500-1900). Comparison of regional responses to specific climate events is providing insights into potential impacts of future climate change, and continuing efforts are underway to fill data gaps and produce a national scale reconstruction of past climate during key intervals of the last few millennia.

- Increase understanding of the impacts of climate and land use change on our Nation's ecosystems, including coastal wetlands and estuaries, mountain habitats, deserts, and marine ecosystems. These efforts use a combination of process-based research, monitoring, examination of past ecosystem variability, and modeling efforts to understand ecosystem response to different climate and environmental stressors and to improve predictions of ecosystem response to different climate and land use scenarios.

- Improve our understanding of the interrelationship of Arctic permafrost, carbon flux, and hydrology, and their responses to changing climate and land use. The USGS has the capability to document changes in these parameters over daily to millennial time scales by integrating the monitoring of current conditions with reconstructions of past conditions based on geologic records. Measurements of existing levels of carbon, nitrogen and other elements are made in permafrost and soil. These values can be directly related to existing temperature and precipitation conditions in the region. Researchers then measure values of the same elements from ancient sediments stored in Alaskan lakes and adjacent oceans to document the natural variability of the Arctic system over the last few millennia. This long term perspective provides a baseline to evaluate magnitudes and rates of changes observed in the past few decades.

The Climate R&D Program will continue to convene working groups on these and other priority research topics to synthesize the state of the science, identify data gaps, eliminate redundancies, and initiate collaborative research efforts among R&D scientists, other USGS programs and activities, and external agencies and academic institutions. Initial coordination efforts in 2011 resulted in new collaboration with national and international working groups aimed at developing regional climate reconstructions for the last 2,000 years. Leveraging the expertise within Climate R&D with that of external partners is maximizing the impact and relevance of USGS research.

For more information about the Climate R&D Program, please go to *http://gcp.usgs.gov/rd/*.

Activity: Climate and Land Use Change
Subactivity: Climate Variability
Program Element: Carbon Sequestration

2011 Actual: $10.0 million (32 FTE)
2012 Enacted: **$**9.0 million (32 FTE)
2013 Request: $9.4 million (32 FTE)

Overview

Carbon sequestration is a method of securing carbon dioxide (CO_2) to prevent its release to the atmosphere and contribution to global warming as a greenhouse gas. Geological storage of CO_2 in porous and permeable rocks involves injecting high pressure CO_2 into a subsurface rock unit and displacing the fluid that initially occupied the pore space. Biological carbon sequestration refers to both natural and deliberate processes by which CO_2 is removed from the atmosphere and stored as carbon in vegetation, soils and sediments. Currently, there is no quantitative, probabilistic assessment of the national potential for geologic or biologic sequestration.

The Energy Independence and Security Act (EISA) of 2007 (P.L. 110-140) called for the USGS to develop a methodology for and complete a national assessment of geological storage capacity for CO_2. It also required the Secretary of Interior to complete a quantitative national assessment of the carbon stored in and released from ecosystems. USGS efforts to meet these requirements are undertaken through this program.

Geologic Assessment – In 2010, the USGS published the assessment methodology to estimate carbon sequestration storage potential suitable for uniform application to geologic formations throughout the United States. The USGS methodology, a unique, robust approach to assessing the CO_2 storage potential of individual storage assessment units in the sedimentary basins of the United States, is a geology-based, probabilistic methodology. In fact, the International Energy Agency, in a draft report, has adopted the USGS methodology to use for a global storage capacity roadmap. The USGS methodology will serve as a base international standard for global geologic carbon sequestration potential.

Activities in 2012 are focusing on the completion of the geologic models that form the basis of the national assessment, online digital maps of U.S. sedimentary basins with assessment boundaries, a summary of the state-of-knowledge regarding using coal beds for long term CO_2 storage, and the statistical methodology for aggregation of assessment unit results to the national level. In addition, research activities continue on identification of the controls on storage capacity, factors associated with enhanced oil and gas recovery and CO_2 storage potential, issues related to storage of CO_2 in unconventional reservoirs, and potential impacts of induced seismicity on storage of CO_2.

In 2013, the geologic national assessment will be finalized and published. All the geologic models that form the basis of the national assessment will be published. Research on controls on geologic carbon sequestration will continue, in order to understand the impacts of these processes as well as to improve future assessments. Collaborative efforts with State Geological Surveys, universities, and the U.S. Department of Energy (DOE) National Energy Technology Laboratories Regional Carbon Sequestration Partnerships will continue.

Biologic Assessment – The assessment methodology for the biologic carbon sequestration was published in 2010. A wide range of stakeholders view this assessment as a major scientific effort to advance knowledge on relationships between ecosystem capacities to store carbon (or ecosystem vulnerability to release carbon into the atmosphere) and natural and anthropogenic processes, particularly land use change, ecosystem disturbances, management practices and climate change.

In 2011, the USGS delivered the first stage of the biologic assessment: a comprehensive assessment report for the Great Plains region of the Nation (USGS Professional Paper 1787, *http://pubs.usgs.gov/pp/1787/*). The assessment report was highlighted in December 2011 at the American Geophysical Union annual meeting in San Francisco, California. A key finding in this study is that the Great Plains region is currently an overall "carbon sink"; it takes up more carbon than it emits. In addition, the amount of sequestered carbon offsets most of the emissions of nitrous oxide and methane from this region. On a national scale, the amount of carbon that is currently stored per year in ecosystems within the Great Plains is about 21 percent of emissions from personal vehicles and 3.6 percent of total fossil fuel emissions nationwide. The values for vehicle and total fossil fuel emissions are not part of the USGS study but were calculated using the 2009 Environmental Protection Agency (EPA) National Greenhouse Gas (GHG) Inventory Report.

In 2012, the USGS will complete the analysis for American West, deliver all data products, and deliver a comprehensive assessment report. The Carbon Sequestration Program will complete most of its analysis tasks for all eastern regions and make significant progress towards delivering data and a report for the East.

In 2013, to meet the EISA mandate and assess ecosystem carbon sequestration in relation to changes in land use and climate, the USGS will:

- Complete the national assessment and publish assessment reports and journal papers on carbon storage and sequestration, as well as GHG emissions, in all ecosystems for all 50 States.
- Deliver and distribute major data products in a digital map format to facilitate applications by Federal, State, and local agencies, as well as private users.
- Collaborate with Interior bureaus and other agencies and user communities in using assessment results for land use planning, developing of land management decisions, and other scientific or land use applications. One example of such an application is a planned collaborative pilot study in which the U.S. Fish and Wildlife Service (FWS) and the USGS will use the assessment results to understand carbon storage and sequestration as related to refuge management.

For more information on the Carbon Sequestration Program, please go to:
Geological Carbon Dioxide:
http://energy.usgs.gov/HealthEnvironment/EnergyProductionUse/GeologicCO2Sequestration.aspx

Biological Storage of Carbon Dioxide: *http://www.usgs.gov/climate_landuse/land_carbon/*

Activity: Climate and Land Use Change
Subactivity: Climate Variability
Program Element: Science Support for DOI Bureaus

2011 Actual: $5.0 million (8 FTE)
2012 Enacted: $2.4 million (8 FTE)
2013 Request: $9.0 million (12 FTE)

Overview

Managing natural resources at a landscape scale is a goal of Interior management agencies, as well as many other Federal, State, local, and tribal entities. As a core strategy for achieving this goal efficiently and effectively, Secretary Salazar established LCCs to work across Interior bureaus and with other public and private partners to identify and implement landscape scale conservation actions. Land and resource management bureaus within Interior, including the National Park Service (NPS), the FWS, the Bureau of Reclamation (USBR), and the Bureau of Land Management (BLM) are key participants in LCCs and are the primary entities supported by these funds.

USGS science centers provide a wide range of expertise and capabilities to address landscape scale science questions. The USGS provides the ability to model current conditions and projected physical and biological changes across extensive landscapes and aquatic systems with studies of ecosystem and population processes. The USGS can provide a multi-scale approach that will integrate large-scale global change information with more local information relevant to resource managers, thereby supporting adaptive management for fish and wildlife in the face of climate change. The USGS is working to strengthen population and ecosystem modeling capacity at regional and local levels, better integrate remotely-sensed and other existing datasets, standardize monitoring protocols, improve large-scale syntheses, and expand analytical support for Federal, State, and tribal resource managers. These funds are already producing valuable information for managers. For example:

- USGS scientists are working closely with the BLM, USFS, DOE, and the Department of Defense on developing remote sensing tools to understand how vegetation change affects hydrology, breeding sagebrush for successful sage-grouse habitat restoration, and managing agro-ecosystems in the presence of exotic plants.
- The BLM and the Idaho Army National Guard are using USGS research to develop raptor conservation policies, and the American Wind and Wildlife Institute will also use the results for their wind energy siting support tools.

The USGS will continue to provide ecological and population modeling capacity to the LCCs. USGS support for the LCCs benefits all Interior bureaus as well as other Federal, State, tribal, academic, and private eco-regional fish, wildlife and land conservation efforts by providing integrated ecological and population modeling capacity across national efforts, as well as providing increased capacity for applying models and other scientific information directly to management challenges. These activities complement and enhance research activities conducted at the DOI CSCs by increasing the capacity to respond to individual LCC and Interior bureau's needs, enabling the DOI CSCs to focus on broad, regionally applicable science needs. Activities supported by these funds include:

- Data modeling and programming expertise to support data management in LCCs in Alaska and along the Gulf Coast;
- Hydrologic expertise to plan overall climate and hydrologic investigations in Alaska;
- Development of a regional decision support tool to assess vulnerability of riverine fishes in the Midwest area;
- Development of indicators of fish trophic level interactions in Great Lakes fish;
- LCC science planning (assistance to LCCs to identify and properly scope needed research);
- Modeling of climate impacts on LCCs on the Gulf Coast;
- Evaluating effects of changing streamflow on fish species and the effects of sea level rise on wildlife in the Southeast;
- Modeling the influence of changing climate on water cycling, water availability, and fish in the Southern Rockies; and
- Identification of the effects of changing ocean conditions on invasive fish species in the Florida/Caribbean region.

Program Performance

Support for LCCs and Interior Bureau Science Needs – USGS climate science support will take a variety of forms, depending upon the LCC and bureau needs. USGS climate change research, data management, modeling, and tool development can be employed to inform new Federal, State, tribal, and private management strategies for terrestrial and freshwater fish and wildlife species. The USGS has provided both dedicated research scientists and access to the full range of expertise within the USGS science centers to respond to bureau and LCC identified priorities. In addition, USGS efforts to support the LCCs included funding for development of database tools to deliver necessary information to LCC staff easily, inexpensively, and quickly.

The USGS will use these funds to provide direct support to the FWS, the NPS, and the BLM through support to all 22 LCCs. Activities in 2013 will be defined through ongoing consultations between USGS regional staff and LCC managers to identify the most high priority activities. Types of work to be conducted include:

- Supporting basic ecological studies of species that may be affected either positively or negatively by climate change;
- Providing scientific input to the development of monitoring for fish and wildlife resources vulnerable to climate change;
- Describing landscape-specific adaptation strategies for managers to use in developing new resource management scenarios; and
- Developing new strategies to protect and restore coastal and marine resources under climate change and sea level rise conditions.

In 2013, these funds will enable the USGS to continue and expand to address the scientific needs of our partners and the LCCs to allow natural resource managers to plan for adaptation to climate change.

Activity: Climate and Land Use Change
Subactivity: Land Use Change
Program Element: Land Remote Sensing Program

2011 Actual: $62.4 million (125 FTE)
2012 Enacted: $73.7 million (127 FTE)
2013 Request: $72.1 million (127 FTE)

Overview

The Nation's economic and environmental vitality and security interests rely on continuous observations of the Earth's land surface. These remotely sensed data provide the foundation for scientific studies to understand changes occurring on the landscape at local, regional, and global scales. The LRS Program provides, on national and global scales, high-quality imagery acquired by Landsat satellites and other remote-sensing instruments flown on aerial and space-borne platforms. This work ensures a comprehensive record of land surface data is available for environmental and economic decisionmaking. As a world leader in managing a remotely sensed data archive, the USGS is responsible for ensuring these data are readily and easily accessible to users. The LRS Program also conducts research on the uses of remotely sensed data and provides Federal civil agencies with access to classified assets. Under the Land Remote Sensing Policy Act of 1992 (P.L. 102–555) and Presidential Decision Directive NSTC-3, Interior, through the USGS, shares the responsibility for Landsat Program Management with NASA. This Act directs Interior, through the USGS to provide a comprehensive, permanent, and impartial record of the Earth's land surface to users, which is accomplished through the National Satellite Land Remote Sensing Data Archive.

Program Performance

Earth observations – The USGS is responsible for the operations and maintenance of the Landsat satellites, including collecting, archiving, processing, and making these data available to users worldwide. The entire Landsat series of satellites provides the only global record of the Earth's land surface over the last 40 years at a scale where human and natural land changes can be differentiated. Satellites are the most efficient means of collecting data on a global scale – necessary to observe the impacts of change on the environment, such as deforestation, desertification, urbanization, and natural hazards.

Results of a Recent Survey of the Landsat User Community

The report, "The Users, Uses, and Value of Landsat and Other Moderate-resolution Satellite Imagery in the United States-Executive Report" summarizes the results of a survey responded to by 2,500 users of satellite imagery. Respondents were surveyed on their use of satellite imagery, including Landsat, and on the impact of working without access to Landsat imagery.

Each of 37 different application areas investigated – from agriculture and environmental management, to education and disaster response – were primary uses for some respondents. More than 91 percent of respondents currently use Landsat imagery to answer questions or solve problems, while 57 percent reported using it to make decisions. Over 80 percent indicated the imagery is somewhat or very important to their work. A follow-on survey is being planned that will focus on the changes in the Landsat user community since establishment of the free data policy.

For additional information see: *http://www.fort.usgs.gov/LandsatSurvey/.*

During 2012 and 2013, the USGS will:

- Continue operation and maintenance of Landsats 5 and 7;
- Complete the Landsat 8 ground system in preparation for launch in January 2013;
- Work closely with the Office of Science and Technology Policy, NASA, and NOAA to examine alternatives for providing land remote sensing data in a cost effective manner;

- Transition ownership and responsibility for Landsat 8 from NASA to the USGS following a 90-day on-orbit check-out period after launch; and
- Negotiate agreements for the acquisition of other remotely sensed land image data from government, commercial, and foreign sources.

Remote sensing archive – The USGS provides the Nation's portal to the largest archive of remotely sensed land data in the world, supplying continuous access to current and historical image-based products. These products serve many purposes from assessing the impact of natural disasters, monitoring global agricultural production, monitoring the impact of climate and other global changes, and supporting national defense. The USGS Earth Resources Observation and Science (EROS) Center near Sioux Falls, South Dakota, manages and makes these data available to users. Without restrictions, scientists, resource managers, and the general public can select and download USGS products derived from over 170 datasets. Projections for 2012 and 2013 indicate over 2.5 petabytes of data will be distributed by EROS each year. In 2012, the USGS will begin development of a high-quality, improved-resolution (30-meter) global land cover product using Landsat data. This baseline product will provide scientists with better detection of land surface change at the scale of most human activity that support climate and land use change studies.

Remote sensing research and applications – The LRS Program also manages classified assets and capabilities under the National Civil Applications Program. These assets provide for the acquisition, dissemination, archive, and exploitation of classified remote sensing systems to Interior and other Federal civil agencies. Data from classified systems are used to address land and resource management concerns, disasters, geospatial, and scientific policy issues.

The USGS seeks new ways to make remotely sensed data products more accessible and useful. The USGS is developing Terrestrial Essential Climate Variables (ECVs) needed to support the climate change research and monitoring activities of the USGCRP, as well as the United Nations Framework Convention on Climate Change and the IPCC. In 2012 and 2013, the USGS will use the Landsat archive for current and historical data necessary to develop ECVs for land cover, fire disturbance, surface-water extent and leaf area index for the conterminous United States.

The USGS is leading the safe and cost effective adoption of Unmanned Aircraft Systems (UAS) technology by Interior bureaus and other USGS mission areas. The use of UAS technology has the potential to effectively fill the observation gaps that are critical to gaining a better understanding of the complexities in climate change research, water resources forecasting, ecosystem monitoring and management, and natural hazards. These information gaps exist over the remote, scarcely populated and often volatile lands managed by Interior (i.e., volcanic islands, Everglades) and other remote reaches of the Earth. In 2012, the USGS is working with the NPS to utilize UAS technology to monitor sediment transfers on the Elwah River system during removal of the Elwah Dam in northwestern Washington and is assisting the Interior Office of Surface Mining to use UAS technology in permit inspections of mines.

For more information about the LRS program and Landsat, please go to *http://remotesensing.usgs.gov/index.php* and *http://landsat.usgs.gov/*.

Activity: Climate and Land Use Change
Subactivity: Land Use Change
Program Element: Geographic Analysis and Monitoring

2011 Actual: $11.4 million (68 FTE)
2012 Enacted: $11.5 million (68 FTE)
2013 Request: $13.9 million (78 FTE)

Overview

The Geographic Analysis and Monitoring (GAM) Program provides understanding of the Nation's urgent environmental, natural resource, and economic challenges and provides information and tools that identify possible solutions to these challenges. To do this, the USGS conducts research on land cover, which provides a historical record of resource use and an indication on the availability and quality of natural resources, and develops tools that enable decisionmakers to make informed decisions on resource allocation. Comprehensive land cover information is essential in a wide variety of investigations, such as assessing the impacts of climate change, evaluating ecosystem status and health, understanding spatial patterns of biodiversity, and informing land use planning.

Research activities include:

- Understanding environmental consequences of land change and its impacts on the people, environment, economy, and resources of the Nation;
- Improving the scientific basis for vulnerability and risk assessments, as well as disaster mitigation, response, and recovery activities; and
- Developing the necessary tools and methods to support resource allocation and decisionmaking.

The GAM Program manages the creation, updating and distribution of the NLCD, which is the standard land cover map of the Nation. It provides valuable information on the types of land cover changes occurring, their distribution and patterns, and the potential consequences of these changes. Land cover information is critical for identifying and assessing climatic changes because surface energy fluxes between the land and the atmosphere have a major impact on climate. Updated every 5 years, this information is also an important element of assessing water quality and quantity, biodiversity conservation efforts and reducing the risks from natural hazards.

Decision support activities utilize land cover information, land change models, sensitivity analyses, geographic distribution of people and infrastructure, and probability of specific disturbance factors occurring to develop tools that will help land and community managers make informed resource allocation decisions. These projects include developing case studies, interpretative assessments, and workshops involving stakeholders and other clients in collaborative processes.

Strong collaborations with other USGS programs include participation in USGS and Interior priority efforts, including the Science Application for Risk Reduction (SAFRR), LANDFIRE, WaterSMART, and the Chesapeake Bay restoration effort. The GAM program supports the

research objectives of the USGCRP and is an active participant in international global science initiatives by promoting the use of USGS science results and assets around the globe.

Program Performance

National Land Cover Database (NLCD) – Provides consistent public domain information on the Nation's land cover characteristics. Much of this work is accomplished through USGS partnerships with Federal, State and local government agencies, private industry, and nongovernmental organizations. In 2012, the accuracy assessment of the 2006 version of the NLCD will be completed and the mapping of NLCD 2011 will commence, providing the Nation with current and accurate land cover information.

Vulnerability and Risk Assessment – To assist the Disaster Response activities, GAM scientists are demonstrating how integrative hazards science can be used to improve community resiliency to natural hazards. The research assists States and localities reduce their risk from natural hazards by directing research toward the community's needs, improving monitoring technology, producing innovative vulnerability and risk products, and improving dissemination of the results. Currently, GAM scientists are assessing the economic and social impacts of major wildfires and winter storms and will use this information to support risk reduction efforts as part of planned disaster scenario exercises.

Ecosystem Services Assessment and Valuation (ESAV) – ESAV addresses both the primary research needs associated with the quantification and valuation of ecosystem services (ES), as well as the practical problems associated with utilizing ES information to inform environmental management decisions. Current work is being conducted in the San Pedro River Basin in southeastern Arizona, under the auspices of an interagency (USGS, U.S. Department of Agriculture (USDA), EPA, BLM, USBR) partnership. Project scientists will evaluate the utility of ES valuation in public lands management and planning decisions and assess the ability of BLM field offices to use available tools for ES valuation.

Irrigation Monitoring – As part of WaterSMART, the GAM Program is working to achieve a sustainable water strategy to meet the Nation's water needs. Scientists are developing and applying remote sensing and surface energy balance modeling methods to estimate precipitation, runoff, and evapotranspiration in order to identify the amount of water being used for irrigation. Current work is focused on estimating irrigation water usage on a national scale and developing methodologies to analyze the efficiency of irrigation activities.

Chesapeake Bay Research – Current GAM research is assessing the effectiveness of winter cover crops in reducing both soil erosion and nitrogen runoff from agricultural fields into the Chesapeake Bay. Research is conducted in collaboration with the USDA-Agricultural Resource Service, the Maryland Department of Agriculture, and local Soil Conservation Districts. Project scientists are using satellite-based remote sensing data products with site specific, privacy protected conservation program farm data records to measure cover crop success in preventing sediment and nutrients from reaching the Bay.

For more information on the GAM Program, please go to *http://gam.cr.usgs.gov/index.shtml.*

Activity: Energy, Minerals, and Environmental Health

		2011 Actual	2012 Enacted	2013				Change from 2012 Enacted (+/-)
				Fixed Costs and Related Changes (+/-)	Program Changes (+/-)	Internal Transfers	Budget Request	
Mineral Resources ($000)		52,168	49,231	290	-4,250	0	45,271	-3,960
	FTE	356	346	0	-34	0	312	-34
Energy Resources ($000)		27,750	27,292	200	3,000	0	30,492	3,200
	FTE	151	150	0	12	0	162	12
Contaminant Biology ($000)		9,216	9,062	138	700	0	9,900	838
	FTE	65	65	0	1	0	66	1
Toxic Substances Hydrology ($000)		10,778	10,628	136	700	0	11,464	836
	FTE	53	53	0	1	0	54	1
Total Requirements ($000)		**99,912**	**96,213**	**764**	**150**	**0**	**97,127**	**914**
Total FTE		**625**	**614**	**0**	**-20**	**0**	**594**	**-20**

Summary of Program Changes

Request Component	($000)	FTE	Page
Mineral Resources	**-4,250**	**-34**	
Rare Earth Elements Research	1,000	5	B-33
Mineral Resources	-5,000	-39	B-37
Minerals External Research Program	-250	0	B-37
Energy Resources	**3,000**	**12**	
Hydraulic Fracturing	3,000	12	B-19
New Energy Frontier - Wind Energy	1,000	2	B-33
Energy Resources - Conventional Energy	-1,000	-2	B-37
Contaminant Biology	**700**	**1**	
WaterSMART: Water Quality Enhancement	1,000	4	B-7
Ecosystem Priority: Chesapeake Bay	100	0	B-22
Ecosystem Priority: Columbia River	100	0	B-23
Impact of Environmental Contaminants	-500	-3	B-38
Toxic Substances Hydrology	**700**	**1**	
WaterSMART: Water Quality Enhancement	2,000	10	B-7
WaterSMART: Predictive Modeling	500	1	B-8
Ecosystem Priority: Chesapeake Bay	100	1	B-22
Ecosystem Priority: Columbia River	100	0	B-23
Methods Development and Assessments	-2,000	-11	B-38
Total Program Change	**150**	**-20**	

Justification of Program Changes

The 2013 Budget Request for Energy, Minerals, and Environmental Health (EMEH) is $97,127,000 and 594 FTE, a net program change of +$150,000 and -20 FTE from the 2012 Enacted Budget. For more information on the EMEH Mission Area changes, please see Section B, Program Changes as referenced in the table.

Activity Summary

The EMEH Mission Area includes programs that conduct research and assessments on the location, quantity, and quality of the Nation's and world's mineral and energy resources, including economic and environmental effects of resource extraction and use, and programs that conduct research on environmental impacts of human activities that introduce chemical and pathogenic contaminants into the environment and threaten human, animal (fish and wildlife), and ecological health.

The U.S. Geological Survey (USGS) is the sole Federal provider of scientific research and information on mineral resource potential, production, consumption, and environmental effects in the United States and around the world. The USGS conducts research to better understand energy resources, including non-traditional energy resources, and the environmental and human health effects of energy resource occurrence and use. The USGS also evaluates energy resource accumulation, distribution, and potential of the Nation and the world. Results of these mineral and energy studies, research, and assessments are used by resource managers and policymakers to support informed policy and management decisions on resource use, national security, energy mix, and assessing trade-offs and environmental risks.

The USGS is a lead Federal agency in providing information and tools to address occurrence, behavior, and effects of environmental contaminants, including impacts on susceptible ecosystems and implications for human, wildlife, and fish health. This information includes identifying chemical and pathogenic environmental contaminants (pesticides, surfactants, human and veterinary pharmaceuticals, and other industrial and naturally occurring contaminants); developing methods to identify sources of environmental contamination and measuring those contaminants in habitats and biota; assessing toxicological significance of contaminant exposure to vulnerable organisms; characterizing effects on organisms exposed in susceptible environmental settings, including potential human exposure; and providing information on performance of best management practices and treatment alternatives. This information informs decisionmaking by the public and industry and helps resource managers and policymakers to assess environmental risks; prevent contamination; license and approve chemicals; and manage, protect, and restore natural resources, contaminated lands, and important natural ecosystems, including trust resources of the Department of the Interior. These efforts complement other USGS programs by focusing on new and understudied issues and contaminants and by developing and improving methods to detect and characterize toxic substances in the environment.

The EMEH Mission Area is increasing focus on integrating its core capabilities more broadly. Mission Area Programs are jointly developing approaches to assessments that incorporate both energy and mineral resource information, as well as environmental and economic information. Several pilot projects, including an integrated uranium study, are being developed or are in the early stages of implementation.

Management Summary

Program Reviews – Portions of the Energy Resources Program were reviewed by external technical committees in 2011. Each time a new assessment methodology is developed in Energy Resources, an external panel of technical experts formally reviews the methodology and approach. Energy Resources revises the methodology based on the review and does not

consider a methodology final until it has received expert review. In 2010 and 2011, Energy Resources had the following methodologies reviewed by external experts:

- Methodology to estimate carbon sequestration potential for uniform application to geologic formations across the Unites States;
- Methodology to assess reserve growth in oil and gas fields (assessment of both undiscovered resources and additions to reserves from discovered fields and reservoirs requires estimation of reserve growth); and
- Methodology to determine economically recoverable resources of unconventional petroleum resources (coalbed methane, tight gas sands, shale gas, shale oil).

Review of the methodology to assess economically recoverable resources for conventional petroleum in the Arctic will occur in 2012. Other methodologies, as they are developed, such as that for a national uranium assessment and the water budget associated with unconventional oil production, will be reviewed in 2012 and 2013.

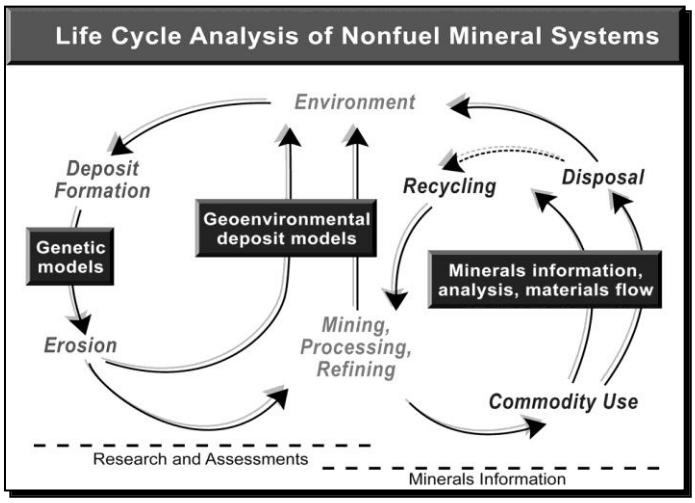
Using guidance developed by the National Academy of Sciences Committee on Critical Minerals published in 2008, Mineral Resources identified 16 mineral commodities as the focus of the next National Mineral Resource Assessment. These commodities include metals and Rare Earth Elements needed for new energy and "green" technology development and industrial minerals important to agriculture. The USGS conducted a Mineral Resource Assessment Forum in 2012 to examine methodologies for producing mineral assessments and to determine the science needed to produce the most relevant and useful assessments in anticipation of starting the next National Assessment. New mineral deposit and mineral environmental model development for critical commodities continued in 2012. Deposit models are scheduled for completion in 2013; research on and development of mineral environmental models will be terminated in 2012.

End Outcome Goal 4.2: Provide Science for Sustainable Resource Use, Protection, and Adaptive Management									
Strategy #5: Assess National and International Energy and Mineral Resources									
Performance Measure	**2008 Actual**	**2009 Actual**	**2010 Actual**	**2011 Operating Plan**	**2011 Actual**	**2012 Enacted**	**2013 Budget Request**	**Change from 2012 Enacted to 2013**	**Long-term Target 2016**
Mineral Resources Program									
Percent of targeted non-fuel mineral commodities for which up-to-date deposit models are available to support decision making (SP)	**7%**	**20%**	**53%**	**73%**	**73%**	**80%**	**93%**	**+13%**	**100%**
Number of systematic analyses and investigations delivered to customers (MRP)	**3**	**3**	**4**	**3**	**3**	**3**	**2**	**-1**	**2**
Number of formal workshops or training provided to customers (MRP)	**6**	**6**	**8**	**6**	**6**	**5**	**3**	**-2**	**3**
Number of mineral commodity reports available for decisions (MRP)	**649**	**707**	**748**	**700**	**705**	**680**	**620**	**-60**	**620**
Energy Resources Program									
Number of USGS energy products accessed online (in millions) (SP)	**5.08**	**8.24**	**6.89**	**5.00**	**5.02**	**4.50**	**4.50**	**0.00**	**5.00**
Number of megabytes collected annually (ERP)	**1,201**	**18,072**	**1,707**	**2,323**	**2,323**	**1,126**	**1,024**	**-102**	**1,280**
Comments: The unit was changed to better reflect program performance changes. Performance is decreasing in 2013, because of proposed funding reductions to the State cooperative project that is primarily related to coal resources data. Budget increases for 2013 will result in performance increases in outyears.									
Number of systematic analyses and investigations delivered to customers (ERP)	**5**	**6**	**5**	**5**	**205**	**150**	**150**	**0**	**175**
Comments: The 2011 actual level was used for re-baslinging the redefined measure. Budget increases for 2013 will result in performance increases in outyears.									
Number of outreach activities provided to customers (ERP)	**8**	**8**	**9**	**10**	**1,570**	**1,500**	**1,600**	**+100**	**1,700**
Comments: The 2011 actual level was used for re-baslinging the redefined measure.									
End Outcome Goal 4.3: Provide Scientific Data to Protect and Inform Communities									
Strategy #2: Identify the Connection Between the Natural Enviornment and Wildlife Health									
Performance Measure	**2008 Actual**	**2009 Actual**	**2010 Actual**	**2011 Operating Plan**	**2011 Actual**	**2012 Enacted**	**2013 Budget Request**	**Change from 2012 Enacted to 2013**	**Long-term Target 2016**
Contaminants Program									
Number of emerging disease outbreak (contaminants and pathogens) investigations (SP)	**672**	**669**	**673**	**679**	**581**	**503**	**503**	**0**	**508**
Toxic Hydrology Program									
Number of knowledge products on environmental contamination provided to support management decisions (Toxics)	**149**	**128**	**115**	**115**	**146**	**115**	**100**	**-15**	**110**
Comments: In 2013, the President's budget proposes a decrease of $2.5 million in ongoing activities and an increase of $2.0 million for new activities related to WaterSMART. The discontinuation of ongoing activities will result in fewer products completed in 2013. The new WaterSMART activities are not anticipated to have products in the first year (2013).									

Activity: Energy, Minerals, and Environmental Health
Subactivity: Mineral Resources

2011 Actual: $52.2 million (356 FTE)
2012 Enacted: $49.2 million (346 FTE)
2013 Request: $45.3 million (312 FTE)

Overview



The Mineral Resources Program (MRP) supports data collection and research on a wide variety of nonfuel mineral resources that are important to the Nation's economic and national security. The MRP's Research and Assessments function helps to understand the geologic processes of concentrated known mineral resources at specific localities in the Earth's crust and to assess quantities, qualities, and distribution of undiscovered mineral resources for potential future supply. The program also conducts research on the interactions of mineral resources with the environment, both natural and as a result of resource extraction, to develop geochemical baselines and better predict the impact that resource development may have on human and ecosystem health. The MRP's Minerals Information function supports collection, analysis, and disseminates data that document production and consumption for about 100 mineral commodities, both domestically and internationally for 180 countries. This full spectrum of mineral resource science allows for a comprehensive understanding of the complete life cycle of nonfuel mineral resources and materials—resource formation, discovery, production, consumption, use, recycling, and reuse—and allows for an understanding of environmental issues of concern throughout the life cycle.

Program Performance

Research and Assessments

In 2011, the MRP delivered results of a multi-year project investigating geologic factors that influence the occurrence and availability of minerals required for emerging technologies, including alternative energy. The major emphasis has been on Rare Earth Elements (REE), which are essential to the development of significant alternative energy projects, as well as for a myriad of electronics critical to defense applications. At present, China produces over 95 percent of the world's supply of REE, although there are numerous known deposits in the United States and elsewhere. Products delivered by this project are already providing data essential to the DOD and the DOE as they analyze how best to secure the REE supply required for defense and energy applications.

The expertise and data that underpin the global mineral resource assessment work being conducted by the MRP (see below) were essential to assistance provided by the USGS to DOD

on understanding the mineral resource potential of Iraq and Afghanistan. Recent efforts during 2009-2011 provided the science, information, and capacity building to assist with economic development and stabilization for both countries, emphasizing the important role USGS and the MRP has to play in the area of science diplomacy.

> "Without the stellar work of USGS, the discovery of Afghanistan's vast resources would not have been possible. The USGS teams in Afghanistan were incredibly professional, courageous, and brilliant. It has been a joy to work with them, as many on my staff often remind me. Indeed, it has been the highlight of many of our careers."
>
> *Paul A. Brinkley, Deputy Undersecretary of Defense, 30 June 2011*

In 2012, the MRP will complete a 10-year cooperative project providing the first-ever global assessment of undiscovered resources of copper, potash, and platinum-group metals, commodities essential to infrastructure, food security, and environmental health. Never before have decisionmakers and scientists had access to a publicly available, globally consistent assessment of this type. This USGS-led international cooperative effort was conducted on a regional, multi-national basis with the participation of dozens of interested national and internal geologic, mineral resource, and other governmental and nongovernmental institutions. The final products of this international collaboration include maps and text describing the distribution of areas permissive for undiscovered deposits of copper, potash, and platinum group metals worldwide and the estimated quantity of metals contained in each area. This body of work will form the basis for decisions about land use and mineral supply in the United States and around the world.

The United States requires a sustainable supply of mineral commodities that are critical to the Nation's economic and national security. Many of these critical mineral commodities (for example, rare earth elements) are increasingly important for clean-energy industries (wind turbines, electric motors, compact fluorescent light), defense applications, and consumer electronics. A geographic concentration in global supply for some of these mineral commodities introduces issues of supply risk. To address these issues, the MRP initiated a new effort, *Critical Mineral Resources for the 21st Century* in 2012. This effort includes (1) analysis of vulnerabilities of global critical mineral supply chains, (2) geologic, geochemical, and geophysical characterization of known domestic critical mineral resources to define criteria for a domestic assessment of undiscovered critical mineral resources for potential future supply, and (3) characterization of environmental pathways and biogeochemical behavior of critical mineral resources and associated metals to better understand potential impacts of resource development on human and ecosystem health, providing essential information for sustainable development of critical mineral resources.

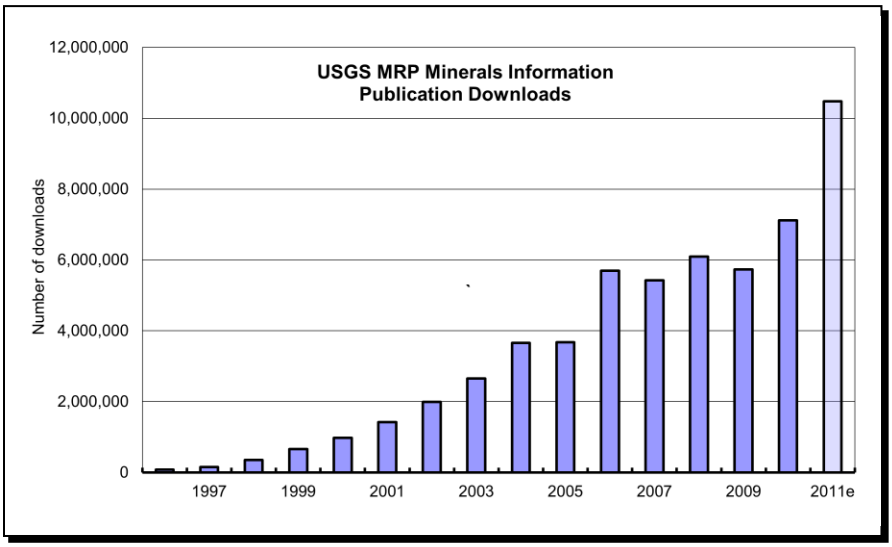
A multi-year effort by the MRP on regional-scale geologic data compilation for Alaska, one of the more underexplored regions of the United States, is continuing in 2012. This work will lead to the release in 2013 of a new State geologic map for Alaska that will be used as an up-to-date geologic foundation for mineral resource assessment activities in Alaska.

Planning and preparing for a new domestic mineral resource assessment, scheduled to begin in 2013, will largely end in 2012 with the completion of three large projects: (1) *Updated National Mineral Resource Assessment—Planning Phase*, (2) *Assessment Techniques for Concealed Mineral Resources*, and (3) *Development of Mineral Environmental Assessment Methodologies*. Major products to be released in 2013 from these three projects will include updated mineral deposit and grade-and-tonnage models that are the keystones for conducting mineral resource assessments.

In 2013, the MRP will proceed with a phased initiation of a new domestic nonfuel mineral resource assessment to document the Nation's known and undiscovered mineral resources and will continue the collaborative effort with the Energy Resources Program to design and initiate a national uranium assessment. The MRP will continue research on the nature and distribution of mineral resources designated as critical to the Nation's economic and national security. The MRP will examine support capabilities, including a restructuring of mineral resource databases and analytical and laboratory capabilities, in order to determine the most efficient structure for program delivery. The MRP will continue mineral environmental research on processes that occur at sites of mined and unmined mineral deposits and basic geologic and mineral deposit research in Alaska.

Minerals Information

In 2011, the use of the USGS minerals information continued to increase. Every year, more than 700 reports are prepared by the USGS and added to the minerals information Web pages *(http://minerals.usgs.gov/)*minerals. The Web site set a new record, averaging nearly 900,000 publications downloads each month in 2011, for a total of nearly 11,000,000.



In 2011, in response to continued interest in rare earth elements and China's dominance in the rare earths' market, the MRP released two reports, "China's Rare-Earth Industry," a brief review of China's rare earth production, consumption, reserves, and trade policies, and "Rare Earth Elements – End Use and Recyclability." Less than 3 weeks after the magnitude 9.0 Tohoku earthquake in Japan, the MRP released a report, "Mines and Mineral Processing Facilities in the Vicinity of the March 11, 2011, Earthquake in Northern Honshu, Japan," that evaluated the potential effects of the disaster on Japan's—and the world's—supply of copper, zinc, titanium, and iodine. This report demonstrated the importance of providing minerals information for analyzing the potential impact of disruption to raw materials supply chains.

In 2012, MRP mineral economists and minerals information specialists will continue to provide minerals information on a regular basis to other Federal agencies, including the U.S. Census Bureau, the Department of Defense, and the Federal Reserve Board (FRB). MRP specialists will also chair and contribute to several Office of Science and Technology Policy (OSTP)-convened working groups that will inform Federal critical minerals policy related to supply chain sustainability, research and development, and information collection and dissemination.

In 2013, the MRP will continue to collect, analyze, and disseminate timely data and information on domestic supply and use for about 100 mineral commodities, and for international minerals information and material flow studies. The USGS mineral commodity specialists will continue to provide production and capacity data for the United States nonfuel minerals industry to the

Federal Reserve Board (FRB). The FRB uses the USGS mineral commodity data to calculate indexes of industrial production, capacity, and capacity utilization, which are among the most widely followed monthly indicators of the U.S. economy.

For more information please go to: *http://minerals.usgs.gov/.*

Activity: Energy, Minerals, and Environmental Health
Subactivity: Energy Resources

2011 Actual: $27.8 (151 FTE)
2012 Enacted: $27.3 (150 FTE)
2013 Request: $30.5 (162 FTE)

Overview

The USGS is the sole provider of unbiased, publicly available estimates of energy resources for the United States, exclusive of the U.S. Outer Continental Shelf, and performs research to forward the science of geologically based energy resources and assessments as well as understand key impacts and issues. Major consumers of the Energy Resources Program (ERP) products are Interior's land and resource management bureaus, other land management agencies such as the U.S. Forest Service, Federal environmental and national security agencies, policymakers and Congressional offices, State geological surveys, energy industry, environmental community, international energy community, nongovernmental organizations, academia, and the public. Providing information utilized to make decisions supporting energy security and environmentally sound production and utilization, ERP activities directly contribute to the DOI strategic plan goal to provide science for sustainable resource use, resource protection, and adaptive management. Because of our reputation of conducting unique, robust, geologically based research and assessments, the ERP was directed by the Energy Policy Act of 2005, and the Energy Independence and Security Act of 2007, to study and assess energy resources including geothermal, alternative energy sources such as gas hydrates and oil shale, unconventional gas resources, conventional oil and gas resources, and to conduct a national geologic carbon sequestration assessment (found under the Climate and Land Use (CLU) Change section).

The ERP conducts research and assessment on many energy resources: National Oil and Gas, World Oil and Gas, Geothermal, Wind, Coal, Uranium, as well as Environmental Studies and Information Delivery. Below are summaries of current research and assessments.

Conventional and unconventional oil and gas resource assessments of the world. An update of global conventional oil and gas resources will be finalized in 2012. The ERP has completed assessments of 120 provinces and will complete the final 20 in 2012. The new assessment of world undiscovered, technically recoverable, conventional petroleum represents 14 additional years of data since the last comprehensive world assessment. In 2012 and 2013, particular emphasis will be placed on the global assessment of technically recoverable resources in continuous (unconventional) accumulations, such as tight gas, tight oil, shale gas, and coalbed gas. Currently, there is no global unconventional resource assessment, yet it is one of the most requested products of the ERP. In 2011, the USGS released the first of its international unconventional resource assessments—the Norte Basin of Uruguay. The ERP will continue to study and assess domestic oil and gas basins as well.

> "Understanding the oil and gas potential of the United States and other countries is important to U.S. foreign and energy policies. USGS energy resource assessments are essential for U.S. national security and diplomacy."
>
> *David Goldwyn, former Special Envoy for International Energy Affairs, Department of State*

Reduce uncertainty and improve future resource assessments. This positions the USGS to better understand possible environmental effects of development and use of these resources.

Study future unconventional resources such as natural gas hydrates and oil shale. The USGS studies gas hydrates in the United States and in cooperation with international colleagues to understand the potential of this resource. Enhance, through research, the recently published national assessment of **geothermal resources** capable of producing electric power to understand the extent to which geothermal resources, including low temperature and unconventional, can play a larger part in the domestic energy mix.

> "California possesses the largest geothermal resource base of any State … the work performed by the USGS is unique—without it we would be forced to rely on inaccurate and outdated information that would inevitably result in flawed policies and decisions."
>
> *W. Glassley, CA Geothermal Energy Collaborative*

Look at impacts of wind energy development in order to develop an assessment methodology of wind energy impacts that can be applied nationwide. In 2012, the ERP will sponsor workshops that will bring together experts in the field to work toward common approaches in the development of a wind energy impact assessment methodology. Results of these workshops will guide future research and the methodology development.

Conduct domestic coal resource assessments to understand how much of the coal resources are available for mining and are technically and economically recoverable (the coal reserve base). Work on the Powder River Basin will be published in 2012. Analysis of the coals in the Colorado Plateau will begin in 2012 and continue into 2013 and 2014.

Environmental and human health research includes the characterization of the volume, quality, and impact of waters co-produced with oil and gas to determine best disposal practices and beneficial uses; the human health impacts of energy resource occurrence and use; legacy environmental impacts from previous uranium mining; and coal quality studies.

The National Coal Resources Data System contains information on location, quantity, attributes, stratigraphy, and chemical components of U.S. coal deposits. A long-term partnership of the USGS and State Geological Surveys enables this sustained effort to collect and analyze basic data, build and verify the digital databases, and serve these USGS-maintained data sets. In 2012 and 2013, the State Cooperative activity will continue to collect information and data on coal and shale gas from those States in which USGS has current activities.

The USGS will develop a methodology and framework for an updated assessment of undiscovered **uranium** resource potential of the United States, to be finalized in 2012. Work in 2012 and 2013 will expand beyond resource assessment to develop a life-cycle approach that complements the national resource assessment, for example evaluating the effect of mining in various geological environments.

Stewardship and access of large volumes of **research information** are necessary to support integrated science and meet Federal information mandates. Delivering ERP information and improving the capacity to do so is a high priority. In 2011, ERP launched a redesigned Web site to improve discovery and navigation, serve more information, and reduce maintenance. A significant proportion of all visits to the USGS's main Frequently Asked Questions site are related to ERP topics. In 2011 and 2012, the ERP worked with the DOE and OSTP, to make a number of ERP products available on a unified Federal Web site that is part of the *data.gov* initiative.

Activity: Energy, Minerals, and Environmental Health
Subactivity: Contaminant Biology

2011 Actual: $9.2 (65 FTE)
2012 Enacted: $9.1 (65 FTE)
2013 Request: $9.9 (66 FTE)

Overview

Contaminant Biology Program (CBP) science is a key resource for managing and protecting the health of the Nation's environment, including the health of fish and wildlife populations. In its 2007 science strategy, the USGS identified *The Role of the Environment and Wildlife in Human Health* as a strategic focus through which the USGS "can make substantial contributions to the well-being of the Nation and the world." In 2011, the USGS established a scientific mission area focused on environmental health science and developed a USGS Environmental Health Strategic Science Plan (EH-SSP) to guide bureau priorities and activities for the next decade.

The CBP, working in close collaboration with the Toxic Substances Hydrology Program (TSHP), funds research and activities that support the priorities identified in the EH-SSP. To maximize resources, the CBP works in close partnership with other USGS mission areas and a multitude of State and Federal agencies and NGOs. These collaborative activities provide a valuable foundation for USGS leadership in the field of environmental health science. In 2013, based on the priorities set out in the EH-SSP, the CBP will focus on providing the natural science needed by resource managers, health professionals, policymakers and the public in three main areas:

- Anticipating, detecting, and preventing adverse health impacts from newly emerging environmental diseases;
- Reducing the impact of environmental diseases on the environment, fish, wildlife, and people including improving management approaches for mitigating the health effects of combined exposure to contaminants and pathogens; and
- Examining biological threats. As the USGS program lead, the CBP will be coordinating and supporting the portfolio of USGS activities to help the Nation prepare for and respond to health related threats resulting from natural and man-made disasters.

Through these activities, the CBP provides leadership and science to inform regulatory decisions; enhance remediation and restoration technologies, and improve best management practices to prevent or mitigate the adverse health impacts of environmental diseases and biological threats.

Program Performance

Providing the Natural Science Needed to Anticipate, Detect, and Prevent the Health Impacts of Emerging Environmental Diseases. Environmentally driven diseases are caused by disease agents such as contaminants and toxins (e.g., endocrine disruptors, pesticides, pharmaceuticals, mercury) and infectious pathogens (e.g., prions, viruses, bacteria, parasites) that constitute a critical threat to environmental health including fish, wildlife, and people. Threats from newly emerging disease agents will continue to increase, resulting in increased health risks and economic vulnerability. Historically, scientists relied on established monitoring programs to assess changes in the environmental conditions that affect disease. That approach allows us to react to past changes, but leaves a significant scientific gap in the Nation's ability to

identify and anticipate emerging health threats. As the number of environmental health threats continues to grow and become increasingly complex, sound science, informed decision-making and early action will be critical for timely and cost-effective prevention and mitigation.

The Natural Science Needed to Reduce the Impact of Environmental Diseases. Environmental factors also influence the distribution, transmission, and severity of existing diseases. It is estimated that 24 percent of the global disease burden and 23 percent of all human deaths are attributable to environmental factors; understanding these factors is critical. Environmental changes resulting from increasing demands for resources and changes from natural processes can increase the risk of exposure to disease agents. Exposure can occur directly from the environment (via water, soil, etc.) or from contact with other organisms (via the food chain, vector-borne, etc.). There is still a significant gap in understanding how changes in environmental processes affect the health of animals and people. The CBP combines research, monitoring, and predictive models to identify and understand the sources, bioavailability, spread, and physiological impacts of emerging disease agents on fish and wildlife species.

Historically, researchers studied the effects of pathogens and contaminants in isolation; yet animals and people are often exposed to both simultaneously. It is critical to identify and assess the potential combined effects of these agents in the environment. To better understand this issue, the CBP is prioritizing research on identifying and evaluating the long term impacts of endocrine disrupting chemicals (EDCs) on fish and wildlife health with implications for human health. These EDCs can have direct toxicological effects (intersex fish, reduced reproduction) and can also affect immune function and genetics increasing an organism's susceptibility to infectious pathogens. The CBP is also developing new, rapid and cost effective diagnostic tools for use in field evaluations and monitoring of EDCs.

The CBP Program Coordinator also serves as the USGS Biological Threat Coordinator, coordinating the portfolio of the USGS biological threat activities. With heightened concerns regarding bioterrorism there is an increasing awareness of the value of using wildlife disease events as an early warning system for detecting human health threats due to chemical agents and zoonotic diseases (diseases transmissible between animals and people). Fish and wildlife can be good sentinels as they are often the first to come in contact with disease agents in the environment. Fish and wildlife disease investigations and laboratory research provide important data for identifying hazards and setting priorities for studies of health effects in animals and people. Most "Select Agents and Toxins" listed in the National Select Agent Registry (a list of select pathogens and toxins deemed a potential threat to human or animal health) can affect or be transmitted by wildlife. The potential role of wildlife is often overlooked yet the dynamics and severity of a biological attack, and the ability to control or stop the spread of a disease, changes dramatically if fish or wildlife become affected or if the agent becomes established in the environment. The USGS provides biological threat expertise to Interior (including Emergency Management), the Department of Homeland Security, the U.S. Department of Agriculture, the Department of Health and Human Services, the U.S. Department of State, and the Department of Defense by developing disease models, maps, and diagnostic tools and providing advice on response strategies for fish, wildlife and zoonotic diseases. The USGS also receives about 1,800 animal carcasses annually and conducts detailed analyses to identify causes of death; disease investigations are co-funded with the Ecosystems Mission Area.

Activity: Energy, Minerals, and Environmental Health
Subactivity: Toxic Substances Hydrology

2011 Actual: $10.8 (53 FTE)
2012 Enacted: $10.6 (53 FTE)
2013 Request: $11.5 (54 FTE)

Overview

The Toxics Substances Hydrology Program (TSHP) supports environmental contamination research, which provides reliable scientific information and tools that explain the occurrence, behavior, and effects of toxic substances in the Nation's natural environments.

Contamination problems addressed by the TSHP are widespread and pose significant risk to human health and the environment. The program focuses on contamination issues of emerging concern based on input from Federal, State, tribal, and local entities, nongovernmental organizations, and others. The program supports laboratory and field based research conducted by large multidisciplinary teams of USGS and other scientists. Field studies are conducted at representative sites, watersheds, or regions. Results provide a foundation for informed decisionmaking by resource managers, regulators, industry, and the public, helping to improve environmental monitoring, characterize and manage contamination, develop best management practices, form regulatory policies and standards, register the use of new chemicals, and guide chemical manufacture and use.

The TSHP reacts rapidly to emerging issues; develops new methods and collects field data in the most susceptible environmental settings across the Nation; maintains field networks and research sites that provide a basis for assessing change; addresses contamination problems at a wide range of geographic scales and environmental settings, and provides fundamental knowledge of the inherent clean-up capacity of our natural environments. Scientific findings are distributed broadly via briefings, workshops, technical meetings, and scientific reports. In the 5-year period 2006–2010, the program produced about 900 scientific publications. The program directly supports the USGS Science Strategy and Interior goals by providing a scientific foundation for decisionmaking and works closely with the CBP. More information about the Toxics program is available on the Web at *http://toxics.usgs.gov/*.

Program Performance

The program has two primary components: investigations of subsurface point-source contamination and investigations of watershed-scale and regional-scale contamination.

Investigations of Subsurface, Point-source Contamination

These investigations improve capabilities to describe, manage, and remediate subsurface contamination from local sources, such as chemical spills, leaking storage tanks, industrial discharges, and leakage from landfills and other waste facilities. The knowledge and new methods developed at intensely studied, representative sites are applied to similar sites across the Nation. Contributions from these investigations during 2011 and 2012 include:

- Publication of a book that is a resource for managers and regulators which compiles the state of the science on the use of plants to restore contaminated environmental media to accepted quality.

- Quantification of the processes that affect contaminant degradation in landfill-leachate-affected groundwater using data from the program's Norman, OK, municipal landfill research site. Knowledge essential for managing long-term environmental impacts of landfill leachate.
- Definition of key microbial pathways for the degradation of solvents in contaminated groundwater.
- Demonstration of the potential transport of *Cryptosporidium parvum* oocysts in groundwater and the effectiveness of riverbank filtration using fluorescent microspheres.
- Development of a new approach that quantifies the mass of solvents removed by pump-and-treat remediation, and showing that previous methods underestimated removal by between 23 and 46 percent

In 2013, the program will contribute to the understanding of subsurface point-source contamination issues associated with contamination in fractured-rock aquifers. Other activities will be evaluated for decrease and termination.

Investigations of Watershed-scale and Regional-scale Contamination

These investigations address nonpoint-source contamination problems typical of widespread land uses or human activities that may pose a threat to human and environmental health throughout a significant portion of the Nation. These investigations include developing laboratory and field methods to ensure accurate measurement of contaminants, characterizing contaminant sources, investigating mechanisms by which source contamination affects aquatic ecosystems, and investigating the processes that transform contaminants into different and possibly more toxic forms. Contributions from these investigations in 2011 and 2012 include:

- Nine of the 12 fungicides of emerging environmental concern were detected in at least one U.S. stream-draining agricultural land, providing the first environmental data for some.
- Six phytoestrogens and two mycotoxins were documented in streams across the State of Iowa. Phytoestrogens (from plants) and mycotoxins (from fungi) are naturally occurring and may contribute to disruption of hormone systems (endocrine disruption) in living organisms.
- Blue-green algae (cyanobacteria) blooms in Midwestern lakes were found to produce mixtures of cyanotoxins and taste-and-odor causing compounds. Cyanotoxins can affect the respiratory system, the liver and kidneys, or nervous system in mammals.
- Analysis of biofilm that coats many of the stones on the bottom of Boulder Creek, CO, demonstrated that the biofilm accumulates endocrine disrupting compounds and may affect exposure of some organisms.
- Laboratory exposure experiments demonstrated adverse health effects on populations of native soil bacteria exposed to sub-therapeutic levels of the antibiotic sulfamethoxazole, a contaminant that has been found in environmental waters by many previous investigators.
- A mobile laboratory at the Boulder Creek research site enabled scientists from the USGS, the University of Colorado, and St. Cloud State University to demonstrate de-masculinization of male fish by exposure to Wastewater Treatment Plant effluent.

In 2013, ongoing research related to improving approaches to setting water quality restoration targets in mined watersheds; defining environmental contamination by assessing mercury methylation and cycling mechanisms; and characterizing discharge of pharmaceuticals from human and animal sources will be evaluated for decreases and potential termination. Planning for implementation of the water quality enhancement of WaterSMART will begin.

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Activity: Natural Hazards

		2011 Actual	2012 Enacted	2013				Change from 2012 Enacted (+/-)
				Fixed Costs and Related Changes (+/-)	Program Changes (+/-)	Internal Transfers	Budget Request	
Earthquake Hazards ($000)		55,979	55,125	241	3,551	0	58,917	3,792
	FTE	246	246	0	-1	0	245	-1
Volcano Hazards ($000)		24,464	24,770	198	0	0	24,968	198
	FTE	147	148	0	0	0	148	0
Landslide Hazards ($000)		3,318	3,266	142	500	0	3,908	642
	FTE	21	21	0	4	0	25	4
Global Seismographic Network ($000)		5,379	5,312	139	0	0	5,451	139
	FTE	13	13	0	0	0	13	0
Geomagnetism ($000)		2,097	2,066	139	0	0	2,205	139
	FTE	13	13	0	0	0	13	0
Coastal & Marine Geology ($000)		44,727	43,941	238	5,150	0	49,329	5,388
	FTE	237	237	0	11	0	248	11
Total Requirements ($000)		**135,964**	**134,480**	**1,097**	**9,201**	**0**	**144,778**	**10,298**
Total FTE		**677**	**678**	**0**	**14**	**0**	**692**	**14**

Summary of Program Changes

Request Component	($000)	FTE	Page
Earthquake Hazards	**3,550**	**-1**	
Rapid Disaster Response: Robust Monitoring Networks	851	1	B-10
Hydraulic Fracturing	1,100	2	B-19
Eastern U.S. Earthquake Research and Assessment	1,600	-4	B-34
Volcano Hazards	**0**	**0**	
Rapid Disaster Response: Robust Monitoring Networks	1,000	3	B-11
Multi-Hazards - National Volcano Early Warning System	-700	-2	B-39
Volcano Observatory Assessments	-300	-1	B-39
Landslide Hazards	**500**	**4**	
Rapid Disaster Response: Robust Monitoring Networks	500	4	B-12
Coastal and Marine Geology	**5,150**	**11**	
Science for Coastal and Ocean Stewardship	5,750	12	B-15
Great Lake Beach Health Study	-600	-1	B-38
Total Program Change	**9,201**	**14**	

Justification of Program Changes

The 2013 Budget Request for Natural Hazards is $144,778,000 and 692 FTE, a net program change of +$9,200,000 and +14 FTE from the 2012 Enacted Budget. For more information on the Natural Hazards Mission Area changes, please see Section B, Program Changes as referenced in the table.

Activity Summary

The Natural Hazards activity includes the Earthquake Hazards Program (EHP), the Volcano Hazards Program (VHP), the Landslide Hazards Program (LHP), the Global Seismographic Network (GSN), the Geomagnetism Program, and the Coastal and Marine Geology Program (CMGP).

Natural hazards threaten the safety, security, and economic well-being of our Nation's communities as well as impact natural resources and surrounding ecosystems. Much of the Nation's infrastructure is aging and vulnerable to sudden extreme events and the cost of response to and recovery from disasters continues to rise. Expanding population in coastal zones, floodplains, wildland-urban interfaces, and areas prone to earthquakes and volcanic eruptions heightens risk of future disasters. In the face of these challenges, the USGS is working with its partners, cooperators, and customers to provide policymakers and the public with a clear understanding of the processes driving these hazards, societal vulnerability to these threats, and strategies for achieving resilience to earthquakes, volcanic eruptions, hurricanes, floods, wildfires, mud slides, and solar storms.

In addition to the USGS's hazard-focused programs, this mission area includes USGS activities that characterize and assess coastal and marine processes, conditions, change and vulnerability. USGS expertise in marine geology, geophysics, and oceanographic disciplines provides science and information products essential to the implementation of priority objectives of the Administration's National Ocean Policy. The National Ocean Policy identifies critical needs for science and information to support broad objectives that include ecosystem restoration and protection, adaptation to climate change, and sustainable development and resources use. The USGS actively engages with other Interior bureaus, Federal agencies, and regional ocean alliances to provide data and tools to support national and regional objectives. USGS efforts to improve and increase understanding in these areas provides managers and policymakers at all levels with tools to make better and more cost effective decisions that anticipate changing conditions and the consequences of resource use, management, and restoration.

In March 2011, a magnitude 9.0 earthquake and an accompanying tsunami struck the eastern coast of Honshu, Japan, with ground shaking levels that most structures were built to survive and did, but with inundation levels that had unanticipated impacts on coastal cities and towns, lifelines, and critical facilities. In August 2011, a much smaller 5.8 magnitude earthquake, struck central Virginia, causing damage locally and in the Nation's Capital some 80 miles away. This earthquake was felt by at least 30 million people and caused disruption and concern throughout the Eastern third of the United States. The eruption of the Icelandic volcano Eyjafjallajokull in the spring of 2010 caused a costly trans-Atlantic and European volcanic ash crisis with commercial air travel shut down for several weeks. These events, each in their own way, demonstrate the seriousness and pervasiveness of natural hazards with threats that are unavoidable but with consequences that are not. This is where USGS science can make a difference.

The Rapid Disaster Response initiative proposed in this budget request would leverage substantial investments in earthquake and volcano monitoring made through the American Recovery and Reinvestment Act (ARRA). During 2010 and 2011, ARRA funding allocated by USGS for Advanced National Seismic System (ANSS) modernization resulted in significant progress toward the replacement of older stations and the upgrading of communications and data centers in 2010 and 2011. Combined with the ARRA network upgrades and ARRA-funded seismic and geodetic monitoring investments being made in 2010-2012 by the National Science Foundation (NSF), our capabilities for monitoring earthquakes have been significantly improved, especially in the Pacific Northwest, and the groundwork has been laid for development of a prototype earthquake early warning system in California. ARRA funds for volcano monitoring supported 17 cooperative agreements between the USGS and universities and State geological surveys. ARRA funding has increased the level of monitoring of the Nation's hazardous volcanoes and facilitated the VHP's ability to accurately interpret and communicate monitoring

information. These partnerships upgraded monitoring infrastructure pursuant to the priorities and plans for the National Volcano Early Warning System (NVEWS). They also produced advances in interpretation and modeling of volcano monitoring data, expanded hazards assessments to address vulnerabilities through GIS techniques, and documented the effects of the numerous recent explosive eruptions of Alaskan volcanoes that pose a substantial threat to aviation.

USGS Natural Hazards programs are critical components of the national hazards, risk and resilience assessment activity called for in the USGS Science Strategy document, *Facing Tomorrow's Challenges*. They also represent important contributions to interagency partnerships, including the multi-agency National Earthquake Hazard Reduction Program (NEHRP), National Space Weather Program (NSWP), and National Tsunami Hazard Mitigation Program, among others. Activities undertaken by these USGS programs are identified as priorities in numerous National Science and Technology Council planning documents, including the Subcommittee on Disaster Reduction's (SDR) *Grand Challenges for Disaster Reduction* (2005), and associated hazard-specific implementation plans for earthquakes, coastal storms, landslides, hurricanes, space weather, tsunamis, and volcanic eruptions (2008-2010), and in joint SDR/U.S. Group on Earth Observations documents *Improved Observations for Disaster Reduction: Near-Term Opportunity Plan* (2006) and *Achieving and Sustaining Earth Observations* plan (2010).

In October 2011, the Natural Hazards Mission Area formed a new project called SAFRR -- Science Application for Risk Reduction. The mission of the SAFRR Project is to innovate the application of USGS hazard science for the safety, security, and economic well-being of the Nation. It builds on the successful Multi-Hazards Demonstration Project, which experimented in new ways of applying USGS hazard science to build resilience in southern California. Scenarios developed by that project led to the Great Southern California ShakeOut public preparedness drill in 2008, which has grown into a series of ShakeOuts in California, Nevada, Oregon, Idaho, Guam, and British Columbia with over 9.5 million participants in 2011. A Central U.S. ShakeOut in 2011 engaged 3 million people in 11 States. The same approach to building an end-to-end scenario of catastrophic impacts has been applied to a California-wide winter storm in the ARkStorm scenario, which is now being used by emergency managers for drills and by many others to work through the impacts of an event that strikes that State with the same frequency as large San Andreas earthquakes and with potentially even greater consequences. Work is underway on a tsunami scenario that looks at the impacts that an Aleutian earthquake-generated tsunami would have, in particular on the Ports of Los Angeles and Long Beach, which handle a large percentage of container traffic in the United States. SAFRR will apply the same scenario-building approach to other types of products with local, regional or national significance.

The American Association for the Advancement of Science 2007 review of the VHP strongly endorsed implementing NVEWS and proposed that the VHP work more closely with State and local partners to develop risk-focused products that deal with future eruption scenarios. From 2008 to 2010, instrumentation and implementation plans for NVEWS were completed. NVEWS served as the blueprint for modernizing the volcano monitoring system under ARRA. During 2010, the USGS strengthened existing volcano partnerships with the Universities of Washington and Utah, created new partnerships with the State of Wyoming and the University of Hawaii at Manoa, and began preparing for creation of a 24/7 seismic alert capability with the National Earthquake Information Center (NEIC).

End Outcome Goal 4.3: Provide Scientific Data to Protect and Inform Communities									
Strategy #1: Monitor and Assess Natural Hazards Risk and Resilience									
Performance Measure	**2008 Actual**	**2009 Actual**	**2010 Actual**	**2011 Operating Plan**	**2011 Actual**	**2012 Enacted**	**2013 Budget Request**	**Change from 2012 Enacted to 2013**	**Long-term Target 2016**
Earthquake and Volcano Hazards									
Percent completion of earthquake and volcano hazard assessments for moderate to high hazard areas (SP)	**26.6%**	**28.5%**	**30.8%**	**33.0%**	**34.0%**	**36.6%**	**38.4%**	**+1.8%**	**43.0%**
Percent implementation of optimal earthquake and volcano monitoring for moderate to high hazard areas (SP)	**24.0%**	**24.6%**	**26.1%**	**28.5%**	**29.5%**	**29.6%**	**29.9%**	**+0.3%**	**30.5%**
Earthquake Hazards									
Number of systematic analyses and investigations completed (EHP)	**132**	**146**	**146**	**157**	**146**	**146**	**150**	**+4**	**150**
Percent completion of optimal monitoring (EHP)	**22.0%**	**23.0%**	**26.0%**	**28.4%**	**30.4%**	**30.2%**	**30.2%**	**0.0%**	**30.2%**
	(1562 / 7100)	**(1633 / 7100)**	**(1846 / 7100)**	**(2013 / 7100)**	**(2158 / 7100)**	**(2142 / 7100)**	**(2142 / 7100)**		**(2142 / 7100)**
Volcano Hazards									
Number of monitoring stations operated by Volcanos Hazard Program (VHP)	**734**	**743**	**743**	**758**	**765**	**773**	**785**	**+12**	**809**
Number of systematic analyses and investigations completed (VHP)	**71**	**99**	**75**	**75**	**124**	**75**	**75**	**0**	**75**
Percent completion of optimal monitoring (VHP)	**26.0%**	**26.1%**	**26.2%**	**28.1%**	**28.6%**	**29.0%**	**29.6%**	**+0.6%**	**30.8%**
	(2291 / 8800)	**(2299 / 8800)**	**(2308 / 8800)**	**(2471 / 8800)**	**(2520 / 8800)**	**(2552 / 8800)**	**(2604 / 8800)**		**(2710 / 8800)**
Landslide Hazards									
Number of systematic analyses and investigations completed (LHP)	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**0**	**15**
Global Seismic Network									
Percent completion of optimal monitoring (GSN)	**79.0%**	**86.0%**	**86.5%**	**88.0%**	**88.6%**	**88.2%**	**88.2%**	**0%**	**88.2%**
	(80.6 / 102)	**(87.7 / 102)**	**(88.2 / 102)**	**(89.8 / 102)**	**(90.4 / 102)**	**(90 / 102)**	**(90 / 102)**		**(90 / 102)**
Geomagnetism									
Percent completion of optimal monitoring (Geomag)	**46.0%**	**45.0%**	**57.4%**	**85.0%**	**84.7%**	**83.3%**	**83.3%**	**0%**	**83.3%**
	(13.8 / 30)	**(13.5 / 30)**	**(17.226 / 30)**	**(25.5 / 30)**	**(25.4 / 30)**	**(25 / 30)**	**(25 / 30)**		**(25 / 30)**
End Outcome Goal 4.2: Provide Science for Sustainable Resource Use, Protection and Adaptive Management									
Strategy #2: Identify and Model Causes and Impacts of Changes to the Earth and Ocean Systems									
Performance Measure	**2008 Actual**	**2009 Actual**	**2010 Actual**	**2011 Operating Plan**	**2011 Actual**	**2012 Enacted**	**2013 Budget Request**	**Change from 2012 Enacted to 2013**	**Long-term Target 2016**
Coastal and Marine Geology									
Percent of regional and topical ocean and coastal studies that cite USGS products within three years of study completion (SP)	**80%**	**80%**	**80%**	**80%**	**81%**	**79%**	**80%**	**+1%**	**82%**
	(24 / 30)	**(24 / 30)**	**(24 / 30)**	**(24 / 30)**	**(26 / 32)**	**(22 / 28)**	**(20 / 25)**		**(23 / 28)**
Cost of collection and processing of LIDAR data for coastal characterization and impact assessments (per megabyte of data collected) (CMGP)	**0.50**	**0.44**	**0.39**	**0.32**	**0.34**	**0.31**	**0.35**	**+0.04**	**0.30**
Number of gigabytes of LIDAR data collected annually (CMGP)	**N/A**	**100**	**555**	**300**	**300**	**300**	**500**	**+200**	**800**
Comments: The increase of gigabytes relates to the replacement of one instrument (flown on USGS aircraft) and the addition of another instrument which will be flown on a NOAA aircraft, therefore getting more airtime and more data collection annually.									
Number of systematic analyses and investigations completed (CMGP)	**200**	**200**	**214**	**210**	**152**	**193**	**178**	**-15**	**185**
Comments: There is a reduction in performance in 2013 because there is a reduction for some assessment activities. The increase in 2013 funding for Coastal and Marine Geology will primarily support data management and data delivery activities, and to a lesser degree will result in more reports and systematic analyses in the outyears (2014 and beyond). Due to the interest in Ocean information management and delivery to support the National Ocean Policy, a new data management performance measures is under consideration.									

Activity: Natural Hazards
Subactivity: Earthquake Hazards

2011 Actual:	$56.0 million (246 FTE)
2012 Enacted:	$55.1 million (246 FTE)
2013 Request:	$58.9 million (245 FTE)

Overview

Earthquakes, of all natural hazards, pose the greatest threat for inflicting catastrophic casualties, damage, economic loss, and disruption to the United States. Over 75 million people live in metropolitan areas with significant earthquake risk. Areas at risk include not only California, but also the Mississippi River valley, Pacific Northwest, intermountain West, Alaska, Hawaii, U.S. Territories, and parts of the eastern seaboard. The impacts of large earthquakes are sudden, widespread, devastating, and long lasting.

The USGS EHP is the applied Earth science component of the multi-agency NEHRP, reauthorized by the Earthquake Hazards Reduction Authorization Act of 2004 (P.L. 108–360). NEHRP is built on the efforts and activities of four agencies, each with its own unique role and area of responsibilities, yet each in mutual support of and dependence on its partners.

Through the ANSS, the USGS and its State and university partners provide seismic monitoring coverage for the Nation and immediate notifications of earthquake occurrences and impacts. Through its national seismic hazard maps and earthquake scenario publications, the USGS provides the ground shaking estimates needed for model building codes, earthquake preparedness, and earthquake response planning. Through its targeted research, internal and external, the EHP improves the products associated with these activities and addresses specific problems in earthquake causes and effects. Partnerships are crucial to the program's success.

Program Performance

Assessment and Characterization of Earthquake Hazards

The USGS contributes to earthquake hazard mitigation strategies by developing seismic hazard models and maps at various scales that describe the likelihood and potential effects of earthquakes throughout the Nation.

In 2012, the EHP will begin the process of developing the next generation national seismic hazard assessment and maps, to be completed in 2014. The process begins with a series of regional and topical workshops to garner recent research results and knowledge and to openly discuss the application of this information for revising the national assessment. This is an important step in building a consensus on the validity of the revised assessment and ensuring its adoption by the user community. Efforts in 2013 will be focused on incorporating the results of the 2012 workshops into a revised national seismic hazard assessment.

The EHP also works with States and local communities to develop large-scale, seismic hazard maps for urban regions. These maps are used in earthquake emergency response planning and in implementing earthquake loss reduction measures. During 2012–2013, the EHP will cooperate with regional and local partners in Missouri, Utah, and Nevada to conduct geologic

mapping and geophysical surveys to provide the scientific foundation for seismic hazard maps of urban areas in these States.

Included in this program activity are post-earthquake scientific investigations to determine the cause and impacts of damaging earthquakes. These studies provide valuable data and insights that are applied to increasing safety and reducing losses in future earthquakes. In 2011, the EHP responded with field studies of domestic earthquakes across the country.

Monitoring and Reporting Earthquake Activity and Crustal Deformation

The USGS ANSS effort is an initiative to expand and improve the performance and integration of national, regional, and urban seismic monitoring networks in the United States. The system consists of a national ANSS backbone network, the NEIC, 14 partner-operated regional networks in areas of moderate-to-high seismic activity, and the National Engineering Strong Motion Project for monitoring earthquake shaking in structures. A major outcome of the ANSS effort has been to develop advanced earthquake notification and impact assessments products. These products are used by emergency response managers, facility operators, and the general public. By the end of 2011, the USGS and partners had installed a cumulative total of 2,142 ANSS earthquake monitoring stations. The network is now capable of detecting almost all felt earthquakes in the United States, except in remote areas of Alaska. The NEIC is prepared to report on domestic earthquakes within minutes of their occurrence.

Conducting Research into Earthquake Causes and Effects

The USGS conducts research on the causes, characteristics, and effects of earthquakes. This research has direct application in increasing the accuracy and precision of USGS earthquake hazards assessments, earthquake forecasts, and earthquake mitigation practices. Research activities for 2012 and 2013 include:

EHP scientists will continue to study seismicity induced by development of geothermal and hydrocarbon energy resources and disposal of waste fluids. The objective of these studies is to inform the development of standards or protocols for pumping rates and volumes that would minimize the potential for induced seismicity.

The USGS will work to improve ground-motion prediction equations, the foundation for seismic hazard maps and related planning tools. Ground motion prediction equations for the Western United States are being updated for delivery in 2012, using new ground-motion recordings from recent earthquakes, in a project led by the Pacific Earthquake Engineering Research consortium. For the Eastern United States, where earthquakes are less frequent, work is underway to gather all available earthquake ground shaking records to revise models of how seismic shaking diminishes with distance. The results for the Eastern United States should be completed in 2013.

The USGS will continue to support external research to take advantage of specialized expertise and experience not available within the USGS. This support broadens our scientific knowledge base and, through partnerships, leverages our access to research facilities and results. This activity involves partnerships with the Southern California Earthquake Center, the Earthquake Engineering Research Institute, and over 60 other organizations including State geological surveys, academic institutions, and private consulting firms.

Activity: Natural Hazards
Subactivity: Volcano Hazards

2011 Actual:	$24.5 million (147 FTE)
2012 Enacted:	$24.8 million (148 FTE)
2013 Request:	$25.0 million (148 FTE)

Overview

Under the Stafford Act (P.L. 93–288), the Department of the Interior has the responsibility to issue timely warnings of potential geologic disasters, among them volcanic eruptions, to the affected populace and civil authorities. Much of the monitoring data from volcanoes are available to the public in near-real-time through data centers and the VHP Web sites.

The USGS provides geoscience data, analyses, and research needed to reduce the loss of life, property, and economic and societal impacts of hazards related to volcanoes. To reduce societal exposure to the threats posed by volcanoes, the VHP conducts a range of activities that may be broadly divided into volcano hazard assessment and volcano-monitoring components. The long-term goal for the volcano hazard assessment component of the VHP is to provide hazard assessments for all dangerous volcanoes in the United States and its Territories and to establish response plans for all communities threatened by those volcanoes. Each volcano hazard assessment requires a geologic map and involves field work, laboratory analysis, and data analysis by research scientists, typically requiring 3–5 years to complete.

The volcano monitoring component of the VHP involves collection and scientific interpretation of real-time and near-real-time geophysical data from extensive networks used to characterize the state of volcanic systems; integration of data collected by other groups, such as National Aeronautics and Space Administration (NASA) and the National Oceanic and Atmospheric Administration (NOAA) imagery and the NSF-supported sensors; management and distribution of data to provide products for hazard awareness, transparency of operations, and credibility of interpretations with the public; and to give decisionmakers tools to manage risks from volcanic eruptions. During volcanic crises, the VHP provides 24/7 technical assistance to emergency response agencies. Ultimately, the VHP's mission is to prevent extreme volcanic events from becoming disasters.

Progressive implementation of NVEWS, a comprehensive and prioritized modernization and unification of the monitoring infrastructure of the five USGS volcano observatories, is now the central goal of the VHP. NVEWS will move the VHP toward state-of-the-art monitoring of all hazardous volcanoes at levels commensurate with the threats posed. The NVEWS concept also calls for 24/7 alerting, organized and openly accessible data for all potentially hazardous U.S. volcanoes, and new hazard information products for the most vulnerable communities, businesses, and infrastructure.

Program Performance

Response to Eruption and Unrest – The VHP focuses resources toward response to volcanoes that are erupting or exhibiting unrest (earthquakes, deformation, increased heat emission, or gas emissions) that may be precursory to an eruption. It is impossible to predict which volcanoes will awaken in 2013; however, the ongoing eruptive activity of Kilauea volcano in Hawaiian Volcanoes National Park, which entered its 29th year in 2012, will likely continue to

require attention. Explosions and high levels of toxic gas emission repeatedly threaten national park visitors and nearby residential areas, requiring close coordination among the USGS Hawaiian Volcano Observatory, the National Park Service, and the Hawaii County Civil Defense. Explosive eruptions will likely recur in Alaska, following the major eruptions of Augustine in 2006, Okmok and Kasatochi in 2008, and Redoubt in 2009. Such events may require program-wide responses lasting from days to months. Eruptions are also likely in the Commonwealth of Northern Marianas, where explosions at Sarigan and Pagan triggered evacuations of U.S. Fish and Wildlife Service researchers in 2010, and SO_2 gas emission from Anatahan intermittently degrades air quality in Saipan. Recurrent episodes of unrest in Long Valley (Mammoth Lakes, California) and Yellowstone (Wyoming) calderas carry the potential for significant economic disruptions in these popular recreational destinations, which can only be mitigated by real-time monitoring data and the credibility and transparency in the development of warnings and advisories that VHP provides.

The USGS will continue its Volcano Disaster Assistance Program (VDAP), a joint project with the United States Agency on International Development (USAID) Office of Foreign Disaster Assistance (OFDA). Noteworthy recent VDAP activities include crisis responses to unrest and eruptions in Colombia, Chile, Saudi Arabia, and Indonesia, where in 2010 VDAP's work saved tens of thousands of lives. With increased support from the OFDA in 2011 and 2012, VDAP expanded work with Indonesian and Latin American counterparts in capacity building, enhanced technology transfer efforts, and strengthened its global rapid-response capability. VDAP remains the foremost emergency volcano team in the world, and brings home important lessons learned to aid crisis response in the United States.

Other international linkages – In 2011, the VHP continued to assist the International Civil Aviation Organization with the issue of ash cloud hazard mitigation. The VHP partnered with Italy's Istituto Nazionale di Geofisica e Vulcanologia to bring volcano observatory scientists from 27 countries together in a first Volcano Observatory Best Practices Workshop to identify successful methodologies in eruption forecasting and develop much needed global communication among observatories. The USGS signed a memorandum of understanding with the Geological Society of Japan (GSJ) in 2011, through which the VHP and the GSJ will share data, techniques, and experience in volcano hazards for mutual benefit. The VHP, working in concert with other USGS programs and other Federal agencies, met repeatedly with Russian counterparts to advance bilateral cooperation in geohazards under the aegis of the Bi-Presidential Commission. Strengthened cooperation in geophysical monitoring and risk mitigation will especially benefit American and Russian residents of the disaster-prone northern Pacific Rim.

Volcanic Hazard Assessments and Systematic Analyses – The VHP will continue to make progress on the production of volcanic hazard assessments to guide development of community response plans and interpretation of volcanic unrest. Increasingly, this work will include quantification of risk through consideration of vulnerabilities.

Eruption Response Plans – The USGS will continue efforts to develop eruption response plans such as the interagency community response plan for the Mount St. Helens/Mount Adams region of Washington State that was completed in 2009, and the regional interagency ash-aviation plan for the Western conterminous United States that was completed in 2011. Development of these plans will ensure the USGS and other Government agencies directly involved in the response to volcanic activity, as well as the aviation community, will coordinate activities and thereby minimize societal and economic disruption.

Activity: Natural Hazards
Subactivity: Landslide Hazards

2011 Actual:	$3.3 million (21 FTE)
2012 Enacted:	$3.3 million (21 FTE)
2013 Request:	$3.9 million (25 FTE)

Overview

Landslide hazards research concentrates on understanding landslide processes, developing and deploying instruments that monitor threatening landslides, and forecasting the onset of catastrophic movement of future landslides. Research on processes and forecasting methodologies is conducted on the types of landslides that result in human and economic losses in the United States such as landslides related to steep slopes, heavy rains, and vegetation loss due to wildfires.

The USGS deploys near-real-time monitoring systems at active sites to gather continuous rainfall, soil-moisture, and pore-pressure data needed to understand the mechanisms of landslide occurrence. Such understanding can form the scientific underpinnings for early warning of conditions that may trigger landslides. A landslide early-warning system based on such information is useful in reducing hazards in landslide-prone areas.

USGS scientists respond to landslide emergencies and disasters nationwide. Federal, State, and local agencies are assisted through landslide site evaluations and recommend strategies for reducing ongoing and future damages from landslides. The LHP works in conjunction with the National Weather Service (NWS) to issue advisories and press releases regarding the potential for landslide activity in previously burned areas in southern California. For foreign disasters, the USGS works with the USAID OFDA in responding to appeals for technical assistance from affected countries.

Consistent with Interior's goal to protect lives, resources, and property by providing information to assist communities in managing risks from natural hazards, the USGS provides timely information through the National Landslide Information Center (NLIC). The Center communicates with the public about current emergency responses and provides information to the external user-community through fact sheets, books, reports, and press releases.

Program Performance

Primary LHP activities include conducting landslide hazard assessments, landslide monitoring, and disseminating landslide information.

Landslide Hazard Assessment Activities

In 2011, the LHP delivered emergency assessments of debris flow hazards following several major fires in New Mexico and Arizona. The report and maps generated from these assessments were provided to the public, the Forest Service, the NWS, and local county emergency response, public works, and flood control agencies before the onset of winter rains. These products were provided as part of the Multi-Hazards Demonstration Project for southern California and the desert Southwest. Other assessment activities include assessment of rock fall hazards at Timpanogos Cave National Monument and at Yosemite National Park, ongoing

monitoring, modeling and assessments in western Oregon, and hazard assessments and inventories of landslides in glacial lake clays in northern Pennsylvania.

The LHP provides susceptibility maps, hazard assessments, and emergency warnings to a broad range of Federal and State agencies ranging from the U.S. Forest Service to local community emergency managers. All of these jurisdictions use USGS products to mitigate the effects of landslides and debris flows through land use planning, response planning, and warning systems. In 2012 and 2013, the LHP will continue to provide information to counties and other jurisdictions in Oregon, California, Colorado, Pennsylvania, New York, Tennessee, and to Interior land management agencies along with other Federal agencies that incorporate this information into emergency response and land use plans and warning systems.

Landslide Monitoring Activities

Sustained efforts in landslide monitoring have led to significant advances in understanding of slope stability and landslide processes. In 2012 and 2013, the LHP will continue to develop rainfall thresholds for areas burned in the desert Southwest, and Western and Rocky Mountain States that will refine the predictive capabilities of the joint NOAA/USGS early warning system. In 2012, the LHP will continue monitoring and analyses of the rainfall response of landslides and landslide-prone areas in western Oregon, at the Ferguson landslide near Yosemite National Park, along U.S. Highway 50 in California, and at Chalk Cliffs in Colorado. In 2011, the LHP completed the user's guide for a three-dimensional slope-stability model developed by the LHP and other USGS scientists to serve numerous public and private users of landslide information.

In 2012, the LHP will continue to respond to landslide emergencies in the United States and internationally and to monitor landslides where necessary. Information and maps of post-fire debris flows in southern California will be entered into interactive geographic information system (GIS) databases to provide immediate and comprehensive response tools for decisionmakers and the public. In 2012, the LHP will release a Web-based survey instrument, "*Did You See It Slide?,"* for the public to register landslide information after it happens in their neighborhoods with a goal of engaging citizens in learning about and reporting landslide hazards.

Landslide Information Dissemination Activities

The LHP will continue to respond to inquiries from the public, educators, and public officials on hazard mitigation, preparedness and avoidance strategies for landslide hazards. The NLIC will continue to provide leadership for the National Landslide Hazard Exchange Group, a group of landslide experts from the USGS and State geological surveys who are striving to create an inventory of landslides in the United States.

The Landslide Handbook, "*A Guide to Understanding Landslides,"* was translated into Portuguese, Japanese, Chinese, and Spanish with the dedicated help of the Geological Survey of China and the World Bank. This publication, coauthored by USGS and Geological Survey of Canada scientists, is an important layperson's guide that explains what citizens can do to mitigate the threat of landslide hazards. In 2011, this publication won the Geological Society of America Burwell Award and the International Coalition of Landslides Best Publication Award. It can now reach a broader audience, and plans for translations into other languages continue to be explored.

Activity: Natural Hazards
Subactivity: Global Seismographic Network

2011 Actual:	$5.4 million (13 FTE)
2012 Enacted:	$5.3 million (13 FTE)
2013 Request:	$5.5 million (13 FTE)

Overview

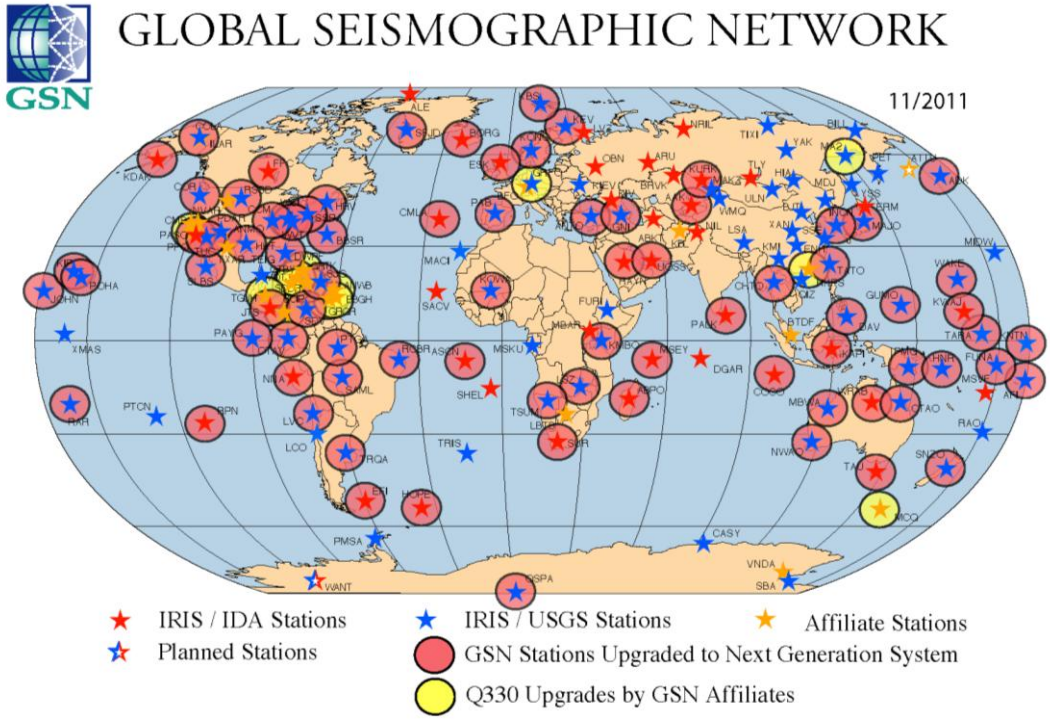
The Global Seismographic Network (GSN) provides high-quality seismic data needed for earthquake alerting, tsunami warning, hazard assessments, national security (through nuclear test treaty monitoring), earthquake loss reduction, and research on earthquake sources and the structure and dynamics of the Earth. The GSN is a joint program between the USGS and NSF implemented by the USGS, the Institute for Geophysics and Planetary Physics (IGPP) of the University of California and the Incorporated Research Institutions for Seismology (IRIS), a consortium of universities. The network currently consists of 150 globally distributed seismic stations, installed over two decades by the USGS and the IGPP.

Network 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, the monitoring and maintenance of telecommunications, troubleshooting problems and providing major repairs, conducting routine service visits to network stations, training station operators, providing some limited financial aid in support of station operations at those sites lacking a host organization, and ensuring data quality and completeness.

An important aspect of GSN activities is evaluating, developing, and advancing new technologies in sensors, instrument installation, data acquisition, and management. To improve performance, stations with unusually high background noise are relocated to quieter sites or configurations (e.g., burying sensors in boreholes) so that smaller events (earthquakes or explosions) or other signals of interest may be detected.

Because of its real-time data delivery, the GSN has become a critical element of continuous USGS hazard warning activities. Ninety-seven percent of GSN stations transmit real-time data continuously to the USGS National Earthquake Information Center in Golden, Colorado, where they are used, along with data from other networks, to rapidly determine the locations, depths, magnitudes, and other parameters of earthquakes worldwide. The high quality of 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. These parameters are essential for modeling earthquake effects.

All GSN data are available to the public and scientists around the world via the IRIS Data Management Center (DMC). Data from the GSN are used extensively for basic and applied research on earthquakes, Earth structure, and other geophysical problems in studies conducted and supported by the USGS and other agencies such as the NSF, the U.S. Department of Energy (DOE), and the U.S. Air Force (USAF).



Map showing progress upgrading the stations of the GSN, through November 2011. Upgrades will continue in 2012 using equipment purchased with economic stimulus (ARRA) funds.

Program Performance

In 2013, the USGS will:

- Continue to operate the 100-station USGS portion of the GSN at a high level of data recovery, real-time telemetry performance, and high cost-efficiency;
- Work with IRIS on issues related to replacement of the GSN's primary sensors (instruments that record a very broadband spectrum of seismic ground motion); and
- Work with partners such as the USAF, the Comprehensive Nuclear Test Ban Treaty Organization, and the International Federation of Digital Seismographic Networks, to improve the efficiency of station operations and reduce maintenance costs.

Other Agency programs will continue to be supported through this effort, including:

- NOAA's Tsunami Warning Program and National Tsunami Hazard Reduction Program;
- The USAF and DOE nuclear test monitoring research programs; and
- The NSF, whose Earth science research programs use GSN data for research on Earth structure and dynamics, wave propagation, earthquake source complexity, and climate change.

Activity: Natural Hazards
Subactivity: Geomagnetism

2011 Actual:	$2.1 million (13 FTE)
2012 Enacted:	$2.1 million (13 FTE)
2013 Request:	$2.2 million (13 FTE)

Overview

With the rise of solar activity, 2013 is expected to bring numerous magnetic storms, caused by the dynamic interaction of the Sun, the solar wind, and the Earth's magnetic field. Large storms can adversely affect the infrastructure and activities of our modern, technology based society. They can cause the loss of radio communication, reduce the accuracy of global-positioning systems, damage satellite electronics and affect satellite operations, enhance radiation levels for astronaut and high-altitude pilots, increase pipeline corrosion, and cause voltage surges in electric power grids, causing blackouts. The estimated annual economic impact of magnetic storms runs into the hundreds of millions of dollars. Continuous, real-time monitoring of the geomagnetic field is important for national security. Drilling programs undertaken by the oil and gas industries rely on magnetic orientation, and these can be degraded during magnetic storms, particularly at high latitudes. Magnetic-field data are also used to check historical property boundaries, many of which were originally established using magnetic orientation from compasses.

The USGS Geomagnetism program is an integral part of the National Weather Space Program (NSWP), which coordinates activities in Department of Defense, NOAA and NSF. The USGS provides ground based observations of geomagnetic activity, operating a network of magnetic observatories capable of accurately measuring the geomagnetic field across a wide range of timescales. The program provides magnetic data and products to various governmental, academic, and private institutions and conducts research on the nature of geomagnetic variations for purposes of scientific understanding and hazard mitigation. The USGS coordinates its work with foreign national geomagnetism programs through INTERMAGNET, a worldwide consortium of observatory programs, and the International Association of Geomagnetism and Aeronomy.

Within the NSWP, a major effort in 2012 will be the development of an interagency implementation plan for a unified space weather capability. The USGS will participate in this activity by representing the ground-based sensing component for geomagnetic activity.

Program Performance

Program activities include operating geomagnetic observatories, managing data and developing products, and conducting scientific research to develop space weather diagnostics for hazard mitigation.

Geomagnetic Observatory Operations

The USGS operates a network of 14 geomagnetic observatories, distributed across the United States and its Territories. Data are collected continuously from each observatory by a variety of instruments housed in buildings designed to provide environmental stability and to ensure long-term baseline accuracy. Each site is visited regularly to conduct calibrations of the instruments.

Data are transmitted in real time to project headquarters in Golden, Colorado, via a set of satellite and Internet linkages. Operational systems upgrades, combined with portable acquisition system design for testing of new operational configurations and rapid deployments, will benefit users through improved data quality, timeliness, and availability.

Data Management and Product Development

Once data from the observatories are received in Golden, Colorado, they undergo initial processing and are organized for immediate transmission to both NOAA's Space Weather Prediction Center in Boulder, Colorado, and the Air Force Weather Agency in Omaha, Nebraska. For longer-term studies, the magnetic data are further refined using periodic calibrations for each observatory, making them useful for research on rapid magnetic field variations and for mapping the field on a global scale. These fully calibrated, definitive data are published yearly in cooperation with foreign national geomagnetism programs, working through the INTERMAGNET consortium. The USGS also distributes magnetic field data, maps, and real-time data products through the *http://geomag.usgs.gov* Web site, which receives an average of over 30,000 Web hits per day from the public.

Scientific and Applications Research

The USGS conducts geomagnetic research to better understand basic physical processes and the effects of solar-terrestrial interaction on the infrastructure and activities of our modern, technologically based society. Recent projects have included development of statistical and time series methods for characterizing long term changes in geomagnetic activity; development of a method for mapping magnetic disturbance during storms; development of methods for measuring magnetic storm intensity; analysis of the recent solar-cycle minimum; analysis of possible links between solar-terrestrial interaction and global climate change; and analysis of claims of magnetic precursors to earthquakes.

Over the next 2 years, and in response to the solar maximum that is anticipated in 2013, USGS research staff will develop methods for constructing improved crustal electrical conductivity maps that are needed for diagnosis and prediction of storm-time, localized geomagnetically-induced currents of concern to the power-grid industry; conduct research and development on algorithms for identifying and cataloging geomagnetic substorms; and develop methods for estimating the rate of occurrence of rare magnetic storms, including methods for estimating the errors associated with these occurrence rates. Results from these projects will help make assessments of geomagnetic hazards and the risks that they pose.

Activity: Activity: Natural Hazards
Subactivity: Coastal and Marine Geology

2011 Actual: $44.7 million (237 FTE)
2012 Enacted: $43.9 million (237 FTE)
2013 Request: $49.3 million (248 FTE)

Overview

The CMGP applies capabilities in marine geology, geochemistry and oceanography to provide information and research products on conditions and processes critical to the management of the Nation's coastal, ocean and Great Lakes environments. Program activities include characterizing ocean and coastal geological setting, processes, and change to provide the framework understanding for management and policy in response to a range of issues; developing regional and national hazard, resource and environmental assessments of coastal and marine conditions, change, and vulnerability; developing models of coastal and marine change; and developing and implementing national, regional, and topical studies that advance knowledge relevant to national issues.

Program Performance

For 2013, program performance will reflect a significant shift in USGS activities, including a focus on science to support the National Ocean Policy. The USGS will work with Interior and other Federal agencies to establish data standards and delivery systems to increase application of research products; to collect and integrate data for coastal and marine maps and data layers; and to characterize the vulnerability of marine habitats and energy, communication and transportation structures to seafloor change. The USGS, as Interior's primary member of the Interagency Task Force on the Extended Continental Shelf, will use 2012 to analyze data and write reports from 2010 and 2011 research cruises in the Arctic, Bering Sea, and Gulf of Alaska.

Examples of recent accomplishments include:

Data collection and interpretations resulted in a consistent National Assessment of Shoreline Change; development of new methodologies supporting regional shoreline assessments of sea level rise vulnerability; and provision of assessments of pre-storm hurricane vulnerability and post-storm impacts. These data and research products were "repurposed" subsequent to the Deepwater Horizon Oil spill and were the basis for USGS forecast maps of the vulnerability of gulf-coast shorelines and habitats to oil-spill inundation.

Assistance to Japanese scientists documenting the March 2011 Tohoku-oki tsunami, its impacts, and geologic evidence of past tsunamis in Japan. As invited members of an international tsunami survey team, USGS researchers participated in the collection of the most comprehensive dataset ever compiled on tsunami deposits and tsunami characteristics. The new data will improve methodologies for applying geologic records to tsunami hazard assessments, particularly in California and Alaska where USGS efforts to determine the size and frequency of past tsunamis will inform approaches to U.S. tsunami hazard assessment.

Publication of a special report in *Marine Geology* on the "Tsunami Hazard Along the U.S. Atlantic Coast." Field surveys, monitoring and modeling of Caribbean and Atlantic tsunami

sources and development of assessments methods were conducted in partnership with the U.S. Nuclear Regulatory Commission and academic cooperators.

Enhancement and improvement of environmental monitoring, analyses and modeling in the Great Lakes are providing data and forecasts that allow public health agencies to better anticipate when beach conditions represent a threat to human health. Results show that application of study methods and models can substantially reduce economic costs associated with unnecessary beach closings while still protecting human health.

Completion of the Tampa Bay integrated science study (*http://pubs.usgs.gov/circ/1348/*)**,** a partnership with 120 contributors from 56 different Federal and State agencies, municipalities, academics, and nongovernmental organizations, to develop a comprehensive scientific understanding of a heavily-impacted estuarine ecosystem.

Efforts to understand the resource potential and climate role of marine gas hydrates resulted in publication of a special volume of *Marine and Petroleum Geology* on the results of a major drilling project on the Alaskan North Slope, and a high-profile paper in *Nature Geoscience* synthesizing current understanding of the role of gas hydrates in the global carbon cycle.

In 2012 and 2013, a variety of efforts are being completed or will continue including:

Completion of the USGS Northern Gulf of Mexico Coastal Ecosystem Change and Hazards Susceptibility study. Final products will be delivered in 2012, and include special Issues of the *Journal of Coastal Research* (JCR) and the *International Journal of Remote Sensing* (IJRS).

Engaging with Interior bureaus and other Federal agencies in implementing Coastal and Marine Spatial Planning (CSMP). CMSP is a science based process for setting goals and determining how the ocean, coasts, and Great Lakes can be sustainably used and protected. The framework provides guidance for collaborative development, including Federal, State, tribal, and other partners; to develop capacity, leverage existing efforts, and gain efficiencies from lessons learned. Effective implementation of CMSP to meet policy objectives is predicated on the availability, integration, and application of diverse information resources, including data, models, and assessments. The USGS, as part of this collaborative effort, will develop information resources, integrate existing information systems, and contribute to the development of a comprehensive CMSP Information Management System.

Extending river and coastal monitoring of changes to the Elwha River system, following dam removal in 2011, on habitats and sediment processes, as part of restoration of salmon ecosystems within the Puget Sound – Georgia Basin.

Evaluating sea floor disturbance, and its variation in time and space, caused by waves and currents that influences ecosystem function and structure, the distribution of sand resources, coastal erosion, the fate of contaminated sediments and the vulnerability and impact of seabed development (pipelines, energy infrastructure). Results will integrate mapping, sampling, and process models to assess bottom disturbance vulnerability over the continental margin, providing information needed to plan for renewable energy development on the U.S. margin.

Documenting and forecasting the fate and consequences of the shoreline berm construction to mitigate the impacts of the Deepwater Horizon oil spill, identifying the impact of the berm on shoreline process and island habitat health and stability and its effect on the long-term response of barrier islands to storms and sea level rise.

Activity: Water Resources

		2011 Actual	2012 Enacted	2013				Change from 2012 Enacted (+/-)
				Fixed Costs and Related Changes (+/-)	Program Changes (+/-)	Internal Transfers	Budget Request	
Groundwater Resources ($000)		8,481	8,916	141	2,600	0	11,657	2,741
	FTE	64	64	0	-1	0	63	-1
National Water Quality Assessment ($000)		64,234	62,909	318	-1,049	0	62,178	-731
	FTE	467	467	0	-13	0	454	-13
National Streamflow Information Program ($000)		27,100	29,358	159	2,953	0	32,470	3,112
	FTE	106	106	0	2	0	108	2
Hydrologic Research and Development ($000)		11,932	11,665	228	3,600	0	15,493	3,828
	FTE	262	262	0	2	0	264	2
Hydrologic Networks and Analysis ($000)		30,719	31,329	201	-2,800	0	28,730	-2,599
	FTE	201	204	0	-17	0	187	-17
Cooperative Water Program ($000)		63,471	63,985	278	-4,963	0	59,300	-4,685
	FTE	377	377	0	-16	0	361	-16
Water Resources Research Act Program ($000)		6,486	6,490	0	-6,490	0	0	-6,490
	FTE	2	2	0	-2	0	0	-2
Total Requirements ($000)		**212,423**	**214,652**	**1,325**	**-6,149**	**0**	**209,828**	**-4,824**
Total FTE		**1,479**	**1,482**	**0**	**-45**	**0**	**1,437**	**-45**

Summary of Program Changes

Request Component	($000)	FTE	Page
Groundwater Resources	**2,600**	**-1**	
WaterSMART: National Groundwater Monitoring Network	2,500	10	B-6
Hydraulic Fracturing	2,100	0	B-19
Availability Studies	-2,000	-11	B-39
National Water Quality Assessment	**-1,049**	**-13**	
WaterSMART: National/Regional Synopsis & Surveys	500	3	B-6
WaterSMART: Water Quality Enhancement	2,000	12	B-7
WaterSMART: Program & Information Management	500	2	B-8
WaterSMART: Predictive Models	500	2	B-8
Ecosystem Priority: Chesapeake Bay	500	2	B-22
Ecosystem Priority: California Bay Delta	1,000	1	B-25
Methods Development and Monitoring	-6,049	-35	B-40
National Streamflow Information Program	**2,953**	**2**	
Rapid Disaster Response: Robust Monitoring Networks	5,500	0	B-12
Ecosystem Priority: Columbia River	100	1	B-23
Ecosystem Priority: Upper Mississippi River	200	1	B-25
Federal Network Operations	-2,847	0	B-40
Hydrologic Research and Development	**3,600**	**2**	
Hydraulic Fracturing	2,000	1	B-19
Ecosystem Priority: Puget Sound	300	1	B-24
Hydrologic Research and Development	1,300	0	B-35
Hydrologic Networks and Analysis	**-2,800**	**-17**	
WaterSMART: Estimating Water Budget	100	0	B-6
WaterSMART: Ecological Water Science	100	0	B-6
WaterSMART: Program & Information Management	300	2	B-8
Information Management and Delivery	-3,300	-19	B-40
Cooperative Water Program	**-4,963**	**-16**	
Interpretative Studies	-4,963	-16	B-41
Water Resources Research Act Program	**-6,490**	**-2**	
Water Resources Research Act	-6,490	-2	B-41
Total Program Change	**-6,149**	**-45**	

Justification of Program Changes

The 2012 Budget Request for Water Resources is $209,828,000 and 1,437 FTE, a net program change of -$6,149,000 and -45 FTE from the 2012 Enacted Budget. For more information on the Water Resources Mission Area changes, please see Section B, Program Changes as indicated in the table.

Activity Summary

Since 1879, the U.S. Geological Survey (USGS) has addressed issues of water availability, water quality, drought, and flood hazards. This legacy continues through the efforts of hydrologic professionals and support staff located in all 50 States and Puerto Rico. As the primary Federal science agency for water information, the USGS monitors and assesses the amount (quantity) and characteristics (quality) of the Nation's freshwater resources, assesses sources and behavior of contaminants in the water environment, and develops tools to improve management and understanding of water resources. The information and tools allow the public, water managers and planners, and policy makers to:

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

Fundamental to USGS water science is collection and public dissemination of data describing the quantity and quality of the Nation's freshwater resources. During the past 120 years, the USGS has collected streamflow data at over 21,000 sites, water-level data at over 1,000,000 wells, and chemical data at over 338,000 surface-water (streams, rivers, natural lakes, and man-made reservoirs) and groundwater (water beneath the land surface) sites. This data is available online through the National Water Information System (NWIS) at *http://waterdata.usgs.gov/nwis.*

Water resources research, information, and monitoring activities support the USGS Science Strategy to provide scientific information on the water availability and quality of the United States in order to inform the public and decisionmakers about the status of freshwater resources and how they are changing. Efforts of Water Resources scientists also support the USGS Science Strategy themes of understanding ecosystems and predicting ecosystem change, providing a scientific foundation for energy and mineral resources for America's future, climate variability and change, the national hazards, risk, and resilience assessment program, and the role of the environment and wildlife in human health.

The water quality and hydrologic data, and the analytical information provided through the USGS water programs are used by a variety of stakeholders, including other Interior bureaus, Homeland Security (DHS), the United States Department of Agriculture(USDA), the Environmental Protection Agency (EPA), the National Weather Service, State, tribal, and local governments, academia, consulting and advocacy organizations, industry, and private citizens.

The long-term data collection and analyses of the streamflow and groundwater data are important to water supply planners to identify the influence of population growth, land use change, and climate variability on current and future water availability.

Research and assessments generated through the USGS water programs, many of which are conducted cooperatively with other agencies, serve as the foundation for many USGS mission goals, including water availability, ecosystem health, water quality and drinking water, hazards, energy, and climate. For example, the water programs support data collection and interpretative studies in 48 USGS Water Science Centers providing information needed for a national Water Census. Assessments are conducted to quantify water withdrawals, watershed budgets, groundwater/surface water relations, evapotranspiration, and surface water flows needed for ecosystem sustainability.

Technical excellence is the hallmark of the USGS water programs. The quality assurance of all data and science products and national coordination are conducted to ensure technical excellence and to ensure that information collected across State boundaries is nationally consistent, comparable and suitable for inclusion in the USGS national hydrologic databases. The high-quality technical support also provides a structured manner for transferring new technology to the USGS investigative and data activities in each State. USGS products are widely recognized as unbiased, high quality, and readily available to other agencies, the scientific community, and the public.

End Outcome Goal 4.2: Provide Science for Sustainable Resource Use, Protection, and Adaptive Management									
Strategy #4: Monitor and Assess Water Availability and Quality									
Performance Measure	**2008 Actual**	**2009 Actual**	**2010 Actual**	**2011 Operating Plan**	**2011 Actual**	**2012 Enacted**	**2013 Budget Request**	**Change from 2012 Enacted to 2013**	**Long-term Target 2016**
Groundwater Resources									
Percent of U.S. with groundwater availability status and trends information (SP)	**8%**	**13%**	**15%**	**18%**	**18%**	**20%**	**20%**	**See Comment**	**23%**
	(3 / 40)	**(5 / 40)**	**(6 / 40)**	**(7 / 40)**	**(7 / 40)**	**(8 / 40)**	**(8 / 40)**		**(9 / 40)**
Comments: This measure will remain flat because funding for regional groundwater availability studies was terminated in 2013 halting all future progress. The first study supported by WaterSMART—Groundwater will be completed in 2016 explaining the long-term increase shown for this measure.									
Number of knowledge products on the water availability of the Nation's water resources provided to support management decisions (GWP)	**21**	**15**	**25**	**25**	**40**	**25**	**16**	**-9**	**16**
Comments: The 2013 estimate is less because of planned reduction in the 2013 budget for the Groundwater Resources Program. Additional funding provided for groundwater monitoring does not impact this measure.									
National Water Quality Assessment									
Percent of U.S. with current streamwater quality status and trends information (SP)	**34%**	**52%**	**69%**	**86%**	**86%**	**100%**	**2.3%**	**See Comment**	**9.3%**
	(1707 / 4956)	**(2575 / 4956)**	**(3409 / 4956)**	**(4242 / 4956)**	**(4273 / 4956)**	**(4956 / 4956)**	**(1304 / 56280)**		**(5216 / 56280)**
Comments: For 2013 the denominators for both streams and groundwater are changed to reflect the plan that was endorsed by the National Research Council (NRC). The significantly larger denominators reflect the recommendations by the NRC and National Water Quality Assessment Program (NAWQA).									
Percent of U.S. with current groundwater quality status and trends information (SP)	**56%**	**67%**	**78%**	**89%**	**89%**	**91%**	**3.3%**	**See Comment**	**13.1%**
	(476 / 845)	**(570 / 845)**	**(658 / 845)**	**(751 / 845)**	**(753 / 845)**	**(771 / 845)**	**(393 / 12000)**		**(1572 / 12000)**
Comments: For 2013 the denominators for both streams and groundwater are changed to reflect the plan that was endorsed by the National Research Council (NRC). The significantly larger denominators reflect the recommendations by the NRC and National Water Quality Assessment Program (NAWQA).									
Number of knowledge products on the water availability and quality of the Nation's water resources provided to support management decisions (NAWQA)	**80**	**50**	**80**	**20**	**43**	**128**	**17**	**-111**	**25**
Comments: 2012 is the last year of the second 10-year cycle of NAWQA, as a result a significant number of products are being released based on data and research amassed over the past decade. There is a significant decrease in performance in 2013 because it is the first year of the third 10-year cycle and not as many products are typically produced in the first few years.									
National Streamflow Information Program									
Percent of USGS planned streamgages that are fully funded by the National Streamflow Information Program (SP)	**10.5%**	**7.3%**	**7.3%**	**8.0%**	**8.8%**	**9.7%**	**10.1%**	**+0.4%**	**20.0%**
	(500 / 4756)	**(349 / 4757)**	**(349 / 4757)**	**(380 / 4757)**	**(421 / 4758)**	**(460 / 4758)**	**(480 / 4758)**		**(950 / 4758)**
Hydrologic Research and Development									
Number of knowledge products on the water availability and quality of the Nation's water resources provided to support management decisions (HRD)	**249**	**203**	**220**	**220**	**250**	**200**	**230**	**+30**	**230**
Hydrologic Networks and Analysis									
Percent of U.S. with completed, consistent water availability products (SP)	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**4%**	**8%**	**+4%**	**40%**
						(90 / 2268)	**(180 / 2268)**		**(900 / 2268)**
Number of knowledge products on the water availability and quality of the Nation's water resources provided to support management decisions (HNA)	**9**	**11**	**12**	**11**	**11**	**11**	**9**	**-2**	**8**
Cooperative Water Program									
Number of water monitoring sites supported jointly with State, local, or Tribal cooperators (SP)	**21,800**	**20,600**	**20,000**	**19,500**	**17,850**	**17,500**	**16,200**	**-1300**	**16,200**
Comments: A decrease in funding by 7.7 percent, along with anticipated reduced State resources is projected to result in fewer monitoring sites.									
Number of knowledge products on the water availability and quality of the Nation's water resources provided to support management decisions (CWP)	**250**	**237**	**230**	**225**	**325**	**200**	**150**	**-50**	**150**
NSIP, HNA, GWP, NAWQA and CWP									
Number of retrievals of groundwater and surface water quantity and quality data and information (NSIP, HNA, GWP, NAWQA, and CWP)	**133,000,000**	**154,000,000**	**175,000,000**	**175,000,000**	**283,258,614**	**292,000,000**	**301,000,000**	**+9000000**	**328,000,000**

Activity: Water Resources
Subactivity: Groundwater Resources

2011 Actual:	$8.5 million (64 FTE)
2012 Enacted:	$8.9 million (64 FTE)
2013 Request:	$11.7 million (63 FTE)

Overview

Groundwater is one of the Nation's most important natural resources and is increasingly important to daily life. Groundwater is the primary source of drinking water for approximately half the Nation's population, provides about 40 percent of the irrigation water necessary for the Nation's agriculture, sustains the flow of most streams and rivers, and helps maintain a variety of aquatic ecosystems. Continued availability of groundwater is essential for current and future populations and the economic health of our Nation.

The Groundwater Resources Program (GWRP) provides objective scientific information and interdisciplinary understanding necessary to assess and quantify availability and sustainability of the Nation's groundwater resources. Results of those efforts provide information used in decisionmaking by resources managers, regulators, other Government agencies, and individuals in the public and private sectors. The goals of the program are to:

- Provide fundamental information about groundwater availability in the Nation's major aquifer systems;
- Characterize natural and human factors that control recharge, storage, and discharge in the Nation's major aquifer systems, and improve understanding of these processes;
- Develop and test new tools and field methods to analyze groundwater flow systems and their interactions with surface water; and
- Provide scientific leadership across all Federal programs about the Nation's groundwater resources, including research directions, quality control, technology transfer, and information storage and delivery.

The program coordinates with and complements other USGS programs by providing new methods, tools, and information used in monitoring, assessment, and resource management activities. Goals of the GWRP directly support the USGS Science Strategy focus on providing scientific information on water availability and quality of the United States to inform the public and decisionmakers about the status of groundwater resources and how they are changing. GWRP scientists also support USGS Science Strategy themes of climate variability and change, understanding ecosystems and predicting ecosystem change, and the national hazards, risk, and resilience assessment program.

Program Performance

Progress being made on National and Regional Groundwater Evaluations – In 2011, a groundwater assessment and methods development effort piloted in Arizona's southwest alluvial basins was completed. A final report, *http://pubs.usgs.gov/sir/2011/5071/*, containing updated groundwater budget information for each of the 45 individual basins or management areas, as well as a new groundwater-flow model to test an approach for evaluating interconnected groundwater basins was released. Approaches, techniques, and methods

piloted here will continue to be used in the regional assessment of the Nation's groundwater availability and by individual States in their water resources planning and policy demonstrating what can be achieved under the Water Census theme of the USGS Science Strategy.

A regional groundwater availability evaluation of the Mississippi embayment *http://pubs.usgs.gov/pp/1785/* released in 2011 is an example of a study that is being made available to Federal, State, and local water related agencies to help them address issues affecting sustainability of the area's groundwater resources. In fact, this newly developed tool has already been used by the Yazoo Mississippi Delta Joint Water Management District to assess how water-use conservation efforts would lessen water-level declines (SIR 2011-5019). The tool has also been used by the Arkansas Natural Resources Commission to evaluate changes in water-level altitudes and streamflow depletion from future pumping scenario's (SIR 2011-5215). These regional assessments are part of an effort to evaluate more than 30 regional aquifers and will eventually lead to a national assessment of groundwater availability. Circular 1323 describes the approach to be used for the assessment (*http://pubs.usgs.gov/circ/1323/)*.

Advanced Modeling Techniques to Understand and Manage the Nation's Water Resources – The GWRP provided essential support for the application of the GSFLOW coupled groundwater and surface-water flow model to hydrologists across the Nation. GSFLOW comprehensively simulates hydrologic processes throughout a watershed—from the vegetative canopy to deep aquifer systems. GSFLOW is being applied to more than a dozen watersheds across the country, including the Santa Rosa Plain area in northern California; the Chamokane Creek basin in eastern Washington; the Trout Lake and Black Earth Creek Basins in Wisconsin; and the Walker Lake and Middle Carson Basins in Nevada. These USGS projects are conducted in collaboration with State, tribal, local, and Federal agencies to assess the effects of water-resource development on streamflow and groundwater resources, to evaluate how land-use changes affect watershed hydrology, and to quantify how hydrologic conditions may be affected by climatic variability and change.

Data and Groundwater Level Monitoring – Collecting groundwater information is necessary to assess and quantify availability of the Nation's groundwater resources. The USGS maintains a database of groundwater data records compiled from about 850,000 wells used in groundwater hydrology studies over the past 100 or more years. Wells are monitored for a variety of purposes such as statewide and regional monitoring of ambient conditions, or for local monitoring of drawdown, aquifer tests, or even earthquake effects on water levels. The GWRP makes many of these data available in an easily accessible manner via the Internet at *http://groundwaterwatch.usgs.gov/*.

As a complement to these networks and in response to expanding human and environmental demands, the USGS periodically evaluates water levels on a regional scale to properly inventory groundwater reserves in areas experiencing intense development. In 2011, the USGS released a potentiometric surface map of the Upper Floridan aquifer in Florida and parts of Georgia, South Carolina, and Alabama (*http://pubs.usgs.gov/sim/3182/*). This highly anticipated and cooperatively produced regional evaluation was last published 25 years ago. This important aquifer system is essential to the human and economic well-being of the Southern United States.

Web Site

For more information about the Groundwater Resources Program, please go to: *http://water.usgs.gov/ogw/*gwrp

Activity: Water Resources
Subactivity: National Water Quality Assessment

2011 Actual: $64.2 million (467 FTE)
2012 Enacted: $62.9 million (467 FTE)
2013 Request: $62.2 million (454 FTE)

Overview

The National Water Quality Assessment Program**, (**NAWQA) addresses three long-term goals**:**

- Describe status and trends of the quality of a large, representative part of the Nation's surface-water and groundwater resources;
- Provide improved understanding of primary natural factors and human activities affecting those conditions; and
- Provide information to support development and evaluation of management, regulatory, policy, and monitoring decisions by other Federal, State, tribal and local entities.

The information is used by National, Regional, State, tribal, and local stakeholders to develop effective, science-based policies for water protection and management (*http://water.usgs.gov/nawqa/xrel.pdf)*.

The full-scale NAWQA program began in 1991. During its first decade (Cycle 1), the program established baseline understanding of water-quality conditions and conducted interdisciplinary assessments in 51 of the Nation's most important river basin and aquifer systems, referred to as Study Units. A second decade (Cycle 2) of studies involving selected streams and aquifers in 42 of the 51 Study Units began in 2001, and will be completed in 2012. Plans for the next decade of NAWQA assessments (fiscal years 2013-2022; Cycle 3) were completed in 2011, and the implementation strategy is underway for beginning Cycle 3 in 2013.

Program Performance

NAWQA's performance is best characterized by the contributions it makes to improved assessment and decisionmaking for water-quality management and to public education, human health, and aquatic ecosystems. Several examples of contributions to specific water-quality issues made during 2011 are provided below.

Regional Water Quality Models and Decision Support System – NAWQA released a new online, interactive decision support system that provides easy access to six newly-developed regional water quality models that describe how rivers receive and transport nutrients from natural and human sources to sensitive waters, such as the Gulf of Mexico. The regional water-quality models incorporate geospatial data on geology, soils, land use, fertilizer, manure, wastewater-treatment facilities, temperature, precipitation and other watershed characteristics, from USGS, NOAA, USDA, and USEPA. These data are then linked to measurements of streamflow from USGS streamgages and water-quality monitoring data from about 2,700 sites operated by 73 monitoring agencies. The regional SPARROW models and related Decision Support System directly addresses congressional goals that established the Program in 1991—to provide nationally consistent data, information and understanding needed by local, State,

regional, and national decisionmakers involved in managing the Nation's water resources.

Several examples of how the models and Decision Support System are being used by key stakeholders are at: *http://water.usgs.gov/nawqa/sparrow/mrb/StakeholderQuotes.pdf*.

Sources of toxic contaminants in urban areas – In 2011, the USGS released NAWQA findings on the sources of a class of potentially toxic contaminants in urban lakes. The findings showed that coal-tar-based pavement sealants are a major source of polycyclic aromatic hydrocarbons (PAHs) in urban lakes across the country. PAHs are a group of contaminants that are a significant environmental concern because several are probable human carcinogens, they are toxic to fish and other aquatic life, and their concentrations have been increasing in urban lakes in recent decades. Residences adjacent to parking lots with coal-tar-based sealcoat were found to have PAH concentrations in house dust that were 25 times higher than those residences adjacent to parking lots without coal-tar-based sealcoat. House dust is an important source for human exposure to many contaminants, including PAHs especially for small children, who spend time on the floor and put their hands and objects into their mouths. There are no U.S. health-based guidelines for chronic exposure to PAHs in house dust. The only existing guideline is for a single PAH that was issued by the German Federal Environment Agency Indoor Air Hygiene Commission. The guideline advises minimizing exposure to concentrations of benzo[*a*]pyrene greater than 10 mg/kg in dust to avoid adverse health effects. That guideline was exceeded for 4 of the 11 apartments with coal-tar-seal-coated parking lots and for 1 of the 12 apartments with a parking lot with a different surface type.

Contaminants in Public and Private Wells – In 2011, NAWQA released national findings on the occurrence of potentially toxic trace elements in ground water based on more than 5,000 samples collected primarily from public and private wells nationwide *http://www.usgs.gov/newsroom/article.asp?ID=2914*. The results showed that about 20 percent of untreated water samples from public, private, and monitoring wells across the nation contain concentrations of at least one trace element, such as arsenic, manganese and uranium, at levels of potential health concern. Trace elements in groundwater exceed human health benchmarks at a rate that far outpaces most other groundwater contaminants, such as nitrate, pesticides, and volatile organic compounds (VOCs). Most trace elements, including manganese and arsenic, get into the water through the natural process of rock weathering. Human activities like mining, waste disposal, and construction can also contribute trace elements to groundwater. Long-term exposure to arsenic can lead to several types of cancer, and high levels of uranium can cause kidney disease. In doses similar to some of those found in this study, manganese can adversely affect child intellectual function and, in large doses, acts as a neurotoxin, causing symptoms similar to those experienced by sufferers of Parkinson's disease. Differences in the concentration of trace elements are related to the climatic conditions and land use of the area. Drier areas of the United States saw higher concentrations of trace elements in groundwater than humid regions. Meanwhile, wells in agricultural areas more often contained trace elements than those in urban areas. However, wells in urban areas contained concentrations of trace elements that more often exceeded human health benchmarks. In public wells the most these contaminants are regulated by the USEPA, and are removed from the water before people drink it. However, trace elements could be present in water from private wells at levels that are considered to pose a risk to human health, because they aren't subject to regulations.

Web Site

For more information about the National Water-Quality Assessment Program, please go to: *http://water.usgs.gov/nawqa*

Activity: Water Resources
Subactivity: National Streamflow Information Program

2011 Actual: $27.1 million (106 FTE)
2012 Enacted: $29.4 million (106 FTE)
2013 Request: $32.5 million (108 FTE)

Overview

The USGS operates and maintains a nationwide network of about 7,800 streamgages designed to provide and interpret long-term, accurate, and unbiased streamflow information. The National Streamflow Information Program (NSIP) mission is to provide the streamflow information and understanding that supports water management for national, regional, State, tribal, and local economic well-being, the protection of life and property, and efficient and effective water resource management.

Most of the existing streamgages are funded through partnerships with more than 850 other Federal, State, tribal, and local agencies. The streamflow information collected at USGS streamgages is used for many purposes including agriculture, water-resource assessments and allocations, to provide streamflow information required by interstate agreements, compacts, and court decrees, for engineering design of reservoirs, bridges, roads, culverts, and treatment plants; for the operation of reservoirs, locks and dams for navigation, and power production; to identify changes in streamflow resulting from changes in land use, water use, and climate; for streamflow forecasting, flood planning, and flood forecasting to support water quality programs by allowing determination of constituent loads and fluxes; and for characterizing and evaluating instream conditions for habitat assessments, instream-flow requirements, and recreation.

Program Performance

The five goals of the NSIP and the achievements in 2011 for each objective are described below.

Stable Streamgage Network – In 2011, the NSIP's priority goal was to provide as much stability as possible to the backbone streamgage network because of funding shortfalls among many partner organizations. NSIP Federal-needs streamgages reflect that portion of the USGS national streamgage network funded exclusively by USGS appropriated funds. New program funds in 2010 allowed the Program to provide stability to the network by reestablishing recently-discontinued streamgages and to offset reduced funding from State and local agencies to support operation and maintenance of additional existing streamgages. This NSIP increase provided funds to water science centers for operation and maintenance of threatened streamgages that would have been discontinued because of loss of supporting State and local funds. The USGS streamgage network provides relevant, high-quality information to all users. Data is collected using nationally consistent methods, which enable comparability of data across jurisdictional boundaries and acceptance of results by water management agencies and courts at all levels of government.

Improved Delivery of Streamflow Data to Users – Developing new, state-of-the-art methods to transmit, store, and distribute streamflow information is an essential component of the NSIP. Improving the delivery of streamflow data includes a wide spectrum of activities, such as the automatic transmission of data from the streamgage on the river bank into the database, analysis of the rating curve, and reporting of and access to the data on the World Wide Web. Also included

is ensuring the information is available when needed by establishing backup data-delivery systems and providing enhanced data-storage, retrieval, and analysis capabilities.

The USGS developed a database (Instantaneous Data Archive, or IDA), available through the Internet, that contains about 3.7 billion instantaneous values of streamflow information from about 11,000 streamgages across the Nation. The USGS has also developed a powerful streamflow-information synthesis tool called WaterWatch. WaterWatch allows comparison of real-time streamflow information with historic streamflow information to obtain a current assessment of hydrologic conditions. Recently, the USGS developed WaterAlert to enable users to receive customized real-time e-mail or text messages from streamgages that meet a threshold condition of interest to them. Working with the Federal Emergency Management Agency and the USACE, the USGS also developed a data viewer to display the locations of new temporary storm-surge sensors and incoming data so that the water-level data and high-water mark data could be used in the immediate aftermath of Hurricane Irene.

Regional Assessments of Streamflow Characteristics – The NSIP's goal of regional assessments includes providing a means to estimate streamflow and streamflow statistical characteristics at ungaged locations, a mechanism for identifying trends in streamflow, and information required to assess the adequacy of the streamgage network.

A "point-and-click" tool has been developed that will provide the ability to select any location on any river in the country and obtain estimates of the streamflow characteristics at that location. This tool, called StreamStats, has been or is currently being implemented in 40 States. The USGS also conducted a network analysis, funded by the U.S. Fish and Wildlife Service, intended to identify network gaps that are preventing appropriate estimation of streamflow statistics needed to assess ecosystem flows and allocations.

Expanded Data Collection During Floods and Droughts – Enhancing data collection prior to, during, and following both floods and droughts is critical to improving our understanding of and predictive capability with regard to hydrologic extremes. The scales at which streamflow information is collected during extreme events need to be expanded. In addition, new and creative analysis techniques must be utilized. The new techniques will improve our understanding of floods and droughts and the risks they pose to life and property. The ultimate goal is to improve the prediction of extreme events with improved accuracy and increased lead time.

NSIP funds were used to staff a top-level flood coordinator to orchestrate and improve the USGS response to regional floods; develop and provide a supply of rapid deployment sreamgages that were used in many locations flooded over the last year to either replace a flooded streamgage or to enhance spatially the data obtained; and produce an internal report that reviewed the performance of the USGS in response to the floods on the Mississippi and Missouri Rivers and identified ways to enhance the USGS response to future floods. The USGS response to the 2011 floods was widely endorsed and acclaimed by flood-fighters such as the USACE, flood-forecasters such as the National Weather Service, and various State and local agencies throughout the flooded region. The USGS is in the process of producing a series of USGS Circulars that will interpret and distribute information collected in response to the floods.

Research and Development – Recent technological advances have provided new tools that allow the USGS to do a more efficient, more effective job of obtaining the streamflow information required for the safety and well-being of the Nation. Continued research and development of new tools, technologies, and methodologies will minimize cost increases while improving data quantity and quality.

Web Site

For more information about the National Streamflow Information Program, please go to: *http://water.usgs.gov/nsip/*.

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Activity: Water Resources
Subactivity: Hydrologic Research and Development

2011 Actual:	$11.9 million (262 FTE)
2012 Enacted:	$11.7 million (262 FTE)
2013 Request:	$15.5 million (264 FTE)

Overview

The Hydrologic Research and Development (HR&D) program conducts research on complex problems in the hydrologic sciences and supports research and development needs of the other USGS water resource programs as well as other USGS programs. HR&D program investigations integrate hydrological, geological, chemical, climatic, and biological science to address water-resources issues. Efforts of the HR&D program are multidisciplinary and require collaborative relations, both among scientists funded by the program and with scientists in other USGS programs, in Federal and State agencies, universities, and foreign countries.

The long-term goals of HR&D are to improve understanding of:

- Ecological and biogeochemical processes in the hydrologic cycle and the role of natural and human-induced changes on these processes;
- Chemical and biochemical processes affecting chemical constituents in aquatic systems and their effect on aquatic life;
- Physical processes controlling distribution of the Nation's surface-water resources to assist in mitigating effects of floods and droughts;
- Movement, availability, and transport of subsurface water to inform groundwater management decisions;
- Stream-channel morphology and erosional processes governing the source, mobility, and deposition of sediment to improve management of rivers, dams, and reservoirs, and to reduce effects of contaminated sediments; and
- Basic hydrologic processes through research in small watersheds, addressing effects of atmospheric inputs, environmental setting, and climatic variables on streamflow generation, movement of contaminants, and ecosystem needs.

National Research Program in the Hydrologic Sciences

A key component of the HR&D Program is the USGS National Research Program (NRP). NRP scientists often take a lead role in designing and conducting complex projects, bringing advanced scientific thinking and tools to them. The NRP provides expertise essential for making science-based decisions in many areas of the country where large-scale ecosystem studies are underway, such as the Everglades, the California Bay-Delta, and the Grand Canyon. The NRP also provides expertise in areas related to carbon sequestration, denitrification, detection and effects of man-made chemicals, effectiveness of stream restoration, and hydrologic response to global change, among others.

Program Performance

Investigation of the export of mercury from the Yukon River – Investigation has shown that thawing permafrost in the Yukon River watershed may be a source of naturally occurring

mercury being conveyed by rivers into the environment. The Yukon River watershed, releases nearly 5 tons of mercury per year into the environment. Mercury measured in the Yukon River is strongly correlated with concentrations of organic matter originating from boreal forest soils. Seventy-five percent of the Yukon River watershed is covered by organic-rich permafrost, in which mercury has been accumulating since the end of the last ice age, 10,000 years ago. As a result of warming and changing climatic conditions, the permafrost in this region is thawing at an increased rate that may result in increased mobilization and export of mercury from the Yukon River.

Climate change scenarios in California's Bay-Delta – These scenarios provide the first integrated assessment of how the Bay-Delta system will respond to climate change. Research shows that the combined effects of increasing water temperature and salinity could reduce habitat quality for native species, such as the endangered Delta smelt and winter-run Chinook salmon, and intensify the challenge of sustaining their populations. The research described risk from flooding as sea level rise accelerates and extreme water levels become increasingly common. Increased intensity and frequency of winter flooding could also occur as a result of earlier snowmelt and a shift from snow to rain. Study results provide new information that water-resource planners will need to develop adaptation strategies to address potentially longer dry seasons, diminishing snow packs and earlier snowmelt leaving less water for runoff in the summer.

Large rivers in the Mississippi River Basin – These rivers show no consistent declines in nitrate levels despite efforts to reduce nitrate in the Mississippi River Basin. Excessive nutrients like nitrate in the Mississippi River Basin contribute to hypoxia, or dead zones, in the Gulf of Mexico. The dead zones are the result of too little oxygen to support most marine life in bottom and near-bottom water. State and Federal partners serving on the Mississippi River Gulf of Mexico Watershed Nutrient Task Force are striving to decrease nutrients transported to the Gulf to reduce the size of the hypoxic zone to less than 5,000 square kilometers (about 2,000 square miles) by 2015. For this investigation, the USGS analyzed concentrations and investigated the transport of nitrate at eight major study sites that showed a lack of decline from 1980-2008. These results are based on a new scientific model developed by the USGS that takes into account variation in river flows in order to gain an accurate understanding of long term trends.

MODFLOW and Deep Horizon – USGS groundwater flow model MODFLOW was adapted to simulate the oil reservoir during the Deepwater Horizon crisis. When the Macondo well was shut in on July 15, 2010, the shut-in pressure recovered to a level that indicated the possibility of oil leakage out of the well casing into the surrounding formation. Such a leak could initiate a hydraulic fracture that might eventually breach the seafloor, resulting in renewed and uncontrolled oil flow into the Gulf of Mexico. To help evaluate whether or not to reopen the well, a MODFLOW model was constructed within 24 hours after shut in to analyze the shut-in pressure. The model showed that the shut-in pressure can be explained by a reasonable scenario in which the well did not leak after shut in. The rapid response provided a scientific analysis for the decision to keep the well shut, thus ending the oil spill resulting from the Deepwater Horizon blow out.

Web Site

For more information about the National Streamflow Information Program, please go to: *http://water.usgs.gov/nrp/*.

Activity: Water Resources
Subactivity: Hydrologic Networks and Analysis

2011 Actual:	$30.7 million (201 FTE)
2012 Enacted:	$31.3 million (204 FTE)
2013 Request:	$28.7 million (187 FTE)

Overview

Data on and analysis of the quantity and quality of water in the Nation's streams, lakes, and aquifers are necessary for wise planning, development, utilization, and protection of the Nation's water resources. Federal funds appropriated through the Hydrologic Networks and Analysis (HNA) Program support three distinct water-quality networks described below, selected hydrologic analysis and modeling activities, and a small but vital portion of the information delivery activity of the USGS water resources programs.

Water-quality and hydrologic data and analytical information provided by this program are used by a variety of stakeholders, including other Interior bureaus (for example, NPS Water quality partnership), the EPA, and USDA (both customers for water-quality information), the National Weather Service (for real-time flood level information provided through NWIS), State, tribal, and local governments (for both water-quality and flood level information), academia, consulting and advocacy organizations, industry, and private citizens.

Goals of the HNA Program directly support the Interior goal and USGS Science Strategy focus on providing scientific information on water availability and quality of the United States as a means to inform the public and decision makers about the status of its freshwater resources and how they are changing. The HNA Program supports USGS Science Strategy themes through focused research on multiple issues and is vital to an array of reimbursable projects funded by partner agencies.

The Hydrologic Networks and Analysis program component includes funding for data quality assurance, data archiving and delivery in the National Water Information System (NWIS). Water data collected by the USGS, much of which are more than 100-years old, is maintained as a permanent record in the database—designated an Authoritative Source. The NWIS provides access to more than 1.5 million records of water data. The HNA program supports the ongoing maintenance of the system, management of the data, and innovations in the way water data are collected, quality assured and delivered. USGS real-time data is becoming even more in demand by other Federal and State agencies, first responders, and the public.

The HNA funds the President's Advisory Committee on Water Information (ACWI), which represents the interests of water-information users and professionals in advising the Federal Government on Federal water-information programs and their effectiveness in meeting the Nation's needs. Member organizations help to foster communications between the Federal and non-Federal sectors on collecting, standardizing, and sharing water information, ultimately resulting in reduced Federal costs for operating resource management and environmental protection programs.

Program Performance

Wet Deposition of Fission-Product Isotopes to North America from the Fukushima Dai-Ichi Incident – Utilizing samples from the National Atmospheric Deposition Program (NADP)

network, this analysis provided cost effective observations of the radioisotope activities and deposition (radioactive fallout) in precipitation over North America. This project was implemented to add to the body of knowledge about radioactive fallout from the March 12-14, 2011, incident and to test the capabilities of the NADP in response to an unexpected atmospheric release. The study found concentrations and fallout (deposition) of radioactive iodine and radioactive cesium in precipitation samples collected in the United States directly after the nuclear incidents on March 12 and March 14, 2011. Detectable quantities of Iodine-131 and Cesium-137 and Cesium-134 were observed at approximately 20 percent of the 167 locations where precipitation was sampled, during the sampling period from March 15 to April 5, 2011. This network and specialized analytical expertise provides additional national capabilities to gather important information following these kinds of disasters, should one occur in the future.

Occurrence, Sources, and Potential for Biodegradation of Endocrine Disrupting Chemicals (EDC) in Surface Water in Rocky Mountain National Park – Understanding the ecological threats of EDC in aquatic and associated terrestrial ecosystems is needed to protect national park ecosystems from ongoing and future EDC releases. Characterization of EDC concentrations within the park will help define the environmental impact of EDC. Assessing the potential for EDC biodegradation in the sediment and water compartments will help define the park ecosystem's ability to mitigate the EDC threats from internal and external sources. The combination will provide a basis for establishment of EDC management practices at the Rocky Mountain National Park.

California's Sierra Nevada Mountains may see a potential increase in floods under future climate Projections – California's mountainous topography, exposure to occasional heavily moisture-laden storm systems, and varied communities and infrastructures in low-lying areas make it highly vulnerable to floods. An important question facing the State—in terms of protecting the public and formulating water management responses to climate change—is "how might future climate changes affect flood characteristics in California?" To address this question, simulated floods on the western slopes of the Sierra Nevada Mountains were analyzed based on downscaled daily precipitation and temperature projections from three General Circulation Models (GCMs). All projections yield larger-than-historical floods, for both the Northern Sierra Nevada and for the Southern Sierra Nevada. The increases in flood magnitude are statistically significant (at $p <= 0.01$) for all the three GCMs in the period 2051–2099. These increases appear to derive jointly from increases in heavy precipitation amount, storm frequencies, and days with more precipitation falling as rain and less as snow. Thus, a complex, as-yet unpredictable interplay of several different climatic influences threatens to cause increased flood hazards in California's communities.

WaterAlert for smart phone technology – Smart phones can now receive a text or e-mail from the USGS when waters are rising in rivers and streams**.** WaterAlert allows the public to receive notifications about water levels at any of the 7,000 USGS real-time streamgages around the country. There is no cost to users for this notification service. WaterAlert will also allow users to receive updates about groundwater levels, water temperatures, rainfall, and water quality at sites where USGS collects real-time water information.

Web Site

For more information about the Hydrologic Network and Analysis Program, please go to: *http://water.usgs.gov/nwis/*.

Activity: Water Resources
Subactivity: Cooperative Water Program

2011 Actual:	$63.5 million (377 FTE)
2012 Enacted:	$64.0 million (377 FTE)
2013 Request:	$59.3 million (361 FTE)

Overview

The Cooperative Water Program (CWP) is the Water Mission Area's "bottom-up, on-the-ground" program working in every State and Territory of the United States, in partnership with about 1,550 local, State, and tribal agencies.

Jointly planned monitoring and science efforts bring local State, and tribal water needs and decisionmaking together with USGS national capabilities, including nationally consistent methods and quality assurance; innovative monitoring technology, models, and analysis tools; and robust data management and delivery systems.

Cooperators choose to work with the USGS because of the agency's broad, interdisciplinary expertise; long-standing, high-quality, nationally consistent procedures and quality-assurance; and its commitment to providing readily available public access to national data. The Programs component's include:

Shared benefits and savings – Combined Federal and non-Federal resources help to address many of the Nation's most pressing water resource issues—including, hazard (flood and drought) mitigation and water availability—while allowing direct application of science and innovative tools and models to local, State, and tribal regulatory decisions, management, policy, and jurisdictional disputes.

Awareness of emerging issues – The Program's significant tie to local, State, and tribal agencies allows the USGS to quickly identify and respond to emerging water issues—including, pharmaceuticals in drinking water and impacts of hydraulic fracturing on water quality and quantity—raising those issues to regional and national visibility.

Regional and national perspectives – Because data and analyses adhere to strict national protocols, findings are directly comparable across local, State, regional and national levels; water issues in a specific watershed, municipality, or State can be compared to those in other geographic regions and at different periods of time; and large-scale syntheses and problem-solving, such as related to groundwater sustainability and conjunctive water use in different regions, are possible.

Built-in local, State, and tribal relevance to regulatory decisions, management, policy, and jurisdictional disputes – The Program supports more than 700 interpretative and research studies annually, which results in innovative USGS science, tools, models, and technology that help to inform a myriad of stakeholder decisions related to water availability, ecosystem health, water quality and drinking water, hazards, energy, and climate.

Foundation for national networks – CWP partnerships provide the foundation for USGS national hydrologic data networks, real-time capabilities, and data delivery across the Nation, including, for example, support for nearly 6,000 streamgages, 8,000 groundwater observation wells, and 4,000 water quality monitoring sites.

Program Performance

Summaries of 2011 accomplishments, categorized by the USGS mission area, are provided on the Cooperative Water Program Web site at: *http://water.usgs.gov/coop/* . The Program conducted more than 700 interpretative studies, resulting in more than 300 science and research products.

Water Availability/Water Census – The USGS, in cooperation with the Washington State Department of Ecology and Yakama Nation, developed an innovative USGS groundwater/surface water model to quantify decadal effects of groundwater pumping on streams and to define "groundwater reserve" areas for accommodating new permit-exempt wells in basins that are closed to additional surface-water rights *http://wa.water.usgs.gov/news/2011/newes.sir20115155.htm*.

Ecosystem Health – The State of Hawaii Water Commission set minimum in-stream flow standards for 27 streams in Maui to protect fish and other aquatic life based on USGS data and streamflow analyses. The USGS is working with many other State and local agencies across the Nation to evaluate in-stream flow requirements of aquatic ecosystems, which addresses a key issue of water availability for environmental and wildlife needs.

Environmental Health – Water Quality and Drinking Water – In cooperation with the California State Water Resources Control Board (SWRCB), USGS scientists detected low concentrations of pharmaceutical compounds in groundwater samples from 2.3 percent of tested aquifers used for drinking water in California, showing a distinct connection between surface activities by humans and groundwater resources. The cooperative study is designed to improve comprehensive statewide groundwater monitoring and to increase the availability of groundwater-quality information to the public.

Hazards – There are many examples of how USGS data and analyses from streamgages supported through the CWP have informed emergency management decisions at the State and local level. Examples include decisions that were made on evacuations, floodways, navigation, and levee systems during the unprecedented flooding in the Mississippi River Basin in 2011, as well as efforts by the Town of Fort Kent and Maine's Emergency Management Agency, which used CWP real-time streamflow information and USGS inundation mapping in their 2011 flood response.

Energy – In response to Marcellus Shale fracturing, the USGS, in cooperation with the West Virginia Department of Environmental Protection, began the development of a public Web-based tool to access stream information and assist in water-withdrawal decisions. This is one of many growing efforts to understand and communicate conditions of water quality and availability and habitat conditions prior to, or concurrent with, land disturbance, drilling, and hydraulic fracturing.

Climate and Land-Use Change – The City of Newport News in Virginia reassessed safe yields from water-supply intakes on the Chickahominy River based on USGS findings documenting changing salinity due to sea level rise, http://pubs.usgs.gov/of/2011/1191/. This is just one of many issues associated with climate and land-use change addressed by USGS in concert with its cooperators.

Web Site

For more information about the Cooperative Water Program, please go to: *http://water.usgs.gov/wid/html/COOP.html*.

Activity: Water Resources
Subactivity: Water Resources Research Act Program

2011 Actual:	$6.5 million (2 FTE)
2012 Enacted:	$6.5 million (2 FTE)
2013 Request:	$0.0 million (0 FTE)

Overview

The Water Resources Research Act (WRRA) of 1984 established a Federal-State partnership in water resources research, education, and information transfer through a matching grant program that authorizes State Water Resources Research Institutes at land grant universities across the Nation. There are 54 Institutes: one in each State, the District of Columbia, Puerto Rico, the U.S. Virgin Islands, and Guam. The Guam institute also serves the Federated States of Micronesia and the Commonwealth of the Northern Mariana Islands.

Over the past 25 years, the Institutes provide new opportunities for young people through research and education efforts. Student internships supported by the Institutes provide invaluable and practical training experience for the next generation of hydrologic scientists and engineers and afford students the opportunity to participate in research projects while encouraging them to pursue careers in water resources.

The Water Resources Research Act Program provides an institutional mechanism for promoting State, regional, and national coordination of water resources research, training and coordination and information and technology transfer. In 2011, the program provided training and support to more than 600 undergraduate and graduate students by involving them in institute-sponsored research activities. With its matching requirements, the program promotes State investments in research and training. According to results of surveys conducted by the National Institutes for Water Resources over the period 2007–2009, the amount appropriated to the Institutes under this program accounted for only 6 percent of the total revenues of the 54 Institutes. These funds provide support for training more than 600 students and production of 1,000 publications annually.

Program Performance

Though the program contributes to the Interior goal and USGS Science Strategy focus of providing scientific information on water availability and quality in the Unites States, there are no performance measures specifically linked to this program change. The proposed budget reduction would eliminate funding for this program and no further grants would be issued to the State Water Resources Research Institutes. The elimination of this program is proposed in the current fiscal environment to allow the USGS to redirect scarce funds to other priority issues, such as WaterSMART.

Web Site

For more information about the Water Resources Research Act Program, please go to: http://water.usgs.gov/wrri.

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Activity: Core Science Systems

		2011 Actual	2012 Enacted	2013				Change from 2012 Enacted (+/-)
				Fixed Costs and Related Changes (+/-)	Program Changes (+/-)	Internal Transfers	Budget Request	
Science Synthesis, Analysis, and Research ($000)		18,563	15,052	228	2,454	8,591	26,325	11,273
	FTE	71	59	0	0	34	93	34
Nat'l Geological & Geophysical Data Preservation ($000)		998	996	0	-996	0	0	-996
	FTE	3	3	0	-3	0	0	-3
National Cooperative Geologic Mapping Program($000)		27,713	26,300	191	1,500	0	27,991	1,691
	FTE	131	130	0	1	0	131	1
National Geospatial Program ($000)		65,755	64,330	294	1,450	0	66,074	1,744
	FTE	379	379	0	3	0	382	3
Total Requirements ($000)		**113,029**	**106,678**	**713**	**4,408**	**8,591**	**120,390**	**13,712**
Total FTE		**584**	**571**	**0**	**1**	**34**	**606**	**35**

Summary of Program Changes

Request Component	($000)	FTE	Page
Science Synthesis, Analysis, and Research	**2,454**	**0**	
Science for Coastal and Ocean Stewardship	1,000	0	B-15
Hydraulic Fracturing	600	1	B-19
Ecosystem Priority: Information Synthesis and Management	1,000	5	B-28
Data Preservation	1,000	3	B-36
Ecosystem Science Centers	-700	-6	B-41
Administrative Services	-446	-3	B-42
Nat'l Geological & Geophysical Data Preservation	**-996**	**-3**	
National Geological and Geophysical Data Preservation	-996	-3	B-42
National Cooperative Geologic Mapping Program	**1,500**	**1**	
WaterSMART: Water Quality Enhancement	500	0	B-7
WaterSMART: Information Management	500	0	B-8
Hydraulic Fracturing	2,000	3	B-19
NCGMP Federal and State Partnerships	-1,500	-2	B-42
National Geospatial Program	**1,450**	**3**	
WaterSMART: Information Management	750	0	B-8
Ecosystem Priority: Columbia River	500	2	B-23
Ecosystem Priority: Puget Sound	200	1	B-24
Total Program Change	**4,408**	**1**	

Justification of Program Changes

The 2013 Budget Request for Core Science Systems (CSS) is $120,390,000 and 606 FTE, a net program change of +$13,712,000 and +35 FTE from the 2012 Enacted Budget. For more information on the CSS Mission Area changes, please see Section B, Program Changes as indicated in the table.

Activity Summary

The Critical Zone is the term used in 2001 by the National Research Council and by many others since then to describe the integrated, dynamic processes occurring within a vertical cross section of an ecosystem from the tops of the trees down to its bedrock. Within the USGS, it is the CSS Mission Area's responsibility to ensure that integrated, dynamic views of the data

behind those processes are available to assist scientists, decisionmakers, and others. The CSS Mission Area delivers national-focused Earth-system-science and information science programs that provide fundamental research and data, underpinning all USGS mission areas, the USGS Science Strategy, and Presidential, Secretarial, and societal priorities. This activity provides the Nation with access to science information in a geospatial framework for use in managing natural resources and response planning for natural hazards. Data archives for biology and geology and the spatial data in *The National Map* are accessible to scientists and the public and provide critical data about the Earth, its complex processes, and its natural resources.

Scientists and resource managers require ready access to decades of observational data and analysis. Rigorous analysis of system interconnections and feedbacks is the key to advancing new discoveries of the Earth's complex systems and processes and making decisions regarding potential risks (natural events) such as volcanic eruptions, earthquakes, wildland fires, floods, droughts, and environmental impacts from manmade toxins, invasive species, and animal-borne diseases. Central to identification and evaluation of these connections is accessibility of data and information across multiple scientific disciplines, and geographic, temporal, and political boundaries. Data integration is a prerequisite to joining international efforts to develop worldwide science collaboration that can address future challenges.

The CSS Mission Area uses its information resources to create a more integrated and accessible environment for existing and new USGS data resources and participates in building global integrated science platforms. This activity includes the following subactivities:

- Science Synthesis, Analysis, and Research (SSAR);
- National Cooperative Geologic Mapping Program (NCGMP); and,
- National Geospatial Program (NGP).

The SSAR subactivity develops capabilities to facilitate scientific collaboration across a variety of scientific disciplines and organizations. This alignment ensures the data is strategically managed, integrated, and available to decisionmakers and others as they focus on issues associated with Earth and life science processes. In 2012, the USGS restructured the management of selected programmatic activities and is proposing to establish this new budget subactivity in 2013 by combining Biological Information Management and Delivery, National Geological and Geophysical Data Preservation and a component of Enterprise Information Resources. SSAR will align complementary functions that help to advance the USGS broad vision for scientific and technological capabilities that cross the boundaries between mission areas, programs, science centers, disciplines and individual scientists. This subactivity consists of the USGS Libraries Program, the John Wesley Powell Center for Synthesis and Analysis (Powell Center), the Core Research Center (CRC); and the Core Science Analytics and Synthesis (CSAS) program. This internal transfer continues the restructuring of the USGS to align budget and management to the Science Strategy by transferring library and information management to the Core Science System mission area.

The NCGMP was created following the passage of the National Geologic Mapping Act of 1992 (reauthorized in 2009; PL 111–11). The NCGMP is the primary source of multiple-purpose geologic maps and models that depict the distribution of the Nation's sediment and rocks and the resources they provide. These maps and three- and four-dimensional frameworks contribute to sustaining and improving the quality of life and economic vitality of the Nation and mitigating geologic hazardous events and conditions. For two decades, NCGMP has been a model of

successful cooperation among Federal, State, and university partners in delivering state-of-the-art digital geologic maps to the Nation in a cost-effective, timely manner.

Data are only useful if well documented through metadata and are available in a format that is understandable and accessible. The USGS has made great strides in comprehension and standardization of data. The NGP provides geospatial data and maps in industry-standard data formats and Web services, which allows these products and services to be readily incorporated and used by Government and industry. For example, several Federal and many State natural resource and environmental agencies map their water quality and quantity data using hydrography data from *The National Map*. The Federal Geographic Data Committee Office of the Secretariat (FGDC OS), administered by the USGS, provides key support to the FGDC Chair and Vice Chair, the 32 member agencies, and Federal geospatial initiatives and priorities including the Geospatial Platform, geospatial cloud computing, and coordinated standards development.

Not only is the USGS releasing its own data in more usable and accessible ways, but also is aggregating data from various trusted sources for more robust and meaningful data analysis and model development. The USGS works in cooperation with many organizations across the country to provide critical data and information to partners, stakeholders, customers, and the general public. Through electronic infrastructures overlaid with data management standards, the USGS delivers relevant data and information faster and in more usable formats than in the past, leading to better stewardship of our natural resources.

End Outcome Goal 4.4: Develop a Comprehensive Science Framework for Understanding the Earth									
Strategy #1: Develop and Integrated Data Framework that is used to Guide Science-Based Stewardship of Natural Resources									
Performance Measure	**2008 Actual**	**2009 Actual**	**2010 Actual**	**2011 Operating Plan**	**2011 Actual**	**2012 Enacted**	**2013 Budget Request**	**Change from 2012 Enacted to 2013**	**Long-term Target 2016**
Science Synthesis, Analysis and Research									
Percent of online natural resource products available via National Biological Information Infrastructure whose utility is validated through user interactions and downloads (SP)	**20.52%**	**21.34%**	**21.50%**	**19.00%**	**19.80%**	**Measure discontinued**	**N/A**	**--**	**N/A**
Comments: Due to significant funding redirections, the NBII is being terminated and will no longer be available online.									
Percent of focal migratory bird populations for which species pages are available through NBII (SSAR)	**15%**	**22%**	**29%**	**33%**	**29%**	**Measure discontinued**	**N/A**	**--**	**N/A**
Comments: Due to significant funding redirections, the NBII is being terminated and will no longer be available online.									
Percent of U.S. with land characterization and species distribution information available for resource management decision making updated in the last five years (SSAR)	**37%**	**77%**	**88%**	**91%**	**91%**	**98%**	**100%**	**+2%**	**Measure completed in 2013.**
Percent of records available through core science national products whose utility is validated by user acesses or downloads (SSAR)	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**Baseline being established.**	**Baseline being established.**	**--**	**TBD**
Number of metadata records (Data Pres.)	**N/A**	**600,000**	**1,052,038**	**600,000**	**741,545**	**1,341,545**	**1,941,545**	**+600000**	**TBD**
Comments: National Geological and Geosphysical Data Preservation Program is being combined with the Science Synthesis, Analysis and Research program.									
End Outcome Goal 4.4: Develop a Comprehensive Science Framework for Understanding the Earth									
Strategy #2: Generate Geologic Maps and Models for Sustaining Resources and Protecting Communities									
Performance Measure	**2008 Actual**	**2009 Actual**	**2010 Actual**	**2011 Operating Plan**	**2011 Actual**	**2012 Enacted**	**2013 Budget Request**	**Change from 2012 Enacted to 2013**	**Long-term Target 2016**
National Cooperative Geologic Mapping Program									
Percent of the U.S. that is covered by at least one geologic map and is available to the public through the National Geologic Map Database (SP)	**47.7%**	**48.9%**	**49.4%**	**50.4%**	**50.0%**	**50.8%**	**51.8%**	**+1%**	**54.8%**
	(1687637 / 3,537,438)	**(1729771 / 3,537,438)**	**(1746550 / 3,537,438)**	**(1782868 / 3,537,438)**	**(1767763 / 3,537,438)**	**(1797019 / 3,537,438)**	**(1832393 / 3,537,438)**		**(1938516 / 3,537,438)**
Annual production of geologic maps for the Nation (summed and represented as a percent of U.S. land area) made available to the public through the National Geologic Map Data Base (NCGMP)	**4.15%**	**2.90%**	**2.70%**	**2.00%**	**2.00%**	**1.80%**	**1.80%**	**0%**	**1.80%**
End Outcome Goal 4.4: Develop a Comprehensive Science Framework for Understanding the Earth									
Strategy #3: Advance the Earth Science Application of Geospatial Information									
Performance Measure	**2008 Actual**	**2009 Actual**	**2010 Actual**	**2011 Operating Plan**	**2011 Actual**	**2012 Enacted**	**2013 Budget Request**	**Change from 2012 Enacted to 2013**	**Long-term Target 2016**
National Geospatial Program									
Percent of the area of 48 states and DC published as high-resolution base geospatial databases and topographic map images that depict current geospatial information (SP)	**N/A**	**26.2%**	**63.5%**	**100.0%**	**100.2%**	**33.3%**	**66.7%**	**+33.3%**	**66.7%**
		(13203 / 50414)	**(32013 / 50414)**	**(50414 / 50414)**	**(50515 / 50414)**	**(17895 / 53684)**	**(35789 / 53684)**		**(35789 / 53684)**
Comments: USGS anticipates reaching 100 percent every third year, and then resetting the target to zero for the next 3-year cycle.									

Activity: Core Science Systems
Subactivity: Science Synthesis, Analysis, and Research

2011 Actual: $18.6 million (71 FTE)
2012 Enacted: $15.1 million (59 FTE)
2013 Request: $26.3 million (93 FTE)

Overview

In 2012, the USGS restructured the management of selected programs in the CSS Mission Area and is proposing a new budget subactivity, the SSAR. The USGS aligned similar functions to create this subactivity to advance scientific and technological capabilities that cross the boundaries between mission areas, programs, science centers, disciplines, and scientists. This subactivity includes the CSAS, USGS Libraries Program, the CRC, the Powell Center, the National Geological and Geophysical Data Preservation, and the Biological Information Management and Delivery subactivity.

The SSAR subactivity develops capabilities to facilitate scientific collaboration across a variety of scientific disciplines and organizations. This alignment ensures the data are strategically managed, integrated, and available to decisionmakers and others as they focus on issues associated with Earth and life science processes.

Program Performance

The SSAR subactivity includes the following components:

- the CSAS;
- USGS Libraries program;
- the CRC;
- Powell Center and;
- National Geological and Geophysical Data Preservation.

Core Science Analytics and Synthesis

Activities in the CSAS enhance CSS's ability to advance the USGS science strategy and deliver on USGS and Administration priorities by facilitating data management, communities of practice, applied earth systems information research, and products and tools development. The core of the CSAS comes from efforts formerly under the subactivity called Biological Information Management and Delivery. The 2013 budget request includes increases which will enhance and expand the science activities in the CSAS.

Data management is important to the science lifecycle. Interior is developing policies that will require an increased focus on data management plans as part of a project and study proposal processes. In support of this, CSAS scientists are working to incorporate data management best practices into the workflow of each scientist, often working side-by-side with scientists in the field, improving collaborations and ensuring data are available for reuse. As an example, the CSAS is piloting an approach to further the use of data management best practices by providing liaisons to USGS science data coordinators across the country.

SSAR facilitates a community focus bringing together those with common interests, goals, and data needs. To support communities, the CSAS leads the USGS Community for Data Integration and other communities of practice (e.g., pollinators; invasive species); conducts hands-on training for common methodologies, tools and applications; and contributes to the development, adoption and implementation of standards. As an example, CSAS scientists are leading implementation of the National Vegetation Classification Standard, developed over a decade by partners from many Federal and non-Federal organizations.

The Integrated Taxonomic Information System (ITIS) – With more than 600,000 names, ITIS is the Federal standard and authoritative source for scientific names of species for North America and the World. Led by the USGS, ITIS is a partnership of eight Federal agencies and is widely used in government, industry and academia both through the Website and automated Web services. With its partner Species2000, ITIS produces the *Catalogue of Life* (CoL) as well, which now includes more than 1.3 million species names. ITIS contributes more than 40 global species database sectors to the CoL checklist and is the regional hub for North America.

The USGS science strategy emphasizes applied Earth systems information research with a focus on data integration and new methods of investigation. CSAS activities work with other mission areas to leverage expertise and apply it to the computing and information needs of science research projects. By building collaborations across the USGS, and by partnering with other institutions, knowledgeable programmers, modelers, application developers and others come together virtually to help respond to complex and sometimes perplexing science questions.

The USGS works to understand, characterize, and develop approaches to address complex challenges. Foundational to this effort is the need for a robust capability to access and interact with historic, current, and dynamic data that are relevant, timely and well-managed. Such data assets provide U.S. scientists with a coast-to-coast view of the status, number, location, characterization, or other relevant information about the natural resources of our Nation. The CSAS enables this by developing and maintaining of a suite of national products, ensuring their broad availability to and interoperability with other national and global systems. These products make national-level data available through interactive systems that facilitate integration, modeling, and visualization of the data.

Gap Analysis Program (GAP) – The GAP is a component of SSAR. The GAP's mission is to promote biodiversity conservation by developing and sharing information on where species and natural communities occur and how they are being managed for their long-term survival. "Gap analysis" is a scientific method for identifying the degree to which native animal species and natural plant communities are represented in our present-day network of conservation lands. Those species and communities not adequately represented constitute "gaps" in conservation lands and efforts.

Protected Areas Database of the United States (PAD-US) is the official inventory of over 715 million acres of protected open space in the United States. It is the most complete and up-to-date database of its kind in the country, and feeds the IUCN World Database on Protected Areas. In 2011, maps generated from PAD-US were used by Secretary Salazar in meeting with State Governors to promote America's Great Outdoors.

In 2012, the CSAS is enhancing a new system developed in 2011—Biodiversity Information Serving Our Nation—to provide users with the ability to access, map, and download more than 81 million scientifically verified species occurrence data records. This work will continue in 2013.

National Fish Habitat Data System is a system which provides greater access to fish habitat data, serving the needs of the interagency National Fish Habitat Partnership, and enabled the first national assessment of aquatic habitat, published in 2011 as, *Through a Fish's Eye: The*

Status of Fish Habitats in the United States. Based on national data standards, the system provides Web-based access to data through a geospatial data viewer, as well as the ability to download data, maps, metadata, and map services. This access to data and related products is reducing the data processing workload of partners and better informing decisionmakers.

USGS Libraries

The USGS Libraries Program identifies, acquires, manages, and provides access to a broad collection of scientific information including USGS science products to a wide range of internal and external customers. It maintains physical and digital collections and provides tools for accessing these collections both onsite and remotely. In 2011, USGS libraries maintained over 1.8 million physical items. Collections are being digitized and described, and services are being provided for the identification and acquisition of specialized research products held in other libraries worldwide. In 2012, the Libraries Program is focusing on transition issues related to the closure or reduction of services in 12 USGS science centers to achieve efficiencies and build a consolidated library system. In 2013, the USGS Libraries Program will continue to migrate to a digital environment and improve existing systems and services to support scientific research by both USGS staff and the public.

Core Research Center

The CRC was established in 1974 to preserve valuable rock cores for use by scientists and educators from government, industry, and academia. The cylindrical sections of rock are permanently stored and available for examination and testing at the core storage and research facility in Denver, Colorado. The CRC is currently one of the largest and most heavily used public core repositories in the United States. The CRC encourages use of its facility by all interested parties. In 2011, CRC staff assisted USGS scientists in relocating 7,000 feet of mineral exploration core from collapsing sheds to safe and accessible storage at the CRC. CRC staff also provided drill-site core recovery, slabbing and curation of a new core for a USGS energy assessment of the Niobrara formation. In 2012 and 2013, the CRC will continue to meet the high demand from industry, academia and USGS scientists for access to collections.

The John Wesley Powell Center for Analysis and Synthesis

The Powell Center serves as a catalyst for innovative thinking in Earth system science research focusing on multi-faceted issues. This scientist-driven Powell Center completed its first full year of operation in 2011, after being piloted in 2009 and 2010, and selected five new working groups through peer-review by the Science Advisory Board. These working groups will focus on major ecosystem challenges including specific impacts of climate change, water quality and availability, and conservation, and other aspects of natural resources sustainability. In 2013, the Powell Center will facilitate a synthesis of the science available and identify the science gaps in understanding hydraulic fracturing associated with energy development.

Data Preservation

The USGS proposes to move the National Geological and Geophysical Data Preservation to SSAR. Efforts will continue to be dedicated to the preservation of physical and analog geoscience data including rock and ice cores, fossils, fluid samples of oil, gas, and water, and geochemical samples that represent potentially beneficial or harmful chemical compounds in the rocks. To accomplish this work, the USGS cooperates with State geological surveys and other Interior bureaus.

Web Sites

For more information about the SSAR program, please go to:

- CSAS - *http://www.usgs.gov/core_science_systems/csas/*
- Libraries - *http://library.usgs.gov/*
- CRC - *http://geology.cr.usgs.gov/crc/*
- ITIS - *http://www.itis.gov/*
- GAP - *http://gapanalysis.usgs.gov/*

Activity: Core Science Systems
Subactivity: National Cooperative Geologic Mapping

2011 Actual: $27.7 million (131 FTE)
2012 Enacted: $26.3 million (130 FTE)
2013 Request: $28.0 million (131 FTE)

Overview

The NCGMP, a nationwide program of surficial and bedrock geologic mapping, provides fundamental research and data that underpin all of the themes of the USGS Science Strategy. These primary data are applied in natural hazards mitigation, water resources delineation, energy and minerals exploration, climate change studies, and ecosystem and environmental health analysis and are readily accessible via the National Geologic Mapping Database (NGMDB).

National Cooperative Geologic Mapping

"A foundational science program: determining the geologic framework of areas determined to be vital to the economic, social, or scientific welfare of the Nation." — National Geologic Mapping Act 2009

Geologic maps and frameworks define the subsurface shape of aquifers, how much water can be stored in them, and parameters for water movement through the ground. Geologic mapping products also provide critical information for predicting and mitigating natural hazards, such as landslides, earthquakes, and volcanoes. For example, the USGS provides the Federal Emergency Management Agency (FEMA) with landslide risk-assessment maps that are used to help make decisions on road closures and home evacuations. The program also funds a project constructing three-dimensional maps through time of earthquake-induced ground shaking. These maps, based on accurate geologic parameters, are critical for earthquake disaster planning and mitigation efforts.

A hallmark of NCGMP, NGMDB is a major collaborative effort with the Association of American State Geologists. This national database provides rapid access for the general public, scientists, and decisionmakers to well-documented and standardized Federal and State geoscience information that can be used to support research, understanding, and decisions on a breadth of societal needs. This project leads national level information exchanges and the development of more efficient methods for digital mapping, cartography, Geographic Information System analysis, and information management via annual workshops.

New map of Big Bend National Park bridges past and present along the Texas/Mexico border

"Geology has a profound influence on other park resources, and the information in this map [Geologic Map of Big Bend National Park, Texas] will be used by park managers and researchers to help understand topics such as soils, plant communities, springs, ground water, and human history in the area."

William Wellman, Superintendent
Big Bend National Park
2011

A major Federal geologic mapping partnership is that between the USGS and the National Park Service (NPS). The NCGMP is the principal USGS partner coordinating and prioritizing geologic mapping studies with the NPS. NCGMP-funded projects work with other Federal land management agencies such as the U.S. Fish and Wildlife Service, the Bureau of Land Management, and the U.S. Forest Service.

The NCGMP works in close collaboration with State geological surveys, such as with the Central Great Lakes Geologic Mapping Coalition, which is a Federal-State partnership created to produce urgently needed, detailed, three-dimensional surficial-materials maps that provide a foundation for making sound economic and environmental decisions related to ground water resources, land, and other natural resources of the Great Lakes.

Program Performance

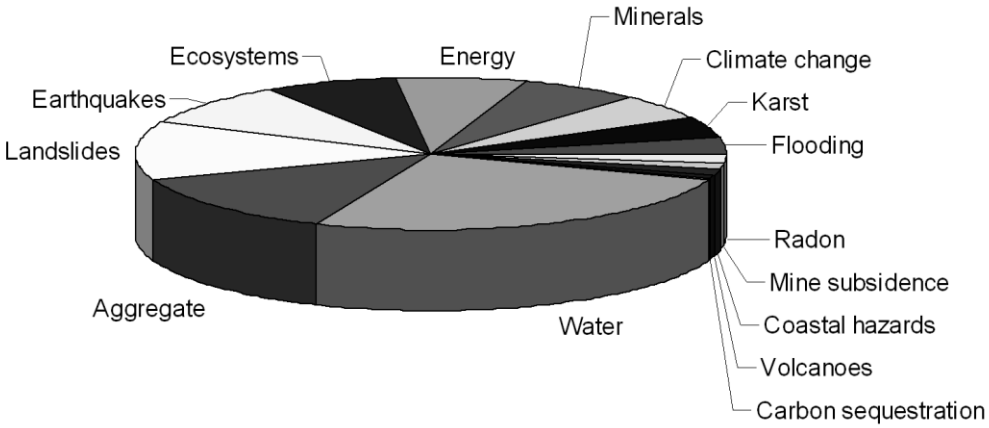
Review panels that include scientists and representatives from Federal and State governments, the private sector, and academia critically review work plans for the three main program components: Federal Lands Mapping program, (FEDMAP), State Mapping program, (STATEMAP), and Education Mapping Program, (EDMAP).

The FEDMAP component of the NCGMP supports about 25 regional geologic mapping and synthesis projects that cross jurisdictional boundaries. Priorities for this work are established jointly with Interior and other Federal agencies such as the NPS. New and ongoing geologic mapping work plans are evaluated annually by a FEDMAP Review Panel, which includes representatives from State geological surveys, the NPS, and USGS researchers that have diverse scientific backgrounds. Examples of NCGMP interdisciplinary geologic mapping accomplishments that contribute to answering a breadth of the Nation's natural resource issues include:

- Groundwater availability, movement, and contamination across the United States, such as in Texas, Oklahoma, New Mexico, and Colorado, Arizona, and New England;
- Earthquake and other hazards mitigation in the Seattle-Portland urban corridor, California, the Central United States, and Virginia;
- Ecosystem health in the Platte River Basin, in national parks, the Appalachian Blue Ridge Mountains, on Native lands in cooperation with tribal nations, and along the U.S.-Mexico border;
- Climate change understanding in the mid-Atlantic, California, and the Greater Platte River Basin, and Mojave Desert; and
- Energy and mineral resource occurrence in Nevada, Arizona, Colorado, and Wyoming.

The STATEMAP component of the NCGMP currently supports geologic mapping studies conducted by 44 State geological surveys through a competitive grant program that matches every Federal dollar with a State dollar. Since STATEMAP's inception in 1993, more than $88.0 million has been matched by 48 States. In each State, geologic mapping priorities are determined with the help of State Mapping Advisory Committees that include representatives from all levels of government, the private sector, academia, and industry. Currently, more than 500 individuals offer their time on these committees to prioritize geologic mapping needs. For the States, geologic maps have 15 primary applications, as follows:

Societal Applications of Federal and State Geologic Mapping



Many STATEMAP geologic mapping projects provide critical information needed by States and industry. In 2010 and 2011, investigations in the foothills of the Brooks Range of Alaska have been widely used by industry to characterize prospective geologic units in the subsurface and constrain the risk associated with various exploration models. Native American organizations that have significant land holdings in the foothills are benefiting from the exploration investment. Program outcomes from geologic mapping for the 2012 proposal cycle include mapping that will provide information primarily for groundwater quantity and quality projects across the United States. STATEMAP geologic maps will aid in understanding hydraulic fracturing in the development of gas production.

The EDMAP component of the NCGMP supports the training of a new generation of geoscientists in universities and colleges through a competitive matching-fund cooperative agreement program. Through the EDMAP program, students learn the fundamental principles of geologic mapping and field techniques. Since EDMAP's inception in 1996, more than $5.0 million from the NCGMP has supported geologic mapping efforts of 935 students working with more than 230 professors at 149 universities in 45 States, the District of Columbia, and Puerto Rico. Sponsoring universities match, dollar-for-dollar, the Federal EDMAP funding.

In 2011 the EDMAP program funded more students (85) than any year previous. Since 2004, the NCGMP has conducted an annual survey of EDMAP students who receive a questionnaire 3 years after completion of their EDMAP projects. The surveys show that 95 percent of respondents continue with advanced geoscience studies or obtain a job in the geosciences. Success of the program is demonstrated by the wide variety of education and industry jobs that the students pursue.

The Federal Advisory Committee for the NCGMP conducts an annual review of the program. In response to the most recent committee recommendations, the USGS is increasing cooperative research among Federal, State, and academic organizations across the country, working to increase numbers and the diversity of students entering geoscience education, engaging a broad stakeholder base in the development of mid-range program plans, and enhancing outreach and program visibility.

For more information on the NCGMP, please go to *http://ncgmp.usgs.gov/*.

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Activity: Core Science Systems
Subactivity: National Geospatial Program

2011 Actual: $65.8 million (379 FTE)
2012 Enacted: $64.3 million (379 FTE)
2013 Request: $66.1 million (382 FTE)

Overview

The NGP organizes, updates, and publishes the geospatial baseline of the Nation's topography, natural landscape, and built environment through *The National Map*; fosters a general understanding of the Nation's broad geographic patterns, trends, and conditions through The National Atlas of the United States®, and coordinates geospatial activities across the Federal agencies and with non-Federal organizations under OMB Circular A-16 and Executive Order 12906 through the Federal Geographic Data Committee (FGDC OS). Users throughout the Federal Government, including Interior, U.S. Department of Agriculture (USDA), the Environmental Protection Agency, the Department of Defense, FEMA, and the Department of Commerce, States, and other organizations receive NGP data and receive NGP Web services to support their decisionmaking and operational activities. The NGP devotes most of its attention to users in the areas of water resource and flood risk management, geologic mapping, geologic hazards, and natural resource management. Cooperative data acquisition projects reduce duplication of expenditures, and result in millions of dollars in contracts for America's geospatial industry.

Program Performance

The National Map

The geospatial baseline of the Nation's topography, natural landscape, and built environment is *The National Map*, a set of databases of geospatial data and information, and related Web services, products, and maps. The NGP carries out governmentwide leadership responsibilities for elevation, hydrography and watershed boundaries, geographic names, and orthoimagery data, and uses its resources to acquire and publish these data.

Elevation: In 2011, the NGP updated 4.7 percent of the area of the conterminous States, and 1.7 percent of Alaska with high resolution elevation data from modern LiDAR (light detection and ranging) and IFSAR (InterFerometric Synthetic Aperture Radar) technology. In 2012, the NGP is completing coverage of medium resolution elevation data for the conterminous States, and add high-resolution data for five percent of the conterminous States and 9.7 percent of Alaska. In 2013, the NGP will continue to cooperatively acquire high-resolution data for the conterminous States and Alaska, implement a process to identify places most in need of updates, and enhance its databases to accommodate data from LiDAR sensors and several interpretations of elevation data. Staff will work with other agencies to improve the return on the Nation's investment in modern elevation data.

Hydrography and Watershed Boundaries: In 2012, the NGP will finish the first 3-year update cycle for major rivers, and the integration of Mexican and Canadian data for watersheds that span the U.S. border. In 2011, NGP integrated very detailed hydrography data from LiDAR for New Jersey; this effort tested the integration of detailed data being produced for many areas of

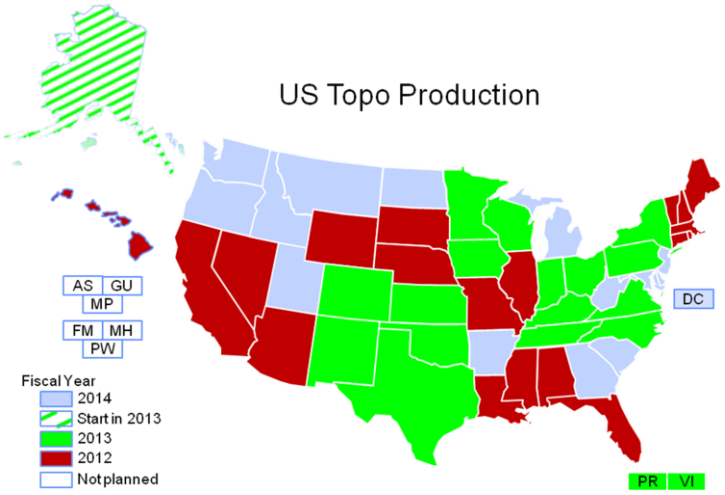
the country. In 2012 and 2013, the NGP will review and integrate the data from stewards into national databases. In 2013, the NGP will investigate the best way to update data for Alaska. To better support the water resource community, the NGP is adding locations of water quality stations to provide the means associating water quality, quantity, habitat, and other observations to the map data. In 2012 and 2013, the NGP will add key structures such as aqueducts and pipelines that change the natural water flow now modeled in the data.

Geographic names: The NGP maintains names data and staffs the Board on Geographic Names authorized by P.L. 80-424. In 2011, the NGP completed a multi-year effort to add 1.4 million names to create the Nation's most comprehensive source of geographic names; the effort reduces the likelihood of conflicting names appearing in Federal publications. In 2012 and 2013, NGP will add or update 35,000 records annually, and will define the extent of named physical features to speed production of US Topo and other maps.

Orthoimagery: The NGP funds half of Interior's contribution to the USDA National Agriculture Imagery Program (NAIP), which acquires imagery of the conterminous States every 3 years. In 2011, the NGP agreed with the State of Alaska to use Alaskan imagery in the US Topo maps for the State. The NGP works with National Geospatial-Intelligence Agency to acquire detailed imagery over the Nation's urban areas. In 2011, the NGP acquired data for 42 urban areas using NGA and NGP resources to match cooperators' funding, and plans another 31 agreements in 2012.

US Topo Maps

In 2012, the NGP started the second 3-year production cycle (see Figure – US Topo Production) for electronic topographic maps, and plans to produce approximately 18,333 US Topo maps annually. The map content is from *National Map* databases and NAIP imagery. The NGP continues to add content each year. In 2012, the NGP is releasing the remaining 180,000 scanned historical USGS topographic maps.



The map above shows the 3-year schedule for US Topo production. States with red (or dark) shading are scheduled for 2012. States with green (or medium) shading are scheduled for 2013 (including initial work for Alaska, and production for Puerto Rico (PR) and the Virgin Islands (VI)). States with blue (or light) shading are scheduled for 2014. Pacific island territories (American Samoa (AS), Guam (GU), Northern Mariana Islands (MP), Federated States of Micronesia (FM), Marshall Islands (MH), and Palau (PW)) have not been scheduled.

Data Access

The NGP releases its information through data download, and Web-based map services and a map viewer. In 2011, a new viewer allowed the retirement of several systems. In 2012, improvements will enable faster map display, better access to urban imagery, and new capabilities for users to download historical topographic maps, and contours and geographic names. In 2013, the NGP will make data available in new Web map formats and provide indexes to help users to find its

products and services. The NGP also supports a data archive that held 240 terabytes in 2011; the archive grows at a rate of 50 terabytes annually.

The NGP provides unique data and access to the emergency response community. In 2011, NGP provided imagery and data for flooding along the Red, Missouri, and Mississippi Rivers and in Northeastern States, tornados in central, Southern, and Northeastern States, and wildfires in South-Central and -Western States and Florida. The NGP supported earthquake and flood response in eight nations. Responders downloaded more than 150 terabytes of data. In 2012 and 2013, the NGP will respond to events and new needs, and lead USGS response coordination.

Cooperative Data Acquisition

Projects funded jointly with Federal, State, and other agencies provide most data used to update *The National Map*. In 2011, the NGP leveraged $3.6 million with $31.9 million from cooperators, yielding a 1:9 leveraging ratio.

Funding Source	2011
NGP	$3.6M
Cooperator	$31.9M
Total	$35.5M
Leverage	1:9

Value of data (in millions of dollars (M)) obtained through cooperation available to update *The National Map* in 2011. Typically the NGP leverages each appropriated dollar with $8-to-$9 of cooperator funds.

User Engagement

In 2011, more than 400 persons provided feedback through *The National Map* User Conference, and more than 500 organizations provided needs through the National Enhanced Elevation Assessment. In 2012 and 2013, the NGP will work with the users in the water, natural hazards, natural resource conservation, and geologic mapping communities to identify needs. Such engagement activities ensure the relevance of NGP products and services to users.

Research

In 2012, the NGP is providing sample data, map vocabularies, and leadership to develop semantic processing, the basis for next-generation geospatial processing. Collaboration with academic scientists led to a new map design for the US Topo map. Other projects to improve NGP efficiency and services investigate data integration, generalization, volunteered geographic information, and methods to process whole national databases at a time. This work will continue in 2013.

The National Atlas

The National Atlas delivers authoritative, accurate Federal geographic information carefully integrated to present a coherent look at America through map and data services. It is popular with educators, businesses, and citizens. In 2011, the USGS completed small-scale base map data and 237 thematic maps, and is preparing them for release in 2012. New in 2012 are upgraded Web map services to better enable customers to use Atlas data on the Internet, and the only integrated digital map of Federal lands for the entire United States. In 2013, the Atlas will focus more on human health, housing, crime, economics, and education, and will deliver an easy means of creating custom high quality page-size printable maps from thousands of National Atlas datasets.

Federal Geographic Data Committee Office of the Secretariat

The FGDC is an interagency committee that coordinates the collection, use, and dissemination of geospatial information to develop the National Spatial Data Infrastructure. It promulgates standards, system interoperability, and best business practices, policies, technology, and partnerships. The FGDC OS provides executive, administrative, and technical support to the FGDC.

In 2011, the FGDC released the Geospatial Platform, an Internet-based capability providing shared and trusted geospatial data, services, and applications for use by government agencies and the public, and completed related planning documents. It conducted a geospatial cloud computing testbed and developed geospatial standards. The Secretariat supported all FGDC activities, including the National Geospatial Advisory Committee. In 2012, the FGDC continues to work on the business case and plan for the Platform, and the maturation of the Platform's shared data, application, and infrastructure services. It will implement A-16 Supplemental Guidance, which directs agencies to use portfolio management for geospatial assets, clarifies agencies' geospatial management roles and responsibilities, outlines a data lifecycle management process, and provides for non-federal partnerships, and increase coordination between FGDC subcommittees and their partners. This activity will continue in 2013.

Management Activities

The NGP anticipates the National Academy of Sciences will deliver the report *Spatial Data Enabling USGS Strategic Science in the 21st Century* early in calendar year 2012. Recommendations from this report will guide NGP efforts to provide better integration of geospatial activities with the USGS strategic science plans.

In spring 2012, the NGP and the Land Remote Sensing program will release the results of a study, "National Enhanced Elevation Assessment," which documents emerging needs by Federal and State agencies and other stakeholders for enhanced elevation data, products, and services derived from modern remote sensing technologies such as Light Detecting and Ranging (LiDAR) and IFSAR, and options to optimize data acquisition strategies.

The NGP's 2012-2017 5-year strategic plan focuses the program on satisfying the needs of customers both inside and outside Interior by providing geospatial services and products that customers incorporate into their decisionmaking and operational activities. These products and services are from geospatial data organized and maintained in ways that minimize life-cycle costs. Data are developed by working with organizations whose outcomes and schedules align with those of the NGP. The strategy changes program activities to rebalance attention paid to customers with that provided to partners over the last decade. Focus will be on priority users in the water resource and flood risk management, geologic mapping, natural (geologic) hazards, and natural resource management communities. This focus aligns the NGP well with the USGS science strategy and the Department of the Interior's Strategic Plan. The strategy commits the Program to investments for which government funding will yield the most benefits, mainly for the themes of elevation and hydrography. The NGP is using the Federal Enterprise Architecture methodology to develop the schedule and actions to implement the strategy.

Web Sites

For more information about the NGP, please go to:

- *http://www.nationalmap.gov* for information about *The National Map*.
- *http://liaisons.usgs.gov/geospatial/* for information about the cooperative data acquisition and liaison activities.
- *http://www.nationalatlas.gov* for information about The National Atlas of the United States®
- *http://www.fgdc.gov/* for information about the Federal Geographic Data Committee.
- *http://www.geoplatform.gov* for Geospatial Platform information and documents.

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Activity: Administration and Enterprise Information

		2011 Actual	2012 Enacted	2013				Change from 2012 Enacted (+/-)
				Fixed Costs and Related Changes (+/-)	Program Changes (+/-)	Internal Transfers	Budget Request	
Science Support ($000)		77,229	73,427	219	-2,369	4,479	75,756	2,329
	FTE	437	419	0	-8	18	429	10
Security and Technology ($000)		23,430	20,991	894	-1,322	2,732	23,295	2,304
	FTE	84	78	0	-10	11	79	1
Information Resources($000)		17,988	15,802	0	0	-15,802	0	-15,802
	FTE	77	63	0	0	-63	0	-63
Total Requirements ($000)		**118,647**	**110,220**	**1,113**	**-3,691**	**-8,591**	**99,051**	**-11,169**
Total FTE		**598**	**560**	**0**	**-18**	**-34**	**508**	**-52**

Summary of Program Changes

Request Component	($000)	FTE	Page
Science Support	**-2,369**	**-8**	
Administrative Services	-2,137	-6	B-42
Administrative Services - IR	-232	-2	B-42
Security and Technology	**-1,322**	**-10**	
Administrative Services	-1,179	-9	B-43
Administrative Services - IR	-143	-1	B-43
Information Resources	**0**	**0**	
Total Program Changes	**-3,691**	**-18**	

Justification of Program Changes

The 2013 budget request for the Administration and Enterprise Information (AEI) activity is $99,051,000 and 508 FTE, a net program change of -$3,691,000 and -18 FTE from the 2012 Enacted Budget. The request includes realigning the funding and services of Information Resources to Science Synthesis, Analysis and Research in the Core Science Systems Mission Area, and Science Support and Security and Technology in this activity. For more information on the Administration and Enterprise Information Mission Area changes, please see Section B, Program Changes as indicated in the table.

Activity Summary

The AEI activity is comprised of two subactivities:

- Science Support
- Security and Technology

The AEI Mission Area is the framework for conducting science and includes bureau and area executive leadership and management that provide guidance, direction, and oversight of all USGS science activities. Additionally, this activity provides business and information systems; organizes and conducts planning and budgeting; provides policy guidance and direction; implements, monitors and enforces statutory requirements; manages people, funds, facilities and information technology; ensures scientific rigor and integrity; and communicates our mission and science to the Congress and public.

To align the funding for Information Resources with the management of the functions and services, this subactivity is proposed to be eliminated and the funding for the USGS libraries and information analysis moved to Science Synthesis, Analysis and Research in the Core Science Systems Mission Area; funding for publishing, enterprise Web activities, and science quality is proposed to move to Science Support within AEI; and funding for enterprise infrastructure is proposed to move to Security and Technology, also within AEI. This internal transfer continues the restructuring of the USGS to align budget and management to the Science Strategy by transferring library and information management to the Core Science System mission area; publishing services to Science Support; and technology information functions to Security and Technology.

Activity: Administration and Enterprise Information
Subactivity: Science Support

2011 Actual: $77.2 million (437 FTE)
2012 Enacted: $73.4 million (419 FTE)
2013 Request: $75.8 million (429 FTE)

Overview

The Science Support subactivity provides bureauwide leadership and direction; establishes organizational vision, mission, goals and scientific priorities; develops and enforces standards for scientific rigor and integrity; plans, obtains and manages necessary resources including people, budget authority, facilities and equipment; provides resource management systems; implements statutory and regulatory requirements and monitors and enforces compliance; and communicates our mission and science. The key areas are:

The USGS **Office of the Director** performs chief executive officer and chief operating officer responsibilities.

The science mission area **Associate Directors** establish program direction and goals, and serve as science advisors to the Director in their respective program areas.

The **Regional Executives** exercise line management responsibility for the science centers and implement science projects on the landscape.

The **Office of Budget, Planning, and Integration (BPI)** secures funding resources needed for the USGS to perform its mission goals, facilitates information sharing internally and externally, and provides in-depth analysis of budget and performance data for the USGS to understand, anticipate, and respond to shifts in social and political paradigms.

The **Office of Communications and Publishing (OCAP)** guides and conducts external and internal communications and provides publishing and Web development services.

The **Office of Science Quality and Integrity (OSQI)** establish and implements standards for scientific integrity and rigor. The OSQI also provides youth outreach, education and Native American liaison.

The **Office of Administration and Enterprise Information (OAEI)** establishes policies, coordinates and conducts activities in the areas of accounting and fiscal service, general services, security, safety and occupational health, acquisitions and grants, internal controls, technology transfer, facilities and property, environmental protection, and business systems. The Associate Director is the Chief Financial Officer (CFO), Assistant Director for Information Resources (ADIR) and Designated Agency Safety and Health Official (DASCHO).

The **Office of Human Capital (OHC)** accomplishes personnel management and policy operations, including ethics, equal employment opportunity, diversity and affirmative employment programs, employee development, competency management, and technical, managerial and leadership training and development.

Program Performance

Bureau leadership will continue to focus on finding innovative ways to deliver high quality services to support science activities, improve stewardship of resources, develop the workforce and reduce costs within the bureau's control.

Achieving Cost Efficiencies for Science (ACES) – In 2012, a formal, executive-led, bureauwide process was chartered to examine all aspects of the USGS for efficiency and effectiveness and encourage innovation. The ACES process will continue to lead data gathering and analysis of facilities utilization, science center efficiencies, administrative and technology services, headquarters functions, and the numbers and boundaries of areas in 2013 and beyond. ACES teams will make recommendations on best management practices, alternatives to achieve cost savings to meet Administration goals, and opportunities to more effectively and efficiently meet the science mission of the USGS.

Ideas and Suggestions Tool – Designed to increase the flow and implementation of innovative improvements from all areas of the organization, this online, automated tool is a way to submit suggestions for science and business management improvements. Any USGS employee can submit an idea, share it with others, and depending upon the degree of positive feedback from other USGS employees, it will be evaluated and considered for implementation by the USGS leadership team.

Fundamental Science Practices (FSP) – These vital science integrity and rigorous reviews were clarified in 2011 to prevent the need for redundant reviews when submitting information to peer-reviewed journals and accelerating reviews for information to be presented at conferences. In addition to ensuring scientific quality, FSP facilitates USGS collaboration on multi-agency projects and timely information sharing.

Real Property – In 2012, to support strategic facility investment opportunities based on integrated science and facility planning, the USGS will refresh the bureau's Facilities Asset Priority Index, focus on utilization improvement objectives, and target disposal of unneeded assets. A major initiative is underway to improve space usage by examining the long-term benefits of expanded teleworking and a hoteling strategy that promotes progress on bureau space and sustainability goals.

Science Education – The USGS participated in developing the Federal Science, Technology, Engineering and Mathematics (STEM) education and workforce needs report, "*A Report from the Federal Coordination in STEM Education Task Force, Committee on STEM Education, National Science and Technology Council, February 2012*." The USGS is continuing efforts to develop opportunities for students to work with USGS scientists in research and continue to expand the National Association of Geoscience Teachers/U.S. Geological Cooperative Summer Field Training Program, the Nation's longest-run science internship program.

Transportation Management – A Fleet Acquisition and Replacement Plan implemented in 2012 will be expanded in 2013 to continue efforts to replace vehicles with higher fuel economy vehicles and eliminate growth in the USGS fleet.

Technology Transfer – The Federal Technology Transfer Act, 15 USC 3710 as amended, requires each Federal laboratory having 200 or more full-time scientific, engineering and related technical positions to establish a research and technology application function. Within the USGS, this function is housed in the Office of Policy and Analysis where staff service USGS

Science Centers and offices throughout the country. In 2013, the USGS will continue negotiating and drafting Cooperative Research and Development Agreements (CRADAs), Technical Assistance Agreements, Facility Use Agreements, Material Transfer Agreements, and Patent Licenses. This office also manages the USGS intellectual property and inventions program; markets USGS technology opportunities and assistance to industry, non-profits, academic institutions, and State agencies; and provides training to USGS personnel on technology transfer and intellectual property protection. At the end of 2011, the USGS held 56 current patents. During 2011, the U.S. Patent and Trademark Office accepted filings for one new USGS patent application, making for a total of 12 patents pending. The table below summarizes the number of projects in 2011.

Technology Transfer 2011	Total Number	Private	Non-Profits/ Academic Institutions	Government/ International Entities	Partner Contributions ($000)	USGS/In-Kind Contribution ($000)
CRADAS	10	10	0/0	0/0	450	50
Other Technology Agreements	91	29	23/10	8/21	1,870	582
Patent Licenses	20	18	0/2	0/0	82	0

USGS science and research contributes to a broad range of valuable collaborative projects in the private and academic sector. With expansion of its facility use program, the USGS has increased to 27 the number of specialty analytical laboratory services providing unique capabilities to the United States, foreign partners, and academia. The total number of user agreements executed during 2011 was 284.

Workforce Planning – Recently developed workforce analysis and evaluation tools are being used to advance a comprehensive bureau-level workforce plan. The plan is a road map for aligning people with the organization's strategic direction that will be implemented in 2013 and beyond.

Energy Efficiency and Environmental Management – In 2012, the USGS will continue to work to achieve the targeted energy use reduction goals. A USGS Greenhouse Gas Reduction master plan is in place that will guide and monitor greenhouse gas emission reductions and outreach efforts in the following years.

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Activity: Administration and Enterprise Information
Subactivity: Security and Technology

2011 Actual: $23.4 million (84 FTE)
2012 Enacted: $21.0 million (78 FTE)
2013 Request: $23.3 million (79 FTE)

Overview

The Security and Technology (S&T) subactivity provides the critical information technology (IT) foundation for the USGS science mission by implementing advances in IT and computing capability and using them to facilitate research, data gathering, analysis and modeling, scientific collaboration, knowledge management and work processes. This subactivity also supports the Department of the Interior (Interior) information technology transformation.

Information Security protects infrastructure and data from improper or malicious access or manipulation, protects the integrity and availability of science information, and preserves the confidentiality of privacy and other sensitive information.

Telecommunications support timely transmission and sharing of emergency and routine data such as from earthquakes, flooding, and volcanic eruptions. This component also provides regular voice and computer network services.

Computing Infrastructure provides data storage and Web-based collaboration tools, directory services, Internet and Intranet services (EWeb), GIS support, and a “One-Stop Shop” Service Desk.

Information Management conducts planning for future requirements, prevents loss of capability through investment control and supports sound investment strategies (Capital Planning and Investment Control).

USGS DOI Enterprise Services supports Information Technology Transformation, technology streamlining and cost and service efficiency initiatives through contributions to the DOI IT Working Capital Fund.

Program Performance

The Security and Technology subactivity will continue to meet the constant demand for more and better IT services by focusing on four key priorities: enhancing science information delivery; protecting science data and assets; maintaining operations; and supporting Information Technology Transformation initiatives.

Information Technology Transformation Initiatives are supported by S&T staff leading and participating on Interior planning teams. The Secretary of the Interior established direction for the fundamental restructuring and transformation of IT capabilities in order to take advantage of advances in computer technology. The USGS will participate in transformation planning activities thereby preserving unique scientific computing and communications capabilities while contributing to cost and management efficiencies.

The USGS will participate on teams planning departmentwide electronic mail and instant messaging services; common technology products and services for non-specialized requirements; consolidated telecommunications infrastructure, hosting processing capabilities, help desks and facilities; standardized risk management strategy; and standardized radio technologies. Additionally, the USGS will support the continued efforts toward improving and enhancing open collaboration and communication with citizens through the Open Government and Web Reform initiatives.

Science Information Delivery is enhanced by increasing information and real-time collaboration resources available on the Internet and enhancing wireless and mobile applications to enable information delivery to scientists and customers faster and more efficiently. For example, 90 percent of the USGS's approximately 9,000 streamgages are equipped with telemetry that transmits a reading of stream depth (stage) to a district office via satellite or telephone. The networks and Internet access provided by the S&T ensure this information is captured and accessible. These real-time data are used by the National Weather Service, the U.S. Army Corps of Engineers, and the Federal Emergency Management Agency for real-time hazard mitigation such as blowing the dams in spillways and for designing future reservoirs and dams.

USGS Science Data and Assets are protected to ensure availability and prevent corruption of data by implementing risk management policy and procedures which balance potential risk to technology systems with mission requirements for data access and sharing. Real-time security status information, such as progress in updating software to patch identified vulnerabilities or attempted system breaches, is provided automatically to appropriate mission and security personnel. This will enable the USGS to effectively balance organizational risk with the value of collaborating with scientists in other organizations.

Operations are delivered more efficiently by using software and new equipment technologies to provide user support remotely (zero touch) instead of through traditional face-to-face, desk-side support. Automating these user support services will further reduce the costs of these services without reducing quality or responsiveness.

In 2013, the USGS will continue consolidating computer data centers; taking advantage of economies of scale, enabling reductions in the number of machines running, which will lower operating costs. This effort, which began in 2011, will consolidate the 99 existing USGS data centers into four central locations and other key locations determined by mission requirements. The four central locations are: Denver, CO; Reston, VA; and two sites in Menlo, CA.

Activity: Facilities

		2011 Actual	2012 Enacted	2013				Change from 2012 Enacted (+/-)
				Fixed Costs and Related Changes (+/-)	Program Changes (+/-)	Internal Transfers	Budget Request	
Rental Payments and Operations & Maintenance		97,427	93,141	3,686	-4,390	0	92,437	-704
($000)	FTE	60	60	0	0	0	60	0
Deferred Maintenance and Capital Improvements		7,292	7,280	0	0	0	7,280	0
($000)	FTE	0	0	0	0	0	0	0
Total Requirements ($000)		**104,719**	**100,421**	**3,686**	**-4,390**	**0**	**99,717**	**-704**
Total FTE		**60**	**60**	**0**	**0**	**0**	**60**	**0**

Summary of Program Changes

Request Component	($000)	FTE	Page
Rental Payments and Operations & Maintenance	**-4,390**	**0**	
O&M Efficiencies	-4,390	0	B-43
Total Program Changes	**-4,390**	**0**	

The 2013 Budget Request for Facilities is $99,717,000 and 60 FTE, a net change of $704,000 from the 2012 Enacted Budget. For more information on the Facilities Mission Area change, please see Section B, Program Changes as indicated in the table.

Activity Summary

The USGS Facilities Activity provides safe, functional workspace for accomplishing the bureau's scientific mission. Funds support basic facility operations; security costs; facility maintenance in compliance with Federal, State, and local standards; and the provision of a safe working environment for USGS employees, visiting partners, and customers.

Assets include property consisting of land, buildings, or other improvements permanently attached to the land or a structure on it. The Department of the Interior (Interior) defines a facility as an individual building or structure. The USGS defines facilities to include all sites where USGS activities are housed and mission related work conducted. Facilities typically provide space for offices, laboratories, storage, parking, and shared support for cafeterias, conference rooms, and other common space uses. The USGS also classifies its eight large (greater than 45 feet in length) research vessels as laboratory facilities. Owned assets are usually part of a campus; for example, the Leetown Science Center includes all associated land, buildings, and other structures.

The Facilities Activity is comprised of two subactivities: Rental Payments and Operations and Maintenance (RP and O&M), and Deferred Maintenance and Capital Improvements (DMCI).

In 2012, appropriated funds included in this activity are anticipated to cover approximately 64 percent of recurring USGS facilities costs. Customers, through reimbursable funding, will provide approximately 27 percent, and USGS science programs will provide the remaining nine percent. This activity supports Interior's goal of facilities improvement by tracking outcomes such as overall condition of buildings and structures as reported in the Federal Real Property Profile; reduction of energy intensity by three percent annually; percentage of square footage that meets Executive Order (E.O.) 13514 sustainable building goals; and percent of assets targeted for disposal that were disposed.

The facilities program goal is to meet bureau science needs while optimizing facilities location, distribution, and use to control or reduce costs. Objectives for meeting this goal include:

- Coordinating facility planning with science planning to provide safe, high-quality workspace aligned with science needs;
- Developing Asset Business Plans to meet asset management goals, continue annual surveys, and cyclic condition assessments;
- Meeting performance targets for improving space utilization, controlling rent and operating costs, and releasing unneeded space;
- Reducing deferred maintenance by renovating and constructing buildings and other facilities to replace assets otherwise no longer cost effective to operate;
- Establishing an effective maintenance program at each owned facility to meet industry best practices;
- Increasing co-location consistent with science program objectives; and
- Achieving energy performance goals.

Facility Planning – The USGS updated its Site-Specific Asset Business Plans (ABPs) to support the bureau's Asset Management Plan (AMP). The ABPs are 5- to 10-year plans addressing specific needs of a field unit, campus, or region including all assets reported in the Federal Real Property Profile (FRPP). The USGS ABPs effectively address the life cycle issues and characteristics of a site's real property assets. For the local facility or program manager, the ABPs help provide a profile of their current facilities, anticipate future needs, create an awareness of recurring and one time space costs, plan mission operations with facilities in mind, and identify initiatives that may qualify for additional funding. The ABPs are also used as annual action plans to direct bureau area resources where they are most needed to support the USGS mission.

Space savings are integral to rent and operations management. The USGS realizes space savings when locations are able to consolidate space or relocate to space with lower costs. The USGS is participating in Interior's goal to develop and proceed with a Cost Savings and Innovation Plan (CSIP). The USGS's goals under the CSIP are to reduce its footprint and costs; move toward the 180 square foot per person utilization standard; and utilize space more efficiently by implementing computer technology and programs such as teleworking. The USGS has implemented a centralized space action approval process to focus on meeting these goals.

At the USGS National Center in Reston, VA, the USGS performs building operations under General Services Administration (GSA) delegation and has day-to-day control of most space assignments. The USGS supports other agencies at the National Center, including a Department of the Interior computer center and office space occupying 25,000 square feet and another Federal tenant, which occupies 73,500 square feet of USGS-released space. The agreement for this space will continue through 2013, providing the USGS with a space savings of 82,000 square foot.

The USGS will make every effort in 2013 to ensure that when entering lease agreements, provisions that encourage energy and water efficiency will be incorporated. Build-to-suit lease solicitations shall contain criteria encouraging sustainable design and development, energy efficiency, and verification of building performance. In addition, a preference for buildings

having the Energy Star building label will be included in the selection criteria for acquiring leased buildings, and leasing companies will be encouraged to apply for the Energy Star building label.

The USGS relies on GSA owned and leased buildings for nearly 70 percent of the space it occupies. The USGS has no ability to reduce fixed rental rates at these sites and can only offset the higher facility costs by vacating space. Therefore, the primary emphasis will be on improving space utilization, disposal of underutilized assets; consolidating operations within and relinquishing space to GSA provided offices, laboratories, data centers, and warehouses at major USGS centers in Reston, VA, Denver, CO; and Menlo Park, CA.

Bureau Systems – The USGS is utilizing the Financial and Business Management System (FBMS) to track the bureau's facilities cost at the asset level. In the long range this will allow for improved facility planning and reporting to the Department.

Maintaining America's Heritage – As the steward of priceless natural and cultural treasures, Interior is committed to preserving and maintaining operational facilities and major equipment. The USGS 2012 budget included an estimated $30.3 million for Maintaining America's Heritage. This includes $7.2 million for DMCI, including facilities projects, equipment maintenance, maintenance management, condition assessment and project planning;
$4.0 million is the estimated amount spent from program dollars for facilities and equipment maintenance needed for Hazards Networks; and $19.1 million for O&M.

The USGS owns 33 installations that are comprised of 275 buildings on approximately 2,115 acres. These installations include 10 ecological science centers; 5 ecological field and research stations, 1 land use center—the National Center for Earth Resources Observation Science (EROS), 10 geomagnetic, seismic and volcano observatories, and 7 miscellaneous owned properties such as stream gage stations, warehouses and a storage annex. The USGS also owns eight large research vessels that have operations and maintenance costs that are comparable to those of a USGS building. These vessels exceed 45 feet in length and perform overnight research to support biological, water resources, and marine geology research. Five of the vessels operate on the Great Lakes, two operate in California, and one in Alaska. The vessels are equipped with wet laboratories, trawls, gillnets, larval fish tow nets, equipment for limnological and contaminant sampling, acoustic fish-detection systems, and computers. All vessels also have state-of-the-art navigation systems to precisely locate sampling stations. The Great Lakes Science Center is the only organization in the United States and Canada that has a research vessel with deepwater capability on each of the Great Lakes.

In 2012, the USGS is planning to spend $145.8 million on rent and operations and maintenance. Of these costs, 64 percent ($93.1 million in 2012) are funded through this subactivity. The remaining costs are funded by reimbursable partners (27 percent) and science programs (9 percent). In 2012, the total facilities rent cost is estimated to be $110.8 million. Approximately 20 percent of rent and operations and maintenance funds are spent on USGS owned properties; these assets are the most unique and mission critical in the USGS portfolio.

As part of the Strategic Facilities Master Plan (SFMP), USGS facilities were ranked in terms of their mission dependency using a tool called the Asset Priority Index (API). Although the largest concentrations of employees are in GSA-controlled space in Reston, VA, Denver, CO, and Menlo Park, CA, 15 of the top 20 mission-critical assets are owned assets in other locations. These owned assets have specialized capabilities or are positioned on the landscape to address specific science issues.

For example, the National Wildlife Health Center (NWHC) in Madison, WI, maintains a high-security infectious disease facility that operates at the Biological Safety Level 3 (BSL-3), and is certified by the Centers for Disease Control and Prevention (CDC) to receive and work with "select" disease agents, and approved by the U.S. Department of Agriculture (USDA) to import, export, and transport domestic animal infectious agents. In the case of wildlife disease emergencies, the NWHC is the lead for Interior under the Department of Homeland Security's National Response Plan. The 24-acre NWHC tract is surrounded by a 7-foot-high cyclone fence. The entrance to the science center has a high-security-card access gate. Each building has security card readers for entrance and security key pad systems. Twenty-four hour access to restricted areas is limited per CDC Select Agent requirements for BSL-3 laboratories. The Tight Isolation Research Building is further secured by an additional cyclone fence.

The USGS updated its SFMP in 2012, to explore and document the best approaches available for the USGS to meet reductions in the Facilities Budget Activity and recommendations to meet the USGS Real Property CSIP in targeted reductions. The SFMP examined all existing USGS facilities and identified cost saving opportunities for consolidation taking into account the importance of each location to the USGS mission. The effort involved identifying new metrics and refining and updating existing metrics such as utilization and Asset Priority Index (API). The plan identified opportunities for improving the integration of science and facilities planning.

The USGS 5-Year Space Management Plan supports the bureau's SMP and Site Specific ABPs and provides a framework, strategic vision, and plan of action for effective bureau management of GSA provided space, USGS direct leases, and owned property. It is used by USGS management to implement bureau space goals, including consolidation, co-location, and disposal. Information contained in the AMP is focused on mission dependency and program requirements for space.

The Facility Maintenance Management System (FMMS) is the USGS implementation of the commercial maintenance management software application Maximo™. Interior has required that all bureaus use Maximo™ as the standard maintenance management solution. The system is used to document maintenance requests and day-to-day maintenance activities, establishing preventive maintenance schedules, and developing the Deferred Maintenance and Capital Improvement (DMCI) 5-Year Plan. It supports efficient operation and maintenance of USGS facilities by providing accurate maintenance information to local, regional, and national facility managers. It includes a mobile work order solution used by maintenance technicians at larger centers to document maintenance activities as they are performed without requiring a connection to the FMMS database. Use of FMMS supports the USGS's AMP by establishing an inventory and maintenance history on all constructed assets and associated equipment, standardizing maintenance business practices, facilitating maintenance reporting and data analysis, and supporting budgeting and the 5-year DMCI planning process. The FMMS is connected to the Department's Financial and Business Management System (FBMS) through the use of an interface that synchronizes real property data between both systems. In 2013, the FMMS will be modified to provide additional functionality for reporting on bureau condition assessment and deferred maintenance activities.

End Outcome Goal 5: Building a 21st Century Department of the Interior									
Strategy #5: Improving Acquisition and Real Property Management									
Performance Measure	**2008 Actual**	**2009 Actual**	**2010 Actual**	**2011 Operating Plan**	**2011 Actual**	**2012 Enacted**	**2013 Budget Request**	**Change from 2012 Enacted to 2013**	**Long-term Target 2016**
Science Synthesis, Analysis and Research									
Overall condition of owned buidlings and structures(as measured by the FCI) that are mission critical and mission dependent (as measured by the API), with emphasis on improving the condition of assets wth critical health and safety needs	**0.134**	**0.134**	**0.137**	**0.078**	**0.111**	**0.107**	**0.099**	**-0.008**	**0.078**
	(68404 / 510141)	**(71543 / 532365)**	**(72956 / 530616)**	**(41515 / 532365)**	**(59223 / 534377)**	**(56911 / 532365)**	**(53069 / 534377)**		**(41543 / 534377)**
Comments: In order to maintain reporting consistency as previously reported, the metric currently includes owned, direct leased, and state and government owned assets.									

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Activity: Facilities
Subactivity: Rental Payments and Operations and Maintenance

2011 Actual: $97.4 (52 FTE)
2012 Enacted: $93.1 (60 FTE)
2013 Request: $92.4 (60 FTE)

Overview

The Rental Payments (RP) and *Operations and Maintenance* (O&M) Subactivity provides the USGS with funding needed to meet asset management goals and carry out Executive Orders (E.O.) related to Federal space.

The RP cost component provides rental payments for space occupied by the USGS to GSA, other Federal sources, private lessors, and cooperators. The USGS has unique facility requirements for supporting science functions and relies heavily on the GSA to meet those needs, including modern laboratory space. The USGS occupies a total of 4.2 million square feet of rentable space in about 175 GSA buildings nationwide, making the USGS one of the largest users of GSA space within Interior. Approximately 20 percent of USGS space is owned and the remaining 80 percent is provided by GSA, direct leases, and cooperative and interagency agreements.

The O&M component provides funding for basic facility operations; security costs; facility maintenance in compliance with Federal, State, and local standards; and the provision of a safe working environment for USGS employees, visiting partners, and customers. Maintenance involves the upkeep of USGS owned facilities, structures and capitalized equipment, necessary to maintain the useful life of the asset. This includes preventive maintenance; cyclic maintenance; repairs; rehabilitation; replacement of parts, components, or items of equipment associated with the facility; adjustment, lubrication, and cleaning (non-janitorial) of equipment associated with the facility; periodic inspection; painting; reroofing; and resurfacing. Also included are special safety inspections and other activities to ensure smooth operation and to prevent breakdowns; scheduled equipment servicing (such as that for heating, ventilation, and air conditioning equipment); and maintenance for owned facility-support equipment such as snowplows and landscape-maintenance vehicles.

Operational costs at USGS owned, and some leased, facilities include electricity, water, and sewage; gasoline, propane, natural gas, diesel, and oil; janitorial services; groundskeeping; waste management and disposal; vehicles operated solely in direct support of operating the facility; annual certification for building systems such as fire systems, fire extinguishers, back-flow preventers, and fume hoods; and upkeep standards necessary to assure the anticipated useful life of the vessels, salaries and benefits of marine professionals operating the vessel, fuel, docking fees, inspections, minor repairs, cyclic maintenance, and at least one vessel haul-out per year. In addition to maintenance costs, salary costs associated with onsite staff responsible for the day-to-day operations of the facility and for maintaining it in operating order are included in the subactivity.

Program Performance

The USGS is dedicated to achieving energy and water use reduction and renewable energy consumption goals, set forth in E.O. 13423, Strengthening Federal Environmental, Energy, and Transportation Management; the Energy Independence and Security Act of 2007 (EISA); and E.O. 13514, Federal Leadership in Environmental, Energy, and Economic Performance, and has implemented an energy management plan to guide programs toward meeting mandated goals. The USGS continues to reduce its potable water consumption. Savings are anticipated in 2013, as several locations are implementing projects that will impact potable water use.

In compliance with the December 2, 2011, Presidential Memorandum, Implementation of Energy Savings Projects and Performance-Based Contracting for Energy Savings, the USGS will prioritize Energy Conservation Measures (ECMs) with the greatest return on investment, leveraging both direct appropriations and performance contracting, consistent with guidance by the Office of Management and Budget.

In 2012, the USGS completed an Energy Savings Performance Contract (ESPC) at the National Wildlife Health Center (NWHC) in Madison, WI. The project required a total investment of $7.2 Million with an estimated annual savings of $82,000 per year. Energy consumption savings are estimated to be 18.8 percent for the center. A 72.2-kW photovoltaic (PV) system was installed, as part of the ESPC, which provides 3.9 percent of the electric energy requirements of the site, saving 93,300 kWh and $8,700 per year. In addition, passive solar daylighting was installed.

The S.O. Conte Fish Laboratory in Turner Falls, MA, completed installation of new roofs on three buildings with passive solar daylighting included in one room. The roofs were cool roof construction with Energy Star roofing membranes. The center also installed a new energy efficient 30-ton rooftop unit as well as variable frequency drives on pumps and setbacks on heaters to reduce operating hours and save energy.

The Earth Resources Observation and Science Center, in Sioux Falls, SD, is one of the largest USGS campuses both, in size and energy consumption. Energy and water efficiency projects included replacement of indoor cooling towers with water conserving models; upgrade of a 200 and 300 ton chiller to energy efficient models; and replace the HVAC system with an energy efficient system for the 272,400 square foot building.

The Upper Midwest Environmental Science Center in La Crosse, WI, completed energy and water efficiency projects including the installation of new boilers and duel fuel burners on existing boilers; installation of geothermal cooling and heating; construction of a 21,000 square foot LEED certified building addition; replacement of humidifiers in central air handling units; replacement of a water tower; and installation of a stormwater diversion and collection system.

In 2013, the USGS Facility Energy Program will ensure that all facilities understand the energy and water efficiency mandates and goals, and will provide guidance and assistance, as necessary. The program will promote alternative financing, renewable energy technologies, sustainable design principles in all projects, and training to ensure that field personnel have the tools necessary to meet the energy and water efficiency mandates.

Activity: Facilities
Subactivity: Deferred Maintenance and Capital Improvements

2011 Actual: $7.3 million (0 FTE)
2012 Enacted: $7.3 million (0 FTE)
2012 Request: $7.3 million (0 FTE)

Overview

The USGS has developed a DMCI 5-Year Plan. The plan provides the projects of greatest need in priority order, with focus first on critical health and safety and critical resource protection. The bureau has undertaken an extensive effort to develop this plan in the field, where the urgency of remediation and science program impact are most visible.

The DMCI subactivity funds address the highest priority USGS facility and equipment needs according to departmental guidance. The current funding level addresses approximately nine percent of the facilities deferred maintenance and capital improvements backlog of $75.9 million (as reported in the 2011 FRPP). The condition assessment program includes annual surveys and a cyclic process for comprehensive onsite inspections to document deferred maintenance. Facilities projects reflect comprehensive evaluations conducted by independent architectural and engineering firms. These installation-wide assessments help establish core data on the condition of USGS constructed assets.

Through the asset management planning process, the USGS can identify real property assets that are candidates for disposition. Any asset that is no longer critical to the mission, in poor condition, or no longer cost-effective to maintain is a candidate for possible disposal.

The USGS has stewardship responsibility for unique mission equipment assets such as hazard warning networks, river cableways, and streamgaging stations, all of which require maintenance and capital investments to preserve their functionality. Projects targeting these assets are included under the Equipment Section of the DMCI 5-Year Plan and evaluated using the same safety criteria as those governing constructed real property assets.

The USGS prioritizes critical DMCI needs according to the Interior's guidelines. Five-Year Plans are developed and updated on an annual basis using the uniform, departmentwide process. Plans are subject to adjustments in out-years due to funding changes and revised priorities based on comprehensive facility condition assessments, annual condition surveys, and emergency needs. The goal of the 5-year planning process is to focus limited resources on projects that are both mission critical and in the most need of repair or replacement. The ranking equation is designed to accommodate many types and sizes of projects, from simple to complex. It places highest priority on facility-related Critical Health and Safety and Critical Resource Protection deferred maintenance needs in that order. Capital improvement projects that eliminate substantial amounts of deferred maintenance receive a higher ranking than projects that do not address deferred maintenance needs.

The condition assessment process identifies deferred maintenance needs and determines the current replacement value of constructed assets. Knowing the estimated cost of deferred maintenance and the replacement value of constructed assets allows the USGS to use the industry standard FCI as a method of measuring facility condition and condition changes. It is an indicator of the depleted value of capital assets. Funds are also available through the

condition assessment process to identify, report, and track any asbestos, environmental, and disposal liability sites on departmental lands according to guidelines issued by Interior's Office of Environmental Policy and Compliance.

Program Performance

The USGS continues modeling exercises to project the appropriate sustainment level for operations and maintenance funding and to identify voids in critical cyclical and preventive maintenance practices and processes.

DMCI projects that received American Recovery Reinvestment Act (ARRA) funding were completed in 2012. ARRA funding was used to address DMCI projects that were planned for future years in the USGS 5-Year Plan. Use of ARRA funding enabled the USGS to improve the health and safety of visitors and employees in the remediated facilities, sustain the asset through its remaining useful life, and ensure compliance with building codes and industry standards. ARRA funding supported the advancement of USGS asset management and science programs by reducing deferred maintenance on high priority facilities. Deteriorated facilities were decommissioned, which "right-sized" the overall portfolio of assets and improved the bureau's overall FCI. Additionally, the ARRA funding improved the longevity of seismic networks and the streamgage equipment, and maximized the efficiencies of the real property assets and equipment used to carry out the science mission. ARRA funding also provided for the remediation of 1,289 discontinued monitoring sites nationwide that presented public safety and health problems and reduced USGS liability for discontinued monitoring.

The Columbia Environmental Research Center in Columbia, MO, completed two major ARRA construction projects that reduced energy and water consumption on the campus. The first was a laboratory consolidation project that eliminated nine smaller buildings and constructed one new, more efficient laboratory building. The second project was the replacement of the fume hood exhaust system in the main laboratory building with a more energy efficient system.

A 56,562 square foot annex was designed in 2011 for the Patuxent Wildlife Research Center in Laurel, MD, and was LEED Gold certified. The Center also completed construction of a LEED Silver two-story residence in 2012 with ARRA funding under a joint project with the Fish and Wildlife Service.

2013 Deferred Maintenance and Capital Improvement Plan

The following table lists, in priority order, the proposed projects and equipment to be addressed by DMCI in 2013, within available funding ($000).

FACILITY/PROJECT AMOUNT	PROJECT NUMBER/DESCRIPTION
S.O. Conte Anadromous Research Center $95	1907370 – Redesign and Reconstruct Septic System
Upper Midwest Environmental Science Center (UMESC) $84	B20090003B – Replace Failing Concrete in Fish Holding Tank
Florida Caribbean Science Center (FCSC) $263	B19990062F – Replace Chemical Fume Hoods and Upgrade Interior Laboratories
S.O. Conte Anadromous Research Center - Fish Passage Lab $235	B2008CAF01C – Replace Rooftop Heat and Air Conditioning
S.O. Conte Anadromous Research Center – West Laboratory and Flume Area $172	1909907 – Replace and Relocate Exhaust Fans
S. O. Conte Anadromous Research Center $144	B2003CAF12C – Replace Deteriorated Sloping Roofs and Wood Siding
National Wetland Research Center $450	1909481 – Replace Aged and Inefficient Chillers
National Wetlands Research Center $350	1909482 – Replace Aged and Inefficient Cooling Tower
S.O. Conte Anadromous Research Center $166	1909908 – Construct New Storage Building for Research Equipment and Supplies
Cheboygan Vessel Base $170	1923911 – Replace Deteriorating Roof on Warehouse
National Wildlife Health Center (NWHC) $150	1928486 – Rehabilitate Main Building Laboratory Water Piping for Potable Water Compliance
Northern Appalachian Research Center (NARC) $40	1919960 – Redevelopment of Well No. 1 to Eliminate Mineral Buildup
Earth Resources Observation and Science Data Center (EROS) $25	1920671 – Install Lighting Motion Sensors in Conference Room and Restroom
Guam Seismological Observatory $375	G2009CAF106 – Replace Deteriorated Office and Warehouse Buildings
Great Lakes Science Center (GLSC) $1,950	B201000002G – Renovate North Laboratory Wing for Code Compliance and to Meet the Needs of the Science Missions
Fredericksburg Observatory $41	G2010CAF101 – Install Pole Lighting to Improve Site Lighting and Security
National Wildlife Health Center (NWHC) $165	1928496 – Replace Inefficient Fan Systems in the Main Building with Current Energy Efficient System
Earth Resources Observation and Science Data Center (EROS) $73	1923352 – Install Fencing Around the Water Tower, Globes, and Lagoon; and Jersey Barriers at Main Entrance. Install Fencing and Barriers Surrounding the Complex in Compliance with the Department and USGS Security Assessment
Marrowstone Marine Field Station (MMFS) $111	B2009M1001 – Replace Perimeter Fencing and Entry Gate due to Environmental Damage
Upper Midwest Environmental Science Center (UMESC) $202	B200600001B – Upgrade and Insulate Roofing on the Storage Building to Eliminate Ice Buildup Hazard
S.O. Conte Anadromous Research Center (CONTE) $52	1907376 – Replace and Upgrade Building Automation System

Earth Resources Observation and Science Center (EROS) Mundt Federal Building $142	1923355 – Remove and Replace 6 New Vintage Distribution Gears and 1 New Vintage Tie Switch Gear
Patuxent Wildlife Research Center (PWRC) $487	B20010005PW – Repair HVAC in Gabrielson Building (partial, project to be completed in 2014) Complete HVAC Renovation Is Needed to Meet Code Compliance, Provide Safety and Allow the Mission of the Center to Be Met in a More Efficient Manner.

2013 Equipment Projects

PROJECT NAME/PROJECT AMOUNT	PROJECT DESCRIPTION
600 Sites Nationwide $240	Repair or Replace Cablecars (W1998A10000): 600 Cablecars are Active and in Use Nationwide
Northern California Seismic Network $200	Replace Network Analog and Microwave Stations (G987160001): Replace Earthquake Network Stations Providing Seismic Monitoring and Warning for Large Metropolitan Areas.
Condition Assessments (CA) $210	Condition Assessments/Engineering Support: Complete CA's for the Identification of Maintenance and Capital Improvement Needs, Provide Engineering Services Support for Funded Projects, and Conduct Surveys to Determine Asbestos-Related Cleanup, Environmental and Disposal Cost.
Maintenance Management System (MMS) $500	Maintenance Management System (MMS): Implement and Maintain a Maintenance Management System that Meets Bureau Reporting and Oversight Requirements.
Project Planning $185	Project Planning: Contract Architectural, Engineering and Design Services for Complex Projects, Particularly for Developing Project Requirements and Cost Estimates.

Working Capital Fund Overview

The U.S. Geological Survey (USGS) Working Capital Fund (WCF) was established to allow for the efficient financial management of the components listed below. The WCF was made available for expenses necessary for furnishing materials, supplies, equipment, work, and services in support of USGS programs, and as authorized by law (authorization information begins on page 3 of this section), to agencies of the Federal Government and others. The WCF consists of four components:

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

- **Telecommunications Investments** are used for telecommunication hardware, software, facilities, and services. Examples include replacement or expansion of automatic exchange systems and computerized network equipment such as switches, routers, and monitoring systems.
- **Equipment Investments** are used for the acquisition, replacement, and expansion of equipment for USGS programs. Equipment may include, but is not limited to, hydrologic, geologic, and cartographic instruments, laboratory equipment, and computer hardware and software.
- **Facilities Investments** support facility and space management investment expenses for USGS real property, including owned and leased space. Authorized investment expenses include nonrecurring and emergency repair, relocation of a facility, and facility modernization. The component does not include annual expenses such as rent, day-to-day operating expenses, recurring maintenance, or utilities. The investment component is not used to fund construction of buildings.
- **Publications Investments** are used for the preparation and production of technical publications reporting on the results of scientific data and research. Research projects typically are three to five years in duration, and planning the medium in which to report results occurs over the life of the project. The Publications Investment Component provides a mechanism for establishing an efficient, effective, and economical means of funding publications costs over the long term.

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

- **The National Water Quality Laboratory (NWQL)** conducts chemical analyses of water, sediments, and aquatic tissue for all USGS water district offices and other customers, including other USGS mission areas, other Interior Bureaus, and government agencies. The NWQL also does biological classification for these customers. NWQL analysis services are provided on a reimbursable basis, with the price of services calculated to cover direct and indirect costs.

- **The USGS Hydrologic Instrumentation Facility (HIF)** provides **hydrologic** instrumentation on a fee-for-service basis. The facility provides its customers with hydrologic instruments that can be rented or purchased, maintains a technical expertise on instrumentation, calibrates instruments before they are installed, and tests and evaluates new technologies as they become available in the marketplace.
- **Bureau Laboratories –** There are currently three laboratories within the Water Resources Mission Area that perform gaseous dissolved chlorofluorocarbon measurements, environmental microbiology analyses and isotope-ratio measurements of water, sediments, rocks, and gases for all Water Resources Mission Area offices, other USGS mission areas, and other Federal agencies.
- **The National Training Center** conducts USGS training programs. Examples include specialized training for USGS employees, cooperators, and international participants in many facets of hydrology, hydraulics, and water resources investigations, as well as computer applications, management and leadership seminars, and various workshops.
- **Drilling –** There are currently two drilling units, based in Lakewood, CO and Henderson, NV. The drilling units provide drilling services to conduct exploratory drilling for obtaining geologic samples and cores in difficult hydrogeologic environments and the emplacement of sampling devices and sub-surface sensors for hydrologic investigations.

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

4. The **Enterprise Services** Component operates in a businesslike manner, recovering fees for various consolidated services provided to USGS mission areas and other Federal agencies. By leveraging these services through a unified effort, USGS achieves cost and business efficiencies that would otherwise be lost.

The Science Publishing Network (SPN) operates within the Enterprise Services Component of the WCF. The SPN provides high quality publishing support for science information products while improving its operational effectiveness and efficiencies. The SPN offers a wide range of publishing services to authors of USGS information products and others. Services include consultation, technical editing, illustrating, layout and design, Web services, printing management and distribution, electronic publishing as well as other publishing needs.

Appropriation Language and Citations

Permanent authority:

1. Provided further, That, in fiscal year 1986, and thereafter, all amortization fees resulting from the Geological Survey providing telecommunications services shall be deposited in a special fund to be established on the books of the Treasury and be immediately available for payment of replacement or expansion of telecommunications services, to remain available until expended.

    - **43 U.S.C.50a** established the Telecommunications Amortization Fund, which was displayed as part of the Surveys, Investigations and Research appropriation from 1986 through 1990. Beginning in 1991, the Telecommunications Amortization Fund was merged into the WCF described in the next citation.

2. There is hereby established in the Treasury of the United States a working capital fund to assist in the management of certain support activities of the United States Geological Survey (hereafter referred to as the "Survey"), Department of the Interior. The fund shall be available on and after November 5, 1990, without fiscal year limitation for expenses necessary for furnishing materials, supplies, equipment, work, facilities, and services in support of Survey programs, and, as authorized by law, to agencies of the Federal Government and others. Such expenses may include laboratory modernization and equipment replacement, computer operations, maintenance, and telecommunications services; requirements definition, systems analysis, and design services; acquisition or development of software; systems support services such as implementation assistance, training, and maintenance; acquisition and replacement of computer, publications and scientific instrumentation, telecommunications, and related automatic data processing equipment; and, such other activities as may be approved by the Secretary of the Interior.

    There are authorized to be transferred to the fund, at fair and reasonable values at the time of transfer, inventories, equipment, receivables, and other assets, less liabilities, related to the functions to be financed by the fund as determined by the Secretary of the Interior. Provided, That the fund shall be credited with appropriations and other funds of the Survey, and other agencies of the Department of the Interior, other Federal agencies, and other sources, for providing materials, supplies, equipment, work, and other services as authorized by law and such payments may be made in advance or upon performance: Provided further, That charges to users will be at rates approximately equal to the costs of furnishing the materials, supplies, equipment, facilities, and services, including such items as depreciation of equipment and facilities, and accrued annual leave: Provided further, That all existing balances as of November 5, 1990, from amortization fees resulting from the Survey providing telecommunications services and deposited in a special fund established on the books of the Treasury and available for payment of replacement or expansion of telecommunications services as authorized by Public Law 99-190, are hereby transferred to and merged with the working capital fund, to be used for the same purposes as originally authorized. Provided further, That funds that are not necessary to carry out the activities to be financed by the fund, as determined by the Secretary, shall be covered into miscellaneous receipts of the Treasury.

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 The amendments that were made in this appropriations act are shown in underline in the second citation shown above. This authority expanded the use of the Working Capital Fund to partially fund laboratory operations and facilities improvements and to acquire and replace publication and scientific instrumentation and laboratory equipment.

United States Geological Survey

Federal Funds

General and special funds:

WORKING CAPITAL FUND

Program and Financing

(In millions of dollars)

Identification Code 14-4556-0-4-306		2011 Actual	2012 Enacted	2013 Budget Request
	Obligations by program activity:			
08.01	Working Capital Fund	101	100	75
	Budgetary resources:			
	Unobligated balance:			
10.00	Unobligated balance carried forward, start of year	108	83	65
10.21	Recoveries of prior year unpaid obligations	1		
10.50	Unobligated balance total	109	83	65
	Budget Authority:			
	Spending Authority from offsetting collections, disc			
17.00	Collected	75	82	76
19.30	Total budgetary resources available	184	165	141
	Memorandum (non-add) entries:			
19.41	Unexpired unobligated balance, end of year	83	65	66
	Change in obligated balances:			
	Obligated balance, start of year:			
30.00	Unpaid obligations, brought forward, Oct 1	24	36	81
30.30	Obligations incurred, unexpired accounts	101	100	75
30.40	Outlays, Gross	-88	-55	-68
30.80	Recoveries of prior year obligations	-1	0	0
	Obligated balance, end of year:			
30.90	Unpaid Obligations, end of year (gross)	36	81	88
	Budget authority and outlays, net:			
	Discretionary			
40.00	Budget authority, gross	75	82	78
	Outlays, gross:			
40.10	Outlays from new discretionary authority	50	37	34
40.11	Outlays from discretionary balances	38	18	34
40.20	Outlays, gross	88	55	68
	Offsets against gross budget authority and outlays:			
	Offsetting collections (collected) from:			
40.30	Federal Sources	-75	-82	-76
40.70	Budget authority, net (discretionary)			
40.80	Outlays, net (discretionary)	13	-27	-8
41.80	Budget authority, net (total)			
41.90	Outlays, net (total)	13	-27	-8

WORKING CAPITAL FUND

Balance Sheet

(In millions of dollars)

Identification Code 14-4556-0-4-306		2010 Actual	2011 Actual
	ASSETS:		
	Federal assets:		
1101	Fund balances with Treasury	132	119
	Investments in U.S. securities:		
1106	Receivables, net		
1803	Other Federal assets: Property, plant and equipment, net	18	26
1999	Total assets	150	145
	LIABILITIES:		
2101	Federal liabilities: Accounts payable		
2201	Non-Federal liabilities: Accounts payable	5	8
2999	Total liabilities	5	8
	NET POSITION:		
3300	Cumulative results of operations	145	137
3999	Total net position	145	137
4999	Total liabilities and net position	150	145

WORKING CAPITAL FUND

Object Classification

(In millions of dollars)

Identification Code 14-4556-0-4-306		2011 Actual	2012 Enacted	2013 Budget Request
	Reimbursable obligations:			
	Personnel compensation:			
11.1	Full-time permanent	18	15	14
11.3	Other than full-time permanent	1	1	1
11.5	Other personnel compensation	1	1	1
11.9	Total personnel compensation	20	17	16
12.1	Civilian personnel benefits	5	5	3
13.0	Benefits for former personnel	1	0	0
21.0	Travel and transportation of persons	1	1	1
22.0	Transportation of things	1	0	0
23.1	Rental payments to GSA	3	3	1
23.2	Rental payments to others	1	1	1
23.3	Communications, utilities, and miscellaneous charges	3	2	1
24.0	Printing and reproduction	1	1	0
25.1	Advisory and Assistance Services	1	0	0
25.2	Other services	14	17	8
25.3	Other purchases of goods and services from Government Accounts	9	11	8
25.4	Operation and maintenance of facilities	4	3	2
25.7	Operation and maintenance of equipment	3	2	2
26.0	Supplies and materials	5	4	3
31.0	Equipment	27	33	29
32.0	Land and structures	2	0	0
99.0	Reimbursable obligations	101	100	75
99.9	Total new obligations	101	100	75

WORKING CAPITAL FUND

Employment Summary

Identification Code 14-4556-0-4-306		2011 Actual	2012 Enacted	2013 Budget Request
	Reimbursable:			
2001	Civilian full-time equivalent employment	248	204	204

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SURVEYS, INVESTIGATIONS, AND RESEARCH

Summary of Requirements by Object Class

(Millions of Dollars)

Appropriation: Surveys, Investigations, and Research		2012 Enacted		Fixed Costs & Related Changes		Program Changes		2013 Request	
Object Class		FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount
	Personnel compensation								
11.1	Full-time permanent		432		3		0		435
11.3	Other than full-time permanent		42		0		1		43
11.5	Other personnel compensation		13		0		1		14
	Total personnel compensation	5,466	487	0	3	-6	2	5,460	492
12.1	Civilian personnel benefits		138		2		-3		137
13.0	Benefits for former personnel		1		0		0		1
21.0	Travel and transportation of persons		23		0		0		23
22.0	Transportation of things		5		0		0		5
23.1	Rental payment to GSA		61		4		0		65
23.2	Rental payments to others		5		0		0		5
23.3	Comm., utilities and misc. charges		19		0		0		19
24.0	Printing and reproduction		1		0		0		1
25.1	Advisory and assistance services		15		0		0		15
25.2	Other services from non-Fed sources		80		1		23		104
25.3	Other goods and services from Fed sources		67		0		0		67
25.4	Operation and maintenance of facilities		6		0		0		6
25.7	Operation and maintenance of equipment		17		0		0		17
26.0	Supplies and materials		18		0		0		18
31.0	Equipment		43		0		0		43
32.0	Land and structures		1		0		0		1
41.0	Grants, subsidies, and contributions		81		0		2		83
	Total requirements		**1,068**		**10**		**24**		**1,102**

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

SURVEYS, INVESTIGATIONS, AND RESEARCH

Summary of Requirements by Object Class

(Millions of Dollars)

Appropriation: Surveys, Investigations, and Research		2012 Enacted		2013 Request		Increase or Decrease	
Reimbursable Obligations		**FTE**	**Amount**	**FTE**	**Amount**	**FTE**	**Amount**
	Personnel compensation						
11.1	Full-time permanent		161		162		1
11.3	Other than full-time permanent		29		29		0
11.5	Other personnel compensation		6		6		0
	Total personnel compensation	2,823	196	2,823	197	0	1
12.1	Civilian personnel benefits		56		56		0
21.0	Travel and transportation of persons		12		12		0
22.0	Transportation of things		4		4		0
23.1	Rental payments to GSA		18		18		0
23.2	Rental payments to others		1		1		0
23.3	Communications, utilities and miscellaneous Charges		6		6		0
24.0	Printing and reproduction		1		1		0
25.1	Advisory and assistance services		2		2		0
25.2	Other services		48		48		0
25.3	Other purchases of goods and services from Government accounts		38		37		-1
25.4	Operation and maintenance of facilities		2		2		0
25.7	Operation and maintenance of equipment		10		10		0
26.0	Supplies and materials		13		13		0
31.0	Equipment		20		20		0
41.0	Grants, subsidies, and contributions		30		30		0
	Total requirements		**457**		**457**		**0**

United States Geological Survey

Federal Funds

General and special funds:

SURVEYS, INVESTIGATIONS, AND RESEARCH

Program and Financing

(Millions of Dollars)

Identification Code 14-0804-0-1-306		2011 Actual	2012 Estimate	2013 Estimate
	Obligations by program activity:			
00.01	Ecosystems	167	166	178
00.02	Climate and Land Use Change	143	149	154
00.03	Energy, Minerals, and Environmental Health	106	97	97
00.04	Natural Hazards	140	138	145
00.05	Water Resources	219	221	210
00.06	Core Science Systems	116	107	120
00.07	Administration and Enterprise Information	117	118	99
00.08	Facilities	105	106	100
07.99	Total direct obligations	1,113	1,102	1,103
08.01	Reimbursable program	436	449	449
08.02	Reimbursable program – EPA Great Lakes	11	8	8
08.99	Total reimbursable obligations	447	457	457
09.00	Total new obligations	1,560	1,559	1,560
	Budgetary resources:			
	Unobligated balance:			
10.00	Unobligated balance brought forward, Oct 1	399	394	360
10.21	Recoveries of prior year unpaid obligations	9	0	0
10.50	Unobligated balance (total)	408	394	360
	Budget authority:			
	Appropriations, discretionary:			
11.00	Appropriation	1,086	1,070	1,102
11.30	Appropriations permanently reduced	-2	0	0
11.41	Appropriations permanently reduced (Sec 436, HR 2055)	0	-2	0
11.60	Appropriation, discretionary (total)	1,084	1,068	1,102
	Spending authority from offsetting collections, discretionary:			
17.00	Collected	406	457	457
17.01	Change in uncollected payments, Federal sources	57	0	0
17.50	Spending auth from offsetting collections, disc (total)	463	457	457
19.00	Budget authority (total)	1,547	1,525	1,559
19.30	Total budgetary resources available	1,955	1,919	1,919

SURVEYS, INVESTIGATIONS, AND RESEARCH

Program and Financing cont'd

(Millions of Dollars)

Identification Code 14-0804-0-1-306		2011 Actual	2012 Estimate	2013 Estimate
	Memorandum (non-add) entries:			
19.40	Unobligated balance expiring	-1	0	0
19.41	Unexpired unobligated balance, end of year	394	360	359
	Change in obligated balance:			
	Obligated balance, start of year (net)			
30.00	Unpaid obligations, brought forward, Oct 1 (gross)	411	385	324
30.10	Uncollected payments, Fed sources, brought forward, Oct 1	-451	-475	-475
30.20	Obligated balance, start of year (net)	-40	-90	-151
30.30	Obligations incurred, unexpired accounts	1,560	1,559	1,560
30.31	Obligations incurred, expired accounts	1	0	0
30.40	Outlays (gross)	-1,576	-1,620	-1,598
30.50	Change in uncollected payments, Fed sources, unexpired	-57	0	0
30.51	Change in uncollected payments, Fed sources, expired	33	0	0
30.80	Recoveries of prior year unpaid obligations, unexpired	-9	0	0
30.81	Recoveries of prior year unpaid obligations, expired	-2	0	0
	Obligated balance, end of year (net)			
30.90	Unpaid obligations, end of year (gross)	385	324	286
30.91	Uncollected payments, Fed sources, end of year	-475	-475	-475
31.00	Obligated balance, end of year (net)	-90	-151	-189
	Budget authority and outlays, net:			
	Discretionary:			
40.00	Budget authority, gross	1,547	1,525	1,559
	Outlays, gross:			
40.10	Outlays from new discretionary authority	898	1,342	1,372
40.11	Outlays from discretionary balances	677	278	226
40.20	Outlays, gross (total)	1,575	1,620	1,598
	Offsets against gross budget authority and outlays:			
	Offsetting collections (collected) from:			
40.30	Federal sources	-251	-265	-265
40.33	Non-Federal sources	-180	-192	-192
40.40	Offsets against gross budget authority and outlays (total)	-431	-457	-457

SURVEYS, INVESTIGATIONS, AND RESEARCH

Program and Financing cont'd

(Millions of Dollars)

Identification Code 14-0804-0-1-306		2011 Actual	2012 Estimate	2013 Estimate
	Additional offsets against gross budget authority only:			
40.50	Change in uncollected payments, Fed sources, unexpired	-57	0	0
40.52	Offsetting collections credited to expired accounts	25	0	0
40.60	Additional offsets against budget authority only (total)	-32	0	0
40.70	Budget authority, net (discretionary)	1,084	1,068	1,102
40.80	Outlays, net (discretionary)	1,144	1,163	1,141
	Mandatory:			
	Outlays, gross:			
41.01	Outlays from mandatory balances	1	0	0
41.80	Budget authority, net (total)	1,084	1,068	1,102
41.90	Outlays, net (total)	1,145	1,163	1,141

SURVEYS, INVESTIGATIONS, AND RESEARCH

Object Classification

(Millions of Dollars)

Identification Code 14-0804-0-1-306		2011 Actual	2012 Estimate	2013 Estimate
	Direct obligations:			
	Personnel compensation:			
11.1	Full-time permanent	439	432	435
11.3	Other than full-time permanent	43	42	43
11.5	Other personnel compensation	14	13	14
11.9	Total personnel compensation	496	487	492
12.1	Civilian personnel benefits	136	138	137
13.0	Benefits for former personnel	1	1	1
21.0	Travel and transportation of persons	27	23	23
22.0	Transportation of things	6	5	5
23.1	Rental payments to GSA	58	61	65
23.2	Rental payment to others	5	5	5
23.3	Comm., utilities, and miscellaneous charges	19	19	19
24.0	Printing and reproduction	1	1	1
25.1	Advisory and assistance services	18	15	15
25.2	Other services from non-Fed sources	109	114	105
25.3	Other goods and services from Fed sources	67	67	67
25.4	Operation and maintenance of facilities	6	6	6
25.7	Operation and maintenance of equipment	17	17	17
26.0	Supplies and materials	22	18	18
31.0	Equipment	43	43	43
32.0	Land and structures	1	1	1
41.0	Grants, subsidies, and contributions	81	81	83
99.0	Direct obligations	1,113	1,102	1,103

SURVEYS, INVESTIGATIONS, AND RESEARCH

Object Classification cont'd

(Millions of Dollars)

Identification Code 14-0804-0-1-306		2011 Actual	2012 Estimate	2013 Estimate
	Reimbursable obligations:			
	Personnel compensation:			
11.1	Full-time permanent	161	161	162
11.3	Other than full-time permanent	29	29	29
11.5	Other personnel compensation	6	6	6
11.9	Total personnel compensation	196	196	197
12.1	Civilian personnel benefits	56	56	56
21.0	Travel and transportation of persons	12	12	12
22.0	Transportation of things	4	4	4
23.1	Rental payments to GSA	18	18	18
23.2	Rental payments to others	1	1	1
23.3	Comm., utilities, and miscellaneous charges	6	6	6
24.0	Printing and reproduction	1	1	1
25.1	Advisory and assistance services	2	2	2
25.2	Other services from non-Fed sources	48	48	48
25.3	Other goods and services from Fed sources	28	38	37
25.4	Operation and maintenance of facilities	2	2	2
25.7	Operation and maintenance of equipment	10	10	10
26.0	Supplies and materials	13	13	13
31.0	Equipment	20	20	20
41.0	Grants, subsidies, and contributions	30	30	30
99.0	Reimbursable obligations	447	457	457
99.9	Total new obligations	1,560	1,559	1,560

SURVEYS, INVESTIGATIONS, AND RESEARCH

Employment Summary

Identification Code 14-0804-0-1-306		2011 Actual	2012 Estimate	2012 Estimate
	Direct:			
1001	Civilian full-time equivalent employment	5,526	5,466	5,460
	Reimbursable:			
2001	Civilian full-time equivalent employment	2,823	2,823	2,823
	Allocation account:			
3001	Civilian full-time equivalent employment	14	14	14

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

(Thousands of Dollars)

	2011 Actual	2012 Estimate	2013 Estimate
Surveys, Investigations, and Research (SIR)			
Ecosystems			
Appropriated			
Multi-Year appropriation	166,994	165,612	177,354
Total (appropriated)	**166,994**	**165,613**	**177,354**
Reimbursements			
Non-Federal (Domestic) sources			
Miscellaneous	6,173	6,173	6,173
Subtotal (non-Federal domestic sources)	6,173	6,173	6,173
Non-Federal (Foreign) sources			
Miscellaneous	126	126	126
Subtotal (non-Federal Foreign sources)	126	126	126
State and local sources			
States-Coop (unmatched)	2,167	2,167	2,167
Subtotal (state and local sources)	2,167	2,167	2,167
Federal sources			
Department of Agriculture	1,125	1,193	1,193
Department of Commerce			
Nat'l Oceanic & Atmospheric Admin	598	632	632
Department of Defense			
Corps of Engineers	22,908	24,139	24,139
Other	4,013	4,252	4,252
Department of Energy			
Bonneville Power Administration	1,419	1,487	1,487
Other	410	444	444
Department of Interior			
Bureau of Land Management	3,634	3,873	3,873
Bureau of Ocean Energy Management	114	114	114
Bureau of Reclamation	10,019	10,565	10,565
Fish and Wildlife Service	10,300	10,915	10,915
National Park Service	3,294	3,533	3,533
Office of Secretary	622	656	656
Department of State	692	726	726
Environmental Protection Agency	699	733	733
National Aeronautics & Space Admin	51	51	51
Subtotal (Federal sources)	59,898	63,313	63,313
Total (reimbursements)	**68,364**	**71,779**	**71,779**
Total: Ecosystems	**235,358**	**237,392**	**249,133**

	2011 Actual	2012 Estimate	2013 Estimate
Surveys, Investigations, and Research (SIR)			
Climate and Land Use Change			
Appropriated			
Multi-Year appropriation	140,821	96,932	100,178
No-Year appropriation	1,818	52,313	53,337
Total (appropriated)	**142,639**	**149,245**	**153,515**
Reimbursements			
Non-Federal (Domestic) sources			
Miscellaneous	332	332	332
Subtotal (non-Federal domestic sources)	332	332	332
Non-Federal (Foreign) sources			
National Drilling Company	740	740	740
Miscellaneous	1,220	1,220	1,220
Subtotal (non-Federal Foreign sources)	1,960	1,960	1,960
State and local sources			
States-Coop (unmatched)	21	21	21
Subtotal (state and local sources)	21	21	21
Federal sources			
Agency for International Development	2,878	3,143	3,143
Department of Agriculture	459	459	459
Department of Commerce			
Nat'l Oceanic & Atmospheric Admin	143	169	169
Department of Defense			
National Geospatial-Intelligence Agency	11	11	11
Other	192	218	218
Department of Energy	20	20	20
Department of Homeland Security			
Federal Emergency Management Agency	6	6	6
Department of Interior			
Bureau of Indian Affairs	14	14	14
Bureau of Land Management	141	167	167
Bureau of Reclamation	186	212	212
Fish and Wildlife Service	216	216	216
National Park Service	524	630	630
Office of Secretary	2,539	2,830	2,830
Department of State	462	515	515
Environmental Protection Agency	1,437	1,569	1,569
Federal Aviation Administration	11	11	11
National Aeronautics & Space Admin	7,786	8,612	8,612
Sale of maps, photos, reproductions, & digital products	395	421	421
Miscellaneous	277	303	303
Subtotal (Federal sources)	17,697	19,526	19,526
Total (reimbursements)	**20,010**	**21,839**	**21,839**
Total: Climate and Land Use Change	**162,649**	**171,084**	**175,354**

	2011 Actual	2012 Estimate	2013 Estimate
Surveys, Investigations, and Research (SIR)			
Energy, Minerals, and Environmental Health			
Appropriated			
Multi-Year appropriation	105,438	96,452	97,099
No-Year appropriation	242	375	1,000
Total (appropriated)	**105,680**	**96,827**	**98,099**
Reimbursements			
Non-Federal (Domestic) sources			
Miscellaneous	1,232	1,232	1,232
Subtotal (non-Federal domestic sources)	1,232	1,232	1,232
Non-Federal (Foreign) sources			
Miscellaneous	128	128	128
Subtotal (non-Federal Foreign sources)	128	128	128
State and local sources			
States-Coop (unmatched)	145	145	145
Subtotal (state and local sources)	145	145	145
Federal sources			
Central Intelligence Agency	40	40	40
Department of Agriculture	122	122	122
Department of Commerce	121	121	121
Department of Defense			
Corps of Engineers	779	812	812
National Geospatial-Intelligence Agency	12,230	12,804	12,804
Other	532	532	532
Department of Energy	180	180	180
Department of Interior			
Bureau of Land Management	1,084	1,134	1,134
Bureau of Reclamation	130	130	130
Fish and Wildlife Service	610	610	610
National Park Service	150	150	150
Office of Secretary			
National Business Center	150	150	150
Department of Justice	10	10	10
Department of State	187	187	187
Environmental Protection Agency	533	550	550
National Aeronautics & Space Admin	161	161	161
National Science Foundation	912	978	978
Subtotal (Federal sources)	17,931	18,671	18,671
Total (reimbursements)	**19,436**	**20,176**	**20,176**
Total: Energy, Minerals, and Environmental Health *	**125,116**	**117,003**	**118,275**

* This table does not include obligations from the unobligated balance transfer from USAID, which is included in MAX. The amount for FY 2011 is $300K.

	2011 Actual	2012 Estimate	2013 Estimate
Surveys, Investigations, and Research (SIR)			
Natural Hazards			
Appropriated			
Multi-Year appropriation	139,730	137,868	144,468
No-Year appropriation	11	0	0
Total (appropriated)	**139,741**	**137,868**	**144,468**
Reimbursements			
Non-Federal (Domestic) sources			
Miscellaneous	3,180	3,180	3,180
Subtotal (non-Federal domestic sources)	3,180	3,180	3,180
Non-Federal (Foreign) sources			
Miscellaneous	74	74	74
Subtotal (non-Federal Foreign sources)	74	74	74
State and local sources			
States-Coop (unmatched)	1,650	1,650	1,650
Subtotal (state and local sources)	1,650	1,650	1,650
Federal sources			
Agency for International Development	2,057	2,140	2,140
Department of Agriculture	29	29	29
Department of Commerce			
Nat'l Oceanic & Atmospheric Admin	633	666	666
Department of Defense			
National Geospatial-Intelligence Agency	1,005	1,005	1,005
Other	2,735	2,917	2,917
Department of Energy			
Bonneville Power Administration	886	919	919
Other	1,096	1,146	1,146
Department of Interior			
Bureau of Land Management	486	486	486
Bureau of Ocean Energy Management	591	624	624
Bureau of Reclamation	118	118	118
Fish and Wildlife Service	61	61	61
National Park Service	235	252	252
Department of State	190	207	207
Environmental Protection Agency	181	181	181
General Services Administration	3	3	3
National Aeronautics & Space Admin	8,671	9,051	9,051
National Science Foundation	686	686	686
Nuclear Regulatory Commission	1,015	1,065	1,065
Miscellaneous	739	772	772
Subtotal (Federal sources)	21,417	22,328	22,328
Total (reimbursements)	**26,321**	**27,232**	**27,232**
Total: Natural Hazards *	**166,062**	**165,100**	**171,700**

* This table does not include obligations for the Spectrum Relocation Fund, since it is a mandatory fund. MAX obligations do include the Spectrum Relocation Fund. The amounts included in MAX are: FY 2011 $539K; FY 2012 $566K; and FY 2013 $400K.

	2011 Actual	2012 Estimate	2013 Estimate
Surveys, Investigations, and Research (SIR)			
Water Resources			
Appropriated			
Multi-Year appropriation	219,275	220,648	209,974
No-Year appropriation	29	22	0
Total (appropriated)	**219,304**	**220,670**	**209,974**
Reimbursements			
Non-Federal (Domestic) sources			
Permittees & licensees- Fed Energy Regulatory Commissic	4,946	4,946	4,946
Miscellaneous	3,189	3,189	3,189
Subtotal (non-Federal domestic sources)	8,135	8,135	8,135
Non-Federal (Foreign) sources			
National Drilling Company	646	646	646
Miscellaneous	245	245	245
Subtotal (non-Federal Foreign sources)	891	891	891
State and local sources			
States-Coop (matched)	63,471	63,985	59,300
States-Coop (matched - In-Kind Services) NON ADD	520	520	520
States-Coop (unmatched)	96,312	95,798	100,483
Subtotal (state and local sources)	159,783	159,783	159,783
Federal sources			
Department of Agriculture	1,766	1,801	1,801
Department of Commerce			
Nat'l Oceanic & Atmospheric Admin	85	85	85
Department of Defense			
Corps of Engineers	42,858	43,537	43,537
National Geospatial-Intelligence Agency	520	520	520
Other	8,749	8,889	8,889
Department of Energy			
Bonneville Power Administration	660	678	678
Other	7,104	7,209	7,209
Department of Homeland Security			
Federal Emergency Management Agency	2,944	2,997	2,997
Department of Interior			
Bureau of Indian Affairs	421	421	421
Bureau of Land Management	3,490	3,543	3,543
Bureau of Reclamation	14,073	14,283	14,283
Fish and Wildlife Service	2,024	2,059	2,059
National Park Service	2,844	2,879	2,879
Office of Secretary	83	83	83
Office of Surface Mining	15	15	15
Department of State	2,068	2,103	2,103
Environmental Protection Agency			
Great Lakes Initiative - Restoration Program	10,840	7,922	7,922
Other	11,761	15,029	15,029
Health and Human Services	299	299	299
National Aeronautics & Space Admin	355	355	355
National Science Foundation	38	38	38
Nuclear Regulatory Commission	65	65	65
Tennessee Valley Authority	445	445	445
Miscellaneous	2	2	2
Subtotal (Federal sources)	113,509	115,257	115,257
Total (reimbursements)	**282,318**	**284,066**	**284,066**
Total: Water Resources	**501,622**	**504,736**	**494,040**

	2011 Actual	2012 Estimate	2013 Estimate
Surveys, Investigations, and Research (SIR)			
Core Science Systems			
Appropriated			
Multi-Year appropriation	115,497	107,166	119,978
Total (appropriated)	**115,497**	**107,166**	**119,978**
Reimbursements			
Non-Federal (Domestic) sources			
Miscellaneous	40	40	40
Subtotal (non-Federal domestic sources)	40	40	40
Non-Federal (Foreign) sources			
Miscellaneous	14	14	14
Subtotal (non-Federal Foreign sources)	14	14	14
State and local sources			
States-Coop (unmatched)	4,669	4,669	4,669
Subtotal (state and local sources)	4,669	4,669	4,669
Federal sources			
Department of Agriculture	2,269	2,507	2,507
Department of Commerce			
Nat'l Oceanic & Atmospheric Admin	168	168	168
Department of Defense			
National Geospatial-Intelligence Agency	4,629	5,053	5,053
Other	496	496	496
Department of Energy	42	42	42
Department of Homeland Security			
Federal Emergency Management Agency	1,351	1,483	1,483
Department of Interior			
Bureau of Land Management	452	452	452
Bureau of Reclamation	366	366	366
Fish and Wildlife Service	571	597	597
National Park Service	1,324	1,324	1,324
Office of Secretary	683	683	683
Office of Surface Mining	141	141	141
Department of Justice	74	74	74
Department of State	42	42	42
Department of Treasury	18	18	18
Environmental Protection Agency	50	50	50
General Services Administration	42	42	42
Health and Human Services	42	42	42
Housing and Urban Development	42	42	42
National Aeronautics & Space Admin	18	18	18
Miscellaneous	109	109	109
Subtotal (Federal sources)	12,929	13,749	13,749
Total (reimbursements)	**17,652**	**18,472**	**18,472**
Total: Core Science Systems	**133,149**	**125,638**	**138,450**

	2011 Actual	2012 Estimate	2013 Estimate
Surveys, Investigations, and Research (SIR)			
Administration and Enterprise Information			
Appropriated			
Multi-Year appropriation	117,488	117,728	99,386
No-Year appropriation	0	0	0
Total (appropriated)	**117,488**	**117,728**	**99,386**
Reimbursements			
Non-Federal (Domestic) sources			
Map Receipts	3,089	3,089	3,089
Miscellaneous	14	14	14
Subtotal (non-Federal domestic sources)	3,103	3,103	3,103
Federal sources			
Department of Agriculture	2	2	2
Department of Commerce			
Nat'l Oceanic & Atmospheric Admin	73	63	63
Department of Interior			
Bureau of Indian Affairs	84	84	84
Bureau of Ocean Energy Management	4	4	4
Office of Secretary	6,996	6,948	6,948
Office of Surface Mining	78	78	78
Sale of maps, photos, reproductions, & digital products	415	355	355
Miscellaneous	41	38	38
Subtotal (Federal sources)	7,693	7,572	7,572
Total (reimbursements)	**10,796**	**10,675**	**10,675**
Total: Administration and Enterprise Information	**128,284**	**128,403**	**110,061**

	2011 Actual	2012 Estimate	2013 Estimate
Surveys, Investigations, and Research (SIR)			
Facilities			
Appropriated			
Multi-Year appropriation	99,604	101,339	92,458
No-Year appropriation	5,128	4,731	7,280
Total (appropriated)	**104,732**	**106,070**	**99,738**
Reimbursements			
Federal sources			
Central Intelligence Agency	311	311	311
Department of Defense	1,116	1,115	1,115
Department of Interior			
Office of Secretary			
National Business Center	22	22	22
Other	837	837	837
Subtotal (Federal sources)	2,286	2,285	2,285
Total (reimbursements)	**2,286**	**2,285**	**2,285**
Total: Facilities	**107,018**	**108,355**	**102,023**

SIR Summary:			
Appropriated			
Multi-Year appropriation	1,104,847	1,043,745	1,040,895
No-Year appropriation	7,228	57,442	61,617
subtotal (appropriated)	1,112,075	1,101,187	1,102,512
Reimbursements			
Non-Federal Sources			
Map Receipts	3,089	3,089	3,089
Domestic	19,106	19,106	19,106
Foreign	3,193	3,193	3,193
State and local sources	168,435	168,435	168,435
Federal Sources	253,360	262,701	262,701
subtotal (reimbursements)	447,183	456,524	456,524
Total: SIR *	**1,559,258**	**1,557,711**	**1,559,036**

* This table does not include obligations for the Spectrum Relocation Fund, since it is a mandatory fund. MAX obligations do include the Spectrum Relocation Fund. The amounts included in MAX are: FY 2011 $539K; FY 2012 $566K; and FY 2013 $400K. This table also does not include obligations from the unobligated balance transfer from USAID, which is included in MAX. The amount for FY 2011 is $300K.

	2011 Actual	2012 Estimate	2013 Estimate
Surveys, Investigations, and Research (SIR)			
Contributed Funds:			
Permanent, indefinite appropriation:			
Ecosystems	935	738	376
Climate and Land Use Change	6	2	2
Energy, Minerals, and Environmental Health	9	2	2
Natural Hazards	12	1	2
Water Resources	161	181	148
Total: Contributed Funds	**1,123**	**924**	**530**
Operation and Maintenance of Quarters:			
Permanent, indefinite appropriation:			
Ecosystems	3	9	9
Natural Hazards	15	130	27
Total: Operation and Maintenance of Quarters	**18**	**139**	**36**
Working Capital Fund:			
National Water Quality Lab	12,558	12,843	12,235
Hydrologic Instrumentation Facility	18,876	25,842	24,775
Other	69,566	61,315	37,990
Total: Working Capital Fund	**101,000**	**100,000**	**75,000**
Allocations from other Federal Agencies: *			
Department of the Interior: Departmental Offices			
Natural Resource Damage Assessment	1,365	4,615	1,300
Central Hazardous Materials Fund	85	85	85
Total: Allocations	**1,450**	**4,700**	**1,385**

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

United States Geological Survey

Trust Funds

CONTRIBUTED FUNDS

Special and Trust Fund Receipts

(Millions of Dollars)

Identification Code 14-8562-0-7-306		2011 Actual	2012 Estimate	2013 Estimate
01.00	Balance, start of year	0	0	0
	Receipts:			
02.20	Contributed Funds, Geological Survey	1	1	1
04.00	Total: Balances and collections	1	1	1
	Appropriations:			
05.00	Contributed Funds	-1	-1	-1
07.99	Balance, end of year	0	0	0

Program and Financing

(Millions of Dollars)

Identification Code 14-8562-0-7-306		2011 Actual	2012 Estimate	2013 Estimate
	Obligations by program activity:			
08.01	Donations and contributed funds	1	1	1
09.00	Total new obligations	1	1	1
	Budgetary resources:			
	Unobligated balance:			
10.00	Unobligated balance brought forward, Oct 1	2	2	2
	Budget authority:			
	Appropriation, mandatory:			
12.01	Appropriation (trust fund)	1	1	1
12.60	Appropriation, mandatory (total)	1	1	1
19.30	Total budgetary resources available	3	3	3
	Memorandum (non-add) entries:			
19.41	Unexpired unobligated balance, end of year	2	2	2

CONTRIBUTED FUNDS

Program and Financing cont'd

(Millions of Dollars)

Identification Code 14-8562-0-7-306		2011 Actual	2012 Estimate	2013 Estimate
	Change in obligated balance:			
30.30	Obligations incurred, unexpired accounts	1	1	1
30.40	Outlays (gross)	-1	-1	-1
	Obligated balances, end of year (net):			
	Budget authority and outlays, net:			
	Mandatory:			
40.90	Budget authority, gross	1	1	1
	Outlays, gross:			
41.00	Outlays from new mandatory authority	0	1	1
41.01	Outlays from mandatory balances	1	0	0
41.10	Outlays, gross (total)	1	1	1
41.80	Budget authority, net (total)	1	1	1
41.90	Outlays, net (total)	1	1	1

Object Classification

(Millions of Dollars)

Identification Code 14-8562-0-7-306		2011 Actual	2012 Estimate	2013 Estimate
	Direct obligations:			
99.5	Below reporting threshold	1	1	1
99.9	Total new obligations	1	1	1

Employment Summary

Identification Code 14-8562-0-7-306		2011 Actual	2012 Estimate	2013 Estimate
	Direct:			
1001	Civilian full-time equivalent employment	11	11	11

Employee Count by Grade

(Total Employment)

	2011 Actual	2012 Estimate	2013 Estimate
Executive Level V	1	1	1
SES	22	22	22
Subtotal	23	23	23
SL – 00	6	9	9
ST – 00	42	47	47
Subtotal	48	46	46
GS/GM -15	581	562	561
GS/GM -14	797	771	770
GS/GM -13	1,293	1,250	1,249
GS -12	1,576	1,524	1,523
GS -11	1,354	1,309	1,308
GS -10	17	16	16
GS – 9	942	911	910
GS – 8	241	233	233
GS -7	673	651	650
GS – 6	272	263	263
GS – 5	433	419	418
GS – 4	297	287	287
GS – 3	202	195	195
GS – 2	79	76	76
GS -1	29	28	28
Subtotal	8,786	8,497	8,490
Other Pay Schedule Systems	198	198	198
Total employment (actual/estimate)	9,055	8,774	8,767

Mandatory Budget and Offsetting Collection Proposals

The USGS does not have any legislative proposals in the 2013 President's budget that impact receipts or mandatory spending levels.

Section 405 Compliance

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

	2013 Estimate ($000)
External Administrative Costs	
The Department of the Interior's Working Capital Fund	
WCF Centralized Billings	$17,711
WCF Direct Billings	$14,858
Payments to Other Federal Agencies	
Worker's Compensation Payments	$3,038
Unemployment Compensation Payments	$810
GSA Rental Payments	$76,449
Bureau Administrative Costs	
Shared Program Costs	$15,500.0
Internal Bureau Overhead	$39,500.0

External Administrative Costs

The Department of the Interior's Working Capital Fund

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

Centralized billing is used whenever the product or service being provided is not severable or it is inefficient to bill for the exact amount of product or service being procured. Customers are billed each year using a pre-established basis that is adjusted annually to reflect change over time. The following table provides the actual centralized billing to the USGS for 2011 and estimates for 2012 and 2013.

Working Capital Fund Revenue
Centralized Billing
Geological Survey
($ in thousands)

Activity/Office	2011 Actual	2012 Pres Budget	2012 Estimate	2013 Estimate
Other OS Activities				
Secretary's Immediate Office				
Document Management Unit	6.5	0.0	0.0	26.7
FOIA Tracking & Reporting System	29.1	27.4	19.4	21.0
Office of the Executive Secretariat	35.6	27.4	19.4	47.7
Alaska Affairs Office	12.4	12.5	12.5	12.7
Alaska Resources Library and Information Services	166.0	166.4	166.4	157.8
Secretary's Immediate Office	178.4	178.9	178.9	170.6
Departmental News and Information	97.7	103.1	102.9	89.7
Office of Communications	97.7	103.1	102.9	89.7
Departmental Museum	216.4	229.7	156.7	151.7
Secretary's Immediate Office	216.4	229.7	156.7	151.7
Asbestos-Related Cleanup Cost Liabilities	0.4	0.2	0.2	0.2
FedCenter	2.7	2.7	2.2	2.1
Compliance Support ESF-11/ESF-11 Web Site				2.3
Office of Environmental Policy and Compliance	3.1	2.9	2.4	4.5
Invasive Species Council	226.2	214.4	214.4	206.0
Invasive Species Coordinator	38.4	38.3	38.3	38.3
Office of Policy Analysis	264.6	252.8	252.8	244.4
CPIC	22.4	19.6	19.6	24.6
Office of Budget	22.4	19.6	19.6	24.6
Financial Internal Controls & Performance Reporting (Formerly:	121.9	129.0	128.7	95.5
Travel Management Center	25.7	27.8	27.8	27.3
e-Travel (Formerly: e-Gov Travel)	110.1	119.4	119.4	429.6
Office of Financial Management	257.6	276.1	275.9	552.4
FBMS Master Data Systems & Hosting			180.2	141.2
Office of Property & Acquisition Management			180.2	141.2
Interior Collections Management System	2.5	2.2	2.2	2.1
Space Management Initiative	40.2	40.8	40.8	35.7
Renewable Energy Certificates	11.3	3.0	3.0	2.7
Facility Maintenance Management System	0.6	3.7	3.7	4.5
Office of Property and Acquisition Management	54.6	49.7	49.6	45.0
SBA Certifications	0.9	0.0	0.0	
Small and Disadvantaged Business Utilization	0.9	0.0	0.0	
Planning and Performance Management	150.6	138.3	138.5	135.3
Office of Planning and Performance Management	150.6	138.3	138.5	135.3
Departmentwide OWCP Coordination	29.7	31.2	31.2	29.4
OPM Federal Employment Services	61.4	53.7	53.7	53.7
Accessible Technology Center	37.9	40.1	40.0	35.0

Working Capital Fund Revenue
Centralized Billing
Geological Survey
($ in thousands)

Activity/Office	2011 Actual	2012 Pres Budget	2012 Estimate	2013 Estimate
Other OS Activities				
Accountability Team	59.5	60.4	60.3	69.1
Employee and Labor Relations Tracking System	3.3	3.5	3.5	3.3
Office of Human Resources	191.8	188.8	188.6	190.6
EEO Complaints Tracking System	4.2	1.7	1.7	1.7
Special Emphasis Program	5.9	6.2	6.2	5.4
Office of Civil Rights	10.0	7.8	7.8	7.1
Occupational Safety and Health	174.2	202.1	202.1	188.9
Safety and Health Training Initiatives	17.2	0.0	0.0	0.0
Safety Management Information System	151.0	159.5	159.5	145.4
Office of Occupational Health and Safety	342.4	361.7	361.7	334.3
DOI Learn	240.1	212.7	212.7	0.0
DOI Executive Forums (Leadership Development)	14.4	15.1	15.1	86.7
Financial Management Training	28.5	0.0	0.0	0.0
SESCDP & Other Leadership Programs	20.0	21.2	21.2	0.0
Online Learning (Technology Solutions Division)	57.8	61.1	61.0	246.4
Learning and Performance Center Management	69.6	50.6	50.5	0.0
Albuquerque Learning & Performance Center	9.9	11.9	11.9	11.3
Anchorage Learning & Performance Center	11.8	9.6	9.6	0.0
Denver Learning & Performance Center	38.4	27.4	27.4	26.2
Washington Learning & Performance Center	79.1	67.0	67.0	65.9
DOIU Management	47.3	69.5	69.5	82.0
DOI University	616.8	546.0	545.8	518.5
Security (Classified Information Facility)	53.9	56.9	55.1	55.1
Law Enforcement Coordination and Training	103.7	109.4	106.0	99.7
Security (MIB/SIB Complex)	28.3	30.0	30.0	30.0
Victim Witness	19.2	20.3	19.6	20.8
Office of Law Enforcement and Security	205.0	216.6	210.7	205.6
Interior Operations Center	241.0	265.7	301.8	301.8
Emergency Preparedness	92.5	100.3	97.2	92.3
Emergency Response	132.1	139.6	135.2	128.4
MIB Health and Safety	0.5	0.5	0.5	0.6
Office of Emergency Management	466.1	506.2	534.7	465.8
Electronic Records Management	164.9	98.6	98.6	126.2
Enterprise Services Network	3,467.9	2,657.0	2,657.0	2,495.5
Web & Internal/External Comm	53.9	57.0	55.2	0.0
Enterprise Architecture	549.2	418.9	418.9	356.6
FOIA Tracking & Reporting System	0.0	0.0	0.0	
Frequency Management Support	105.7	82.5	82.5	84.6
IT Security-IVV	360.2	273.2	273.2	199.6
Capital Planning	265.4	202.0	202.0	318.6
Privacy (Information Management Support)	92.7	81.1	81.1	58.4

Working Capital Fund Revenue
Centralized Billing
Geological Survey
($ in thousands)

Activity/Office	2011 Actual	2012 Pres Budget	2012 Estimate	2013 Estimate
Other OS Activities				
IT Security - Information Assurance Division	429.8	430.6	430.6	118.6
Active Directory	239.8	350.2	350.2	356.2
Enterprise Resource Management	61.2	53.6	53.6	125.5
DOI Access	133.1	144.8	144.8	130.1
NTIA Spectrum Management	151.7	152.6	152.6	169.3
Radio Program Management Office	144.7	104.8	104.8	104.8
Data at Rest	5.0	7.4	7.4	0.0
IT Asset Management	43.5	38.2	38.2	96.5
OCIO Project Management Office	126.7	92.1	92.1	0.0
Threat Management	119.7	128.7	128.7	358.2
IOS Collaboration	119.1	104.7	104.7	94.2
Unified Messaging	0.0	200.0	200.0	180.0
Federal Relay Service	7.0	7.0	7.0	6.3
Office of the Chief Information Officer	6,641.3	5,685.1	5,683.3	5,364.8
Alternative Dispute Resolution Training	6.0	6.4	6.2	5.9
Collaborative Action and Dispute Resolution	6.0	6.4	6.2	5.9
Office of Valuation Services				
Conservation and Educational Partnerships	31.4	33.0	32.1	28.8
Youth, Partnerships and Service	31.4	33.0	32.1	28.8
Mail and Messenger Services				16.7
Health Unit				1.3
Federal Executive Board				33.8
Special Events Services				6.6
Safety and Environmental Services				2.1
Shipping and Receiving				1.5
Moving Services				1.1
Property Accountability Services				2.8
Family Support Room				0.1
Interior Complex Management & Svcs				3.9
Departmental Library				335.5
Mail Policy				41.9
Space Management Services				1.4
Administrative Operations Directorate				448.7
Aviation Management				315.7
Aviation Management Directorate				315.7
Contingency Reserve	18.1	19.0	18.5	17.6
Cooperative Ecosystem Study Units	75.1	56.9	56.9	56.9
CFO Financial Statement Audit	547.8	548.9	548.9	552.5
Glen Canyon Adaptive Management	95.3	95.5	95.5	123.8
Enterprise Geospatial Information Management	187.3	0.0	0.0	
Departmentwide Activities	923.6	720.2	719.7	750.7

Working Capital Fund Revenue
Centralized Billing
Geological Survey
($ in thousands)

Activity/Office	2011 Actual	2012 Pres Budget	2012 Estimate	2013 Estimate
Other OS Activities				
e-Government Initiatives (WCF Contributions Only)	531.0	437.1	340.3	485.9
Volunteer.gov	15.1	15.1	15.1	15.1
Departmentwide Activities	546.1	452.2	355.4	500.9
Ethics	71.4	75.7	73.3	66.0
ALLEX Database	3.0	0.0	0.0	
FOIA Appeals	15.2	12.7	12.7	11.4
Office of the Solicitor	89.6	88.4	86.0	77.4
Subtotal Other OS Activities	11,351.9	10,090.9	10,108.8	10,821.7

Working Capital Fund Revenue
Centralized Billing
Geological Survey
($ in thousands)

Activity/Office	2011 Actual	2012 Pres Budget	2012 Estimate	2013 Estimate
National Business Center				
NBC IT Security Improvement Plan	438.5	373.3	373.3	373.3
MIB Data Networking	2.2	2.1	2.1	2.0
Information Mgmt. - FOIA and Records Management	0.0	0.0	8.0	8.1
Telecommunication Services	9.5	9.5	9.1	8.6
Integrated Digital Voice Communications System	5.0	2.9	2.9	2.7
Desktop Services	23.8	23.8	22.9	17.0
Audio Visual Services	1.5	1.5	1.5	1.5
Interior Complex Cabling O&M	0.3	0.3	0.3	0.0
NBC Information Technology Directorate	480.8	413.3	420.0	413.2
FPPS/Employee Express - O&M	2,069.6	1,912.5	1,912.5	2,173.7
HRMS (HR LOB W-2 Surcharge)	83.5	0.0	0.0	
Drug Testing	9.4	9.3	9.3	10.7
NBC Human Resources Directorate	2,162.6	1,921.9	1,921.9	2,184.4
Partnership Schools & Commemorative Programs	3.9	0.0	0.0	
Departmental Library	380.0	341.2	341.2	
Interior Complex Management & Services	4.5	3.8	3.8	0.0
Family Support Room	0.1	0.1	0.1	0.0
Property Accountability Services	3.1	2.8	2.8	0.0
Moving Services	1.1	1.1	1.1	0.0
Shipping and Receiving	1.6	1.5	1.5	0.0
Safety and Environmental Services	2.3	2.1	2.1	0.0
Space Management	1.3	1.4	1.4	0.0
Federal Executive Board	34.3	35.2	34.1	0.0
Health Unit	1.4	1.3	1.3	0.0
Mail and Messenger Services	17.0	14.7	14.7	0.0
Mail Policy	42.6	43.8	42.4	0.0
Special Events Services	7.6	7.3	7.3	0.0
Cultural Resources & Events Management	37.2	-1.0	0.0	
NBC Administrative Operations Directorate	538.0	455.4	453.9	0.0
Financial Systems	2,257.5	1,886.7	1,886.7	1,695.6
IDEAS	105.2	89.6	89.6	75.3
Quarters Program	1.0	1.1	1.1	1.0
FBMS Master Data Management	208.3	295.9	115.7	143.2
NBC FBMS Conversion	27.4	29.9	29.9	0.0
Consolidated Financial Statement System	159.0	173.8	173.8	174.6
NBC Financial Management Directorate	2,758.5	2,477.1	2,296.9	2,089.7
FBMS Hosting/Applications Management	693.0	659.8	659.8	232.7
FBMS Redirect - FFS	245.7	379.9	379.9	425.9
FBMS Redirect - IDEAS	283.0	296.7	296.7	312.4
FBMS Help Desk - NBC Customer Support Center				429.8

Working Capital Fund Revenue
Centralized Billing
Geological Survey
($ in thousands)

Activity/Office	2011 Actual	2012 Pres Budget	2012 Estimate	2013 Estimate
National Business Center				
NBC FBMS Support	1,221.7	1,336.3	1,336.3	1,400.9
Aviation Management	335.1	299.0	299.0	
Aviation Management System - O&M	0.0	16.1	16.1	
NBC Aviation Management Directorate	335.1	315.0	315.0	
Subtotal National Business Center	**7,496.6**	**6,919.0**	**6,743.9**	**6,088.2**

Working Capital Fund Revenue
Centralized Billing
Geological Survey
($ in thousands)

Activity/Office	2011 Actual	2012 Pres Budget	2012 Estimate	2013 Estimate
IT Transformation (ITT)				801.0
Office of the Chief Information Officer				801.0
Subtotal				**801.0**
TOTAL	**18,848.5**	**17,009.8**	**16,852.7**	**17,710.9**

Direct billing is used whenever the product or service provided is again severable, but is sold through a time and materials reimbursable support agreement or similar contractual arrangement. The following tables provide the actual direct and reimbursable collections from USGS for 2011, and estimated billings and collections for 2012 and 2013.

Working Capital Fund Revenue
Direct Billing
Geological Survey
($ in thousands)

Activity/Office	2011 Actual	2012 Pres Budget	2012 Estimate	2013 Estimate
Other OS Activities				
Imagery for the Nation	727.5	727.5	950.2	950.2
Policy, Management and Budget	727.5	727.5	950.2	950.2
Ocean Coastal Great Lakes Activities	52.5	52.5	52.5	52.5
Office of Policy Analysis	52.5	52.5	52.5	52.5
Office of Budget				
Single Audit Clearinghouse	0.6	0.6	0.2	0.2
Office of Financial Management	0.6	0.6	0.2	0.2
Federal Assistance Award Data System	4.2	4.4	2.0	
Office of Acquisition and Property Management	4.2	4.4	2.0	
e-OPF	174.8	181.8	193.1	200.5
EAP Consolidation				193.9
Office of Human Resources	174.8	181.8	193.1	394.5
EEO Training	1.0	1.0	16.7	16.7
EEO Investigations	6.3	6.3	6.3	3.0
Office of Civil Rights	7.3	7.3	23.0	19.7
Albuquerque Learning & Performance Center	0.0	8.8	8.8	8.8
Anchorage Learning & Performance Center	4.3	0.7	0.7	
Denver Learning & Performance Center	0.0	20.1	20.1	20.2
Online Learning	18.8	57.5	57.5	57.5
Washington Leadership & Performance Center	2.9	33.3	33.3	33.6
DOI University	26.0	120.4	120.4	120.1
Office of Law Enforcement and Security				
Office of Emergency Management				
Oracle Licenses and Support	1,190.0	1,034.3	1,190.2	2,290.1
Enterprise Architecture Services	2,755.0	920.4	1,810.0	1,810.0
Microsoft Enterprise Licenses	1,487.1	1,487.1	1,634.5	1,634.5
Anti-Virus Software Licenses	382.8	155.4	382.8	272.6
Enterprise Services Network	2,613.9	2,316.7	2,937.3	2,988.9
IOS Collaboration		0.0	0.0	
DOI Access	471.9	619.3	619.3	852.2
Data at Rest Initiative	6.3	14.2	14.2	14.5
EID Office Space			4.0	4.1
EID Rack Space	4.0	75.7	5.6	5.6
Unified Messaging		1,626.6	1,626.6	1,626.6
Office of the Chief Information Officer	8,911.0	8,249.9	10,224.6	11,499.0
Office of Valuation Services				
Creative Communications				20.7
Reimbursable Mail Services				6.7

Working Capital Fund Revenue
Direct Billing
Geological Survey
($ in thousands)

Activity/Office	2011 Actual	2012 Pres Budget	2012 Estimate	2013 Estimate
Other OS Activities				
Administrative Operations Directorate				27.3
Administrative Operations Directorate				
Aviation Management Directorate				
FY 2012 CFO Audit		165.1	0.0	0.0
Departmentwide Programs		165.1	0.0	0.0
Federal FSA Program	301.5	328.1	328.1	359.7
FBMS Change Orders	254.8	180.0	204.2	180.0
Colorado School of Mines	15.2	15.2	0.0	0.0
Departmentwide Programs	571.5	523.3	532.3	539.7
Office of International Affairs				
Subtotal Other OS Activities	**10,475.3**	**10,032.8**	**12,098.3**	**13,603.2**

Working Capital Fund Revenue
Direct Billing
Geological Survey
($ in thousands)

Activity/Office	2011 Actual	2012 Pres Budget	2012 Estimate	2013 Estimate
National Business Center				
Director, NBC Office of the Director				
Enterprise Technology Division	49.0	48.9	48.9	20.7
Enterprise Infrastructure Division	413.2	393.8	393.8	404.0
NBC Information Technology Directorate	462.2	442.7	442.7	424.6
Client Liaison and Product Development Division	5.4	5.5	5.5	
Personnel & Payroll Systems Division	17.6	13.8	13.8	
HR Management Systems Division	109.3	111.4	111.4	
Quicktime Services	401.3	428.6	428.6	0.0
Payroll & HR Systems				829.6
NBC Human Resources Directorate	533.6	559.4	559.4	829.6
Creative Communications	15.9	15.9	15.9	
Reimbursable Mail Services	6.2	6.5	6.5	
NBC Administrative Operations Directorate	22.1	22.4	22.4	
NBC Financial Management Directorate				
Financial Systems	0.0	0.0	0.0	
IDEAS	208.6	138.8	138.8	
NBC Financial Management Directorate	208.6	138.8	138.8	
NBC Aviation Management Directorate				
NBC Acquisitions Services Directorate				
NBC Information Technology Directorate				
Subtotal National Business Center	1,226.4	1,163.2	1,163.2	1,254.3
TOTAL	**11,701.7**	**11,196.0**	**13,261.6**	**14,857.5**

Payments to Other Federal Agencies

	2011 Actual	2012 Change	2013 Change
Worker's Compensation Payments	3,100	+142	-204
The adjustment is for changes in the costs of compensating injured employees and dependents of employees who suffer accidental deaths while on duty. Costs for the BY 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	711	+9	+90
The adjustment is for 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.			
GSA Rental Payments	69,558	+3,336	+3,555
The adjustment is for changes in the costs payable to General Services Administration (GSA) and others resulting from changes in rates for office and non-office space as estimated by GSA, as well as the rental costs of other currently occupied space. These costs include building security; in the case of GSA space, these are paid to DHS. Costs of mandatory office relocations, i.e. relocations in cases where due to external events there is no alternative but to vacate the currently occupied space, are also included.			

Bureau Administrative Costs

Shared Program Costs

The USGS maintains less than 1.5 percent of its appropriation for other bureauwide support and science-related activities. These funds are used for initiatives which may be unfunded mandates, are crosscutting in nature, or respond to new and emerging scientific issues. Examples in previous years are the Department's "Big 9" Initiative, which was implemented to fund essential information technology compliance and security upgrades and funding for a natural hazards coordinator after Hurricane Katrina.

The funding for the initiatives in the Shared Program Costs are assessed to each of the mission areas 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 the aforementioned information technology compliance and security upgrades, would be calculated to each of the mission areas based upon all funding sources, both appropriated and reimbursable. The initiatives on the Shared Program Cost Chart are vetted each year with the Executive Leadership Team of the USGS, and are decided upon in a voting process to ensure bureauwide concurrence.

The following initiatives are currently planned for the USGS's 2013 Shared Program Costs.

2013 USGS Shared Program Costs ($000)

Mission Area	Ecosystems	Climate & Land Use Change	Energy, Minerals & Environmental Health	Natural Hazards	Water Resources	Core Science Systems	Total
CALFED*	130.0	115.8	78.7	108.1	173.3	92.5	**698.4**
Grand Canyon Monitoring*	197.8	176.3	119.7	164.4	263.7	140.7	**1,062.6**
Regional Science*	584.5	520.9	353.8	485.9	779.4	415.8	**3,140.3**
John Wesley Powell Center*	92.4	82.3	55.9	76.8	123.2	65.7	**496.3**
International Programs*	316.9	282.4	191.8	263.4	422.5	225.4	**1,702.3**
Information Product Data System (IPDS)**	48.6	34.8	24.7	33.7	105.1	27.8	**274.8**
USGS Publications Warehouse**	69.4	49.7	35.3	48.2	150.1	39.7	**392.5**
Science Publishing Network (SPN)**	743.0	532.2	377.9	515.7	1,605.9	425.3	**4,200.0**
DOI IT Transformation**	625.0	447.7	317.8	433.8	1,350.8	357.7	**3,532.8**
Total Program Costs	**2,807.6**	**2,242.0**	**1,555.6**	**2,130.0**	**4,974.0**	**1,790.7**	**15,500.0**

* Proportionately Spread by Appropriated Funds Only
** Proportionately Spread by Total Funds (Appropriated and Reimbursable)

CALFED - The California Bay-Delta is recognized as one of the world's threatened treasures of biodiversity supporting unique native species and their critical tidal habitats. The USGS participates in the CALFED Federal-State partnership which coordinates the efforts of 25 State and Federal agencies to improve the quality and reliability of California's water supplies while restoring the Bay-Delta ecosystem. USGS science contributes to restoration challenges such as water supply reliability, water quality, sustainability of native species, and flood risk.

Grand Canyon Monitoring - The USGS's Grand Canyon Monitoring and Research Center (GCMRC) is the science provider for the Glen Canyon Dam Adaptive Management Program. In this role, the research center provides the public and decisionmakers with relevant scientific information about the status and trends of natural, cultural, and recreational resources found in those portions of Grand Canyon National Park and Glen Canyon National Recreation Area affected by Glen Canyon Dam operations.

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

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

International Programs - The Office of International Programs is dedicated to high quality, timely, scientific study that is international in scope and that focuses on the USGS Science Strategy's themes. As one of the world's premier science agencies, the USGS has long recognized the mutual benefits resulting from interaction with scientific partners abroad and extending research and investigations to other countries. By providing reliable scientific

information about the Earth and its resources from an international perspective, the USGS Office of International Programs supports US foreign policy and national security; provides a basis for science diplomacy, and improves the scientific basis for managing ecosystems and natural resources.

Information Product Data System (IPDS) - This system, maintained by the Office of Science, Quality and Integrity (OSQI), tracks the development of information products from planning through dissemination and supports Fundamental Science Practices compliance.

USGS Publications Warehouse - The USGS Publications Warehouse contains basic citation records for all USGS Numbered Series publications going back through USGS history. Many records contain links to online resources associated with the publication for download or online viewing.

Science Publications Network (SPN) - The SPN provides accurate, efficient, effective, and timely reporting of reliable science, which are key factors in assuring the USGS role as a world leader in natural sciences through scientific excellence and responsiveness to society's needs. The SPN is funded through two mechanisms, the fee for-service portion of the Working Capital Fund, and here, through the science program-level contribution.

DOI IT Transformation - This funding will be used to support Interior's efforts in IT Transformation. These funds will support the Department's activities related to data center consolidation, single-source messaging, and cloud-based electronic forms, records, documents and content management solutions.

Internal Bureau Overhead Cost Allocation Methodology

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

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

(Dollars in Thousands)

Source of Funding	2013 Budget Request	2013 Estimated Bureau Overhead Distribution	2013 Estimated Total
Administration and Enterprise Information			
Science Support Subactivity	75,756	30,810	106,566
Security & Technology Subactivity	23,295	8,690	31,985
Total Funding	**99,051**	**39,500**	**138,551**

At the science center level, because there generally is not an appropriated funding source to pay the local overhead (common services) costs, both the appropriated and reimbursable funding are assessed a percentage to cover their share of science center-level costs. Science center common services costs include center costs that are not directly attributable to a specific activity or project, such as managerial, supervisory, administrative, and financial functions and related systems, as well as costs incidental to providing services and products, such as postage, training, miscellaneous supplies and materials. The cost during 2011, for the local overhead, totaled $189.8 million from both appropriated and reimbursable funds.

In recognition of the USGS role as the science bureau for the Department of the Interior, the USGS is continuing to give Interior bureaus and offices a "preferred" customer rate on overhead charges for a significant portion of reimbursable work, to the extent that matching funds are available within the USGS budget. The maximum rate that cost centers may charge other Interior bureaus for common services and bureau costs combined remains 15 percent net. In 2013, of the 15 percent, 7.5 percent is applied to bureau costs, and the remaining 7.5 percent is applied to common services costs. Cost centers must fund the common services costs not recovered (e.g., the difference between the cost center's standard common services costs and the 7.5 percent) from USGS appropriated funds. In this way, the USGS is partnering on the science needs of Interior from both the bureau and cost centers.

The Chief Financial Officer establishes the USGS bureau special rate for each fiscal year. The special rate for 2013 is estimated to remain at three percent. Cost centers do not charge more than the bureau special rate for facilities-related costs or their standard common services rate when funding is approved for a bureau-level special rate. Special rates are applied under the following circumstances:

- When the USGS receives funds from a non-USGS organization and awards a grant to a third-party entity.
- When the USGS receives funds from one or more non-USGS organizations to support, under USGS leadership, a strategic science objective that includes the USGS passing through funds to one or more third-party entities.
- When the USGS receives funds from a non-USGS organization for the purpose of the customer acquiring services through the Cartographic Services or the Remotely Sensed Data Contracts. The special rate helps encourage other Federal agencies to use these contracts for cartographic services and remotely sensed data, rather than establishing and managing their own contracts, and ensures greater data consistency through the use of common service providers.

- When the USGS receives funds from a non-USGS organization for the purpose of passing through the customer's funds to State and local governments for the direct purchase of geospatial data.
- Biology Cooperative Research Units (CRUs) are supported by a three-way partnership including the USGS, a State, and a university. The academic institutions where CRUs are co-located provide significant administrative support. In recognition of the direct services support received from the non-USGS partners, CRUs only recover one-half of the bureau rate (6 percent) normally recovered from reimbursable customers or partners.

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