BUDGET JUSTIFICATIONS

The United States Department of the Interior

and Performance Information
Fiscal Year 2007

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 2007 BUDGET JUSTIFICATION

TABLE OF CONTENTS

Organization
Organization Chart iv
Acronyms v

A – General Statement
Overview of the 2007 Budget Request A-1
Budget Request by Department Mission Component A-1
President's Management Agenda A-8
Performance Summary A-17
Achieving Department Mission Goals A-17
Resource Protection Goal A-19
Resource Use Goal A-21
Serving Communities Goal A-23
Means and Strategies A-26
Science Planning A-26
Strategic Change A-26
Science Integrity A-26
Program Evaluations A-27
Partnerships A-31
Data Validation and Verification A-35

B – Goal Performance Table
Goal Performance Table B-1
Resource Protection B-1
Resource Use B-9
Serving Communities B-13
Management Excellence B-30
Funding Goals Table B-34

C – Research and Development Criteria
Research and Development Criteria C-1
Research and Development Funding Table C-5

D – Budget at a Glance
Comprehensive Activity/Subactivity Table D-1
Program Increases D-3
Program Decreases D-13

E – Surveys, Investigations, and Research
Analysis by Activity E-1
Appropriation Language E-2
Justification of Proposed Language Change E-4
Appropriation Language and Citations E-5
Administrative Provisions Language E-10

Administrative Language and Citations E-11
Fixed Costs and Related Changes E-14
Summary of Requirements E-17

F – Science on the Landscape — Regional and Crosscutting Activities
Science on the Landscape F-1
Integrated Multi-Hazards Demonstration Project F-2
Regional Overview F-7
Science on the DOI Landscape F-10
Department Crosscuts F-15
Science Issues, Accomplishments, and Partnerships F-19

G – Geographic Research, Investigations, and Remote Sensing
Activity Summary G-1
Land Remote Sensing Subactivity G-5
Geographic Analysis and Monitoring Subactivity G-21

H – Geologic Hazards, Resources, and Processes
Activity Summary H-1
Geologic Hazard Assessments Subactivity
Earthquake Hazards H-5
Volcano Hazards H-21
Landslide Hazards H-29
Global Seismographic Network H-37
Geomagnetism H-45
Geologic Landscape and Coastal Assessments Subactivity
Earth Surface Dynamics H-53
National Cooperative Geologic Mapping H-61
Coastal and Marine Geology H-71
Geologic Resource Assessments Subactivity
Mineral Resources H-91
Energy Resources H-101

I – Water Resources Investigations
Activity Summary I-1
Hydrologic Monitoring, Assessments, and Research Subactivity
Ground-Water Resources Program I-5
National Water-Quality Assessment I-15
Toxic Substances Hydrology I-25
Hydrologic Research and Development I-37
National Streamflow Information Program I-45
Hydrologic Networks and Analysis I-55
Cooperative Water Program Subactivity I-67
Water Resources Research Act Program Subactivity I-79

J – Biological Research
Activity Summary J-1
Biological Research and Monitoring Subactivity J-7
Status and Trends of Biological Resources J-13
Contaminant Biology J-16
Fisheries: Aquatic and Endangered Resources J-16

Wildlife: Terrestrial and Endangered Resources J-19
Terrestrial, Freshwater, and Marine Ecosystems J-22
Invasive Species J-24
Biological Information Management and Delivery Subactivity J-33
Science Centers and Field Stations Summary J-45
Cooperative Research Units Subactivity J-51

K – Enterprise Information
Activity Summary K-1
Enterprise Information Security and Technology Subactivity K-5
Enterprise Information Resources Subactivity K-15
National Geospatial Program Subactivity K-23

L – Science Support
Science Support L-1

M – Facilities
Activity Summary M-1
Rental Payments Subactivity M-5
Operations and Maintenance Subactivity M-11
Deferred Maintenance and Capital Improvement Subactivity M-17

N – Working Capital Fund
Working Capital Fund Overview N-1
Appropriation Language and Citations N-3
Program and Financing N-5
Balance Sheet N-7
Object Classification N-8
Personnel Summary N-8

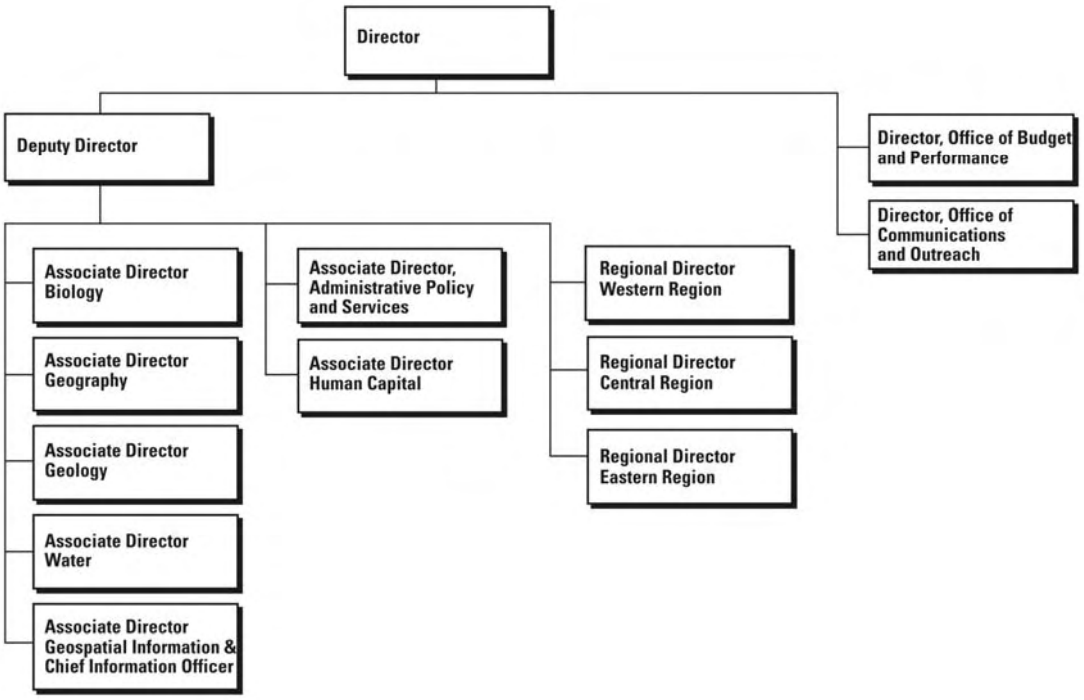
O – Surveys, Investigations, and Research – Exhibits
Summary of Requirements by Object Class O-1
Program and Financing O-3
Object Classification O-5
Personnel Summary O-7

P – Sundry Exhibits
Funding of U.S. Geological Survey Programs (Obligations) P-1
Donations and Contributed Funds P-13
Employee Count by Grade P-14
Program/Project Support of Bureau, Department, and Governmentwide Costs P-15

Q – Authorizations
Authorizations Q-1

View 07 Budget Spreadsheets

U.S. Geological Survey



USGS Regional Structure

Alphabetical List of Acronyms

ABC/M	Activity-Based Costing/Management
ACWI	Advisory Committee on Water Information
ANSS	Advanced National Seismic System
ANWR	Arctic National Wildlife Refuge
APS	Administration and Policy Services
AR	Accounts Receivable
ARMI	Amphibian Research and Monitoring Initiative
ASC	Alaska Science Center
ASIWPCA	Association of State and Interstate Water Pollution Control Administrators
AVO	Alaska Volcano Observatory
BASIS+	Budget and Science Information System
BIA	Bureau of Indian Affairs
BIS	Commerce - Bureau of Industry and Security
BOR	U.S. Bureau of Reclamation
BLM	U.S. Bureau of Land Management
BLT	Business Leaders Team
BRD	Biological Resources Division
BSR	Business Strategy Review
CA	Condition Assessment
CAC	Civil Applications Committee
CALFED	California Federal (Bay-Delta Authority program)
CAP	Cooperative Agreements Program
C&A	Certification and Accreditation
CBM	Coalbed Methane
CBP	Chesapeake Bay Program
CDC	Centers for Disease Control and Prevention
CERC	Columbia Environmental Research Center
CERP	Comprehensive Everglades Restoration Plan
CFO	Chief Financial Officer
CISN	California Integrated Seismic Network
CMGP	Coastal and Marine Geology Program
CNMI	Commonwealth of the Northern Mariana Islands
CPIC	Capital Planning and Investment Control
CR	Central Region
CRADA	Cooperative Research and Development Agreement
CRSSP	Commercial Remote Sensing Space Policy
CRWA	Charles River Watershed Association
CSRS	Civil Service Retirement System
CTBT	Comprehensive Test Ban Treaty
CTM	Cooperative Topographic Mapping
CUES	Comprehensive Urban Ecosystems Studies
CVO	Cascades Volcano Observatory
CWD	Chronic Wasting Disease
CWP	Cooperative Water Program
DCIA	Debt Collection Improvement Act
DEM	Digital Elevation Model
DEP	[State] Department of Environmental Protection
DEQ	[State] Department of Environmental Quality

DiGIR	Distributed Generic Information Retrieval
DOI	U.S. Department of the Interior
DSS	Decision Support System
EDMAP	Education Mapping program (in National Cooperative Geologic Mapping Program)
EEOC	Equal Employment Opportunity Commission
EFT	Electronic Funds Transfer
EHP	Earthquake Hazards Program
EO	Executive Order
EOP	Executive Office of the President
EPA	U.S. Environmental Protection Agency
EPCA	Energy Policy and Conservation Act
ER	Eastern Region
EROS	Earth Resources Observation and Science
ERP	Energy Resources Program
ETM+	Enhanced Thematic Mapper Plus
FAA	Federal Aviation Administration
FACA	Federal Advisory Committee Act
FASAB	Federal Accounting Standards Advisory Board
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
FERS	Federal Employees Retirement System
FFMIA	Federal Financial Management Improvement Act of 1996
FGDC	Federal Geographic Data Committee
FICA	Federal Insurance Contributions Act
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
FSA	Farm Service Agency
FTE	Full-Time Equivalent
FWS	U.S. Fish and Wildlife Service
GAAP	Generally Accepted Accounting Principles
GAM	Geographic Analysis and Monitoring Program
GAO	Government Accountability Office
GEODE	GEO-Data Explorer
GeoMAC	Geospatial Multi-Agency Coordination
GBIP	Great Basin Information Project
GCDAMP	Glen Canyon Dam Adaptive Management Program
GCMRC	Grand Canyon Monitoring and Research Center
GCP	Global Change Program
GIS	Geographic Information System
GLSC	Great Lakes Science Center

GEOSS	Global Earth Observation System of Systems
GOS	Geospatial One-Stop
GPRA	Government Performance and Results Act
GPS	Global Positioning System
GSA	General Services Administration
GSN	Global Seismographic Network
GWRP	Ground-Water Resources Program
HAZUS	Federal Emergency Management Agency's Earthquake Loss Estimation Program
HBN	Hydrologic Benchmark Network
HDOA	Hawaii Department of Agriculture
HHS	[Department of] Health and Human Services
HNA	Hydrologic Networks and Analysis [program]
HPO	High Performing Organization
HR	Human Resources
HR&D	Hydrologic Research and Development [program]
HVO	Hawaii Volcano Observatory
HWATT	Hemlock Woolly Adelgid Action Team
ICL	International Consortium on Landslides
ICWP	Interstate Council on Water Policy
IEAM	Integrated Environmental Assessment and Management
IP	Investment Plan
IRB	Investment Review Board
IRIS	Incorporated Research Institutions for Seismology
InSAR	Interferometric Synthetic Aperture Radar
IT	Information Technology
JFA	Joint Funding Agreement
KSF	Thousand Square Feet
LAS	Local Action Strategy
LDCM	Landsat Data Continuity Mission
LEAG	Long-term Estuary Assessment Group
LHP	Landslide Hazard Program
LiDAR	Light Detecting and Ranging
LMV	Lower Mississippi Valley
LRS	Land Remote Sensing
LTRMP	Long-Term Resource Monitoring Program
LVO	Long Valley Volcano Observatory
MBtu	Million British thermal units
MD	Management Directive
MITS	(Department) Management Initiatives Tracking System
MODIS	Moderate Resolution Imaging Spectroradiometer
MRDS	Mineral Resources Data System
MRERP	Mineral Resources External Research Program
MRP	Mineral Resources Program
MSCP	Multi-Species Conservation Program
MSH	Mount St. Helens
MTBE	methyl tert-butyl ether
NACO	National Association of Counties
NADP	National Atmospheric Deposition Program
NARA	National Archives and Records Administration
NASA	National Aeronautics and Space Administration

NASQAN	National Stream Quality Accounting Network
NAWQA	National Water-Quality Assessment
NBC	Dept. of Interior - National Business Center
NBII	National Biological Information Infrastructure
NCAP	National Civil Applications Program
NCGMP	National Cooperative Geologic Mapping Program
NCRDS	National Coal Resources Data System
NED	National Elevation Dataset
NEHRP	National Earthquake Hazards Reduction Program
NEIC	National Earthquake Information Center
NEPA	National Environmental Policy Act
NGA	National Geospatial-Intelligence Agency
NGIC	National Geomagnetic Information Center
NGO	Nongovernmental organization
NGTOC	National Geospatial Technical Operations Center
NHD	National Hydrology Dataset
NIEHS	National Institute of Environmental Health Sciences
NIFC	National Interagency Fire Center
NIST	National Institute of Standards and Technology
NIWR	National Institutes for Water Resources
NLCD	National Land Cover Database
NOAA	National Oceanic and Atmospheric Administration
NPRA	National Petroleum Reserve, Alaska
NPS	National Park Service
NRIS	Natural Resource Information System
NRC	National Research Council
NRCS	Natural Resources Conservation Service
NRP	National Research Program (research organization in USGS Water discipline)
NSDI	National Spatial Data Infrastructure
NSF	National Science Foundation
NSIP	National Streamflow Information Program
NSMP	National Strong Motion Program
NTN	National Trends Network
NVEWS	National Volcano Early Warning System
NWIS	National Water Information System
NWQL	National Water Quality Laboratory
NWS	National Weather Service
OAFM	USGS Office of Accounting and Financial Management
OBP	USGS Office of Budget and Performance
OES	Office of Emergency Services
OFR	Open-File Report
OIG	Office of the Inspector General
OGDB	Organic Geochemistry Database
OLI	Operational Land Imager
OMB	Office of Management and Budget
OMS	Office of Management Services
OPM	Office of Personnel Management
OSHA	Occupational Safety and Health Administration
PAGER	Prompt Assessment of Global Earthquakes for Response
PART	Program Assessment Rating Tool

PES	Priority Ecosystems Science
PP&E	Property, Plant, and Equipment
PI	Principal Investigator
PSNER	Puget Sound Near Shore Ecosystem Restoration
R&D	Research and Development
RGIO	Regional Geospatial Information Office(r)
RSSI	Required Supplementary Stewardship Information
RTS	Reports Tracking System (Water Resources)
SAFOD	San Andreas Fault Observatory at Depth
SAIN	Southern Appalachian Information Node
SBFD	San Francisco Bay and freshwater delta
SBSP	South Bay Salt Pond Restoration Project
SCEC	Southern California Earthquake Center
SETAC	Society of Environmental Toxicology and Chemistry
SFWMD	South Florida Water Management District
SLC	Scan Line Corrector
SGL	Standard General Ledger
SIR	Surveys, Investigations, and Research
STATEMAP	State mapping program (in Cooperative Geologic Mapping Program)
SPARROW	SPAtially Referenced Regressions on Watershed Attributes
SPRESO	South Pole Remote Earth Science Observatory
SRTM	Shuttle Radar Topographic Mission
TCOM	Tahoe Constrained Optimization Model
TMDL	Total Maximum Daily Loads (Clean Water Act requirement)
TSP	Thrift Savings Plan
TROR	Treasury Report on Receivables
TRPA	Tahoe Regional Planning Agency
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USGCRP	U.S. Global Change Research Program
USGS	U.S. Geological Survey
VHP	Volcano Hazards Program
V&V	Validation and Verification
VSIP/VERA	Voluntary Separation Incentive Payment/Voluntary Early Retirement Authority
WAN	Wide Area Network
WCF	Working Capital Fund
WNV	West Nile Virus
WPA	World Petroleum Assessment 2000
WR	Western Region
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
YMP	Yucca Mountain Program
YVO	Yellowstone Volcano Observatory

General Statement

Overview of the 2007 Budget Request

(Dollars in thousands)

Budget Authority	2005 Actual	2006 Enacted	2007 Request	2007 Request Change from 2006	
				Amount	Percent
Current	[1/] 947,564	[2/] 965,345	944,760	-20,585	-2.1
Permanent	2,353	1,355	7,603	6,248	461.1
Total	**949,917**	**966,700**	**952,363**	**-14,337**	**-1.5**
FTE	*8,920*	*8,757*	*8,396*	*-361*	*-4.1*

[1/] Hurricane supplemental $1 million in FY 2005 for a total of $948,564.
[2/] Hurricane supplemental $5.3 million in FY 2006 for a total of $970,645.

Budget Request by Department Mission Component

(Dollars in thousands)

	2005 Actual	2006 Enacted	2007 Request	Change from 2006
Resource Protection	148,446	151,080	147,360	-3,720
Resource Use	77,264	76,534	56,916	-19,618
Recreation	0	0	0	0
Serving Communities	722,854	743,031	740,484	-2,547
Total	**948,564**	**970,645**	**944,760**	**-25,885**

Science: The Foundation for Sound Management Decisions

The FY 2007 USGS budget request addresses planned outcomes of the Department of the Interior Unified Strategic Plan and ensures implementation of the President's Management Agenda, as adapted by Secretary Norton in her vision for Citizen-Centered Governance—achieving conservation through consultation, cooperation, and communication. The USGS works closely with Interior bureaus to ensure their science and information needs are an integral part of USGS science plans and that those scientific efforts are relevant to the bureaus' needs.

The value of the USGS, the Nation's largest water, earth, and biological science and civilian mapping agency, rests on its ability to

- Carry out large-scale—regional and national—investigations that build the base of knowledge about the Earth,
- Apply multidisciplinary scientific expertise in the fields of biology, geography, geology, and hydrology, and geospatial information,
- Sustain long-term monitoring and assessment of natural resources,
- Collect, monitor, and analyze data and provide scientific understanding about natural resource conditions, issues, and problems, and
- Provide relevant, timely, impartial, peer-reviewed natural resource information and products.

Unique in the aggregate, these combined capabilities, coupled with a non-regulatory, non-land-management mandate, position the USGS as a leader in understanding the complex natural science phenomena and provide scientific products that lead to solutions. For more than a century, natural resource managers, emergency response organizations, land use planners, decisionmakers at all levels of government, and citizens in all walks of life have come to depend on the USGS for reliable information tools they need to address pressing societal issues such as public safety and health, natural resource management, and environmental protection.

FY 2007 Major Focus

The USGS FY 2007 budget request continues high-priority research and refocuses priorities to enhance efforts in the areas of science most needed by the Nation:

- Reduce American's risk to natural hazards,
- Prepare for avian influenza,
- Continue the 30-year legacy of the Landsat satellite missions,
- Shore up the Nation's critical streamgaging network, and
- Research emerging energy sources (e.g., gas hydrates).

Natural Hazards — The Research and Development (R&D) priorities for FY 2007, issued by the Office of Management and Budget (OMB) and the Office of Science and Technology Policy (OSTP), call for "a complete monitoring system that supports risk assessment surveys, providing information critical to improved mitigation strategies and providing systematic and sustained monitoring of regions at risk." Thus, in FY 2007, the USGS will place a major emphasis on science to reduce America's risk to natural hazards. Despite the upward trend in the risk, recent advances in science and technology position us well for *reducing* the Nation's future risk. These scientific and technological advances, coupled with effective communication and careful planning, can help prevent hazard events from becoming catastrophic disasters.

The Integrated Multi-Hazard Demonstration Project, a multi-year pilot proposed for Southern California, will focus on integrating research, information, and products about multiple hazards to improve the usefulness of this information in reducing loss of life and property from natural hazard events. Southern California, having one of the Nation's highest potentials for extreme, catastrophic losses from several natural hazards such as earthquakes, tsunamis, fires, landslides, and floods, will serve as the site for the demonstration project. The development of integrated databases and the enhancement of information technology (IT) systems to track multiple hazards will facilitate more rapid communication and response to the user community, regardless of the timeframe of a natural disaster. This work supports the end outcome goal of "Protect lives, resources, and property" under the mission goal of Serving Communities.

Avian Influenza — In 2006, an interagency effort will be put into place to detect highly pathogenic avian influenza. The effort is funded through an FY 2006 supplemental appropriation, through which Interior received $11.6 million. The 2007 budget proposes to continue these efforts at a level of $11.2 million, including investigation of morbidity and mortality events, targeted surveillance in live wild birds, and targeted surveillance in hunter taken birds. The funding will be divided among the following bureaus: $3.27 million for the USGS, $7.4 million for the Fish and Wildlife Service, and $525,000 for the National Park Service. For the USGS, the FY 2007 budget includes a decrease of $400,000, reflective of a one-time purchase of a robotic micro sample extractor and molecular biology workstation in 2006 to assist in processing samples.

Ensuring the Landsat Earth Observation Legacy — The budget requests an increase of $16.0 million for the Landsat Data Continuity Mission, a partnership of the National Aeronautics and Space Administration and USGS that continues the 30-year legacy of obtaining global earth observation data currently conducted by Landsat satellites 5 and 7. The mission is designed to acquire, archive, and disseminate remotely-sensed data of the Earth's land surface for applications such as monitoring and assessing the impacts of natural disasters; aiding in the management of water, biological, energy, and mineral resources; and analyzing the impacts of climatic and other global change. The FY 2007 request for LDCM was approved by the Department's Investment Review Board (IRB) and is consistent with the Office of Management and Budget Program Assessment Rating Tool and with joint guidance on FY 2006 R&D priorities issued by OMB and the Office of Science and Technology Policy.

National Streamflow Information Program — The budget requests $2.3 million in FY 2007 for the National Streamflow Information Program (NSIP) to increase the number of streamgages by 30 and give USGS flexibility to continue operating high-priority sites identified in the NSIP plan as "Federal interest" streamgages. Loss of partner funding has caused a number of streamgage shut-downs in the last few years, a trend expected to continue in 2007, especially in Mississippi and Louisiana, where budgets of State and local partner agencies have been taxed beyond their limit in the wake of Hurricane Katrina. The USGS anticipates that the funding requested for FY 2007 will help ease the impact of funding pressures among the network's 800 partner agencies nationwide. The funds would provide resources for technological investments that will make the entire network more cost-efficient in the long term. These include procurement or development of improved software for data collection and data processing, and new instruments that are more reliable or make the data collection process more efficient.

Energy — Collaborative efforts between the USGS and Interior land and resource management bureaus have resulted in hundreds of systematic analyses and investigations every year to support the resource management decisions of the Interior bureaus. Consistent with the joint OMB/OSTP R&D priorities for 2007—which note that the Administration's energy and environmental research initiatives are critical for achieving sustained economic growth while ensuring national energy security and a healthy environment—these collaborative efforts will continue and expand in FY 2007 with the joint gas hydrates initiative being developed by the USGS, the Bureau of Land Management, and the Minerals Management Service. A joint plan has been reviewed and approved by the Department's R&D Council. The USGS portion (+$500,000) of this effort is described in section H – Geologic Hazards, Resources, and Processes. Work will focus on Federal lands and resources such as those in the Gulf of Mexico and the North Slope of Alaska. This requested increase is consistent with the Energy Policy Act of 2005, which calls for a focus on alternative energy sources, such as gas hydrates, and reauthorizes the Methane Hydrate Research and Development Act. The increase is also consistent with a 1999 National Research Council review of the USGS Energy Resources Program (ERP), which recommended that the program broaden its portfolio to include geologically based energy resources beyond oil, gas, and coal.

An additional proposed increase of $500,000 is to support Energy Policy Act 2005 requirement for a national assessment of the oil shale resources in the United States. Currently, USGS has no active research effort focused on oil shale. However, USGS does possess expertise in this area and can start an assessment effort in 2007 in concert with IT or Geographic Information System (GIS) contractors and experts from State surveys.

A proposed increase of $1 million would be used to meet mandates in the Energy Policy Act of 2005 for creation of a Preservation of Geological and Geophysical Data program, to preserve

data currently held by government agencies and private firms that may be in danger of loss. The USGS plans a multi-stage response. The first stage will be undertaken in FY 2006, starting with formation of an ad hoc Preservation Subcommittee under the Federal Advisory Committee (FAC) for the National Cooperative Geologic Mapping Program. The Subcommittee will develop an implementation plan, which must be submitted to Congress within one year, for the new preservation program. This plan will set priorities for several funding scenarios within the proposed authorized funding level. A survey of Department of the Interior bureaus and State geological surveys will be undertaken in 2006 to discover, within the geological and geophysical data holdings managed by these agencies, (1) the data that are at risk and (2) the resources needed to rescue and make available these materials.

FY 2007 – Other Major Program Initiatives

An additional increase is requested for the USGS share ($1.5 million) of the **Department's Working Capital Fund**, related to departmentwide information technology (IT) developments.

In the administrative and information technology arenas, USGS will continue support, within base funding, for **competitive sourcing activities** and for priority investments approved by the IRB, such as security certification and accreditation, Homeland Security Presidential Directive 12 (smart card implementation), enterprise messaging, the enterprise services network, active directory, the Maximo project, Geospatial One-Stop, and other e-government initiatives.

Enterprise Information / Geography Restructure — In a strategic move to strengthen geographic research and consolidate geospatial data programs, USGS proposes a budget restructure to realign and hone the focus of geographic research and geospatial data programs. In August 2005, the Director announced an organizational and management realignment that—

- Positions the Geographic Analysis and Monitoring and the Land Remote Sensing programs to be the centerpieces of USGS geography research and applications, and
- Consolidates key elements of the USGS portfolio of national geospatial programs, such as the Federal Geographic Data Committee, the Geospatial One-Stop project, and *The National Map* into a National Geospatial Programs Office.

The decision to reorganize is in direct response to discussions with constituent groups about how best to meet their geospatial data needs, as well as recommendations from a report by the National Research Council of the National Academy of Sciences. The NRC report recommended that the USGS should give higher priority to fundamental geographic research to:

- Improve citizen involvement in decisionmaking for issues related to natural sciences by applying all the USGS primary spatial data sets,
- Expand the utility and application of place-based science by conducting integrative place-specific research in addition to topical research in individual disciplines, and
- Enhance the effectiveness of decision-support systems with increased geographic input and more effective map-like products as output.

This change allows existing expertise in the field of geography at USGS to focus attention on geographic research and enhance USGS leadership in both geospatial programs and geographic research. Therefore, as part of the restructure, USGS proposes to change the "Mapping, Remote Sensing, and Geographic Investigations" activity name to "Geographic Resources, Investigations, and Remote Sensing."

The reorganization consolidates USGS geospatial programs under the new NGPO located within the Geographic Information Office. The NGPO aligns national geospatial activities and responsibilities, assesses USGS geospatial products and services, and expands partnership offices and engages partners throughout the geospatial community. The NGPO will work with programs inside and outside the USGS to improve access to USGS geospatial data and information resources. In keeping with the consolidation of geospatial programs in the Enterprise Information activity, USGS proposes to change the "Federal Geographic Data Coordination" subactivity name to "National Geospatial Program."

Internal management and business practices were implemented in 2005. The USGS is submitting a reprogramming proposal during 2006 to implement the funding adjustments that reflect the new management approach to the geographic and geospatial data programs. The permanent budget restructure commensurate with this change is proposed for implementation through approval of the FY 2007 budget request. Please see the table on the following page for a comparison of the proposed budget structure with the current structure.

Science Support Restructure — The current budget structure for the Science Support activity contains a subactivity entitled “Payments to the NBC,” which was originally intended to reflect payments to the Department for common services provided by the National Business Center and billed through the Department’s Working Capital Fund. However, the subactivity has not kept pace with the increasing number and cost of services provided by the NBC and other Department offices. Additional funding has had to be provided from the Bureau Operations subactivity in particular, and from other components of the budget as well, to cover the full scope of Department services. Since the subactivity no longer reflects the purpose for which it was created, USGS proposes to consolidate the Payments to the NBC subactivity with the Bureau Operations subactivity and manage the Science Support activity at the activity level. This approach also mirrors the level at which this activity is overseen in the appropriation. This proposed restructure is also reflected on the comparison table on the following page.

Proposed FY 2007 Budget Structure Changes

Surveys, Investigations, and Research

Current Budget Structure (FY 2007 Request Funding, Dollars in Thousands)

Surveys, Investigations, and Research Total	**944,760**
Mapping, Remote Sensing, and Geographic Investigations Total	**141,735**
Cooperative Topographic Mapping	69,675
Land Remote Sensing	58,986
Geographic Analysis and Monitoring	13,074
Geologic Hazards., Resources, and Processes Total	**217,418**
Water Resources Investigations Total	**204,047**
Biological Research Total	**172,597**
Enterprise Information Total	**46,109**
Enterprise Information Security and Technology	25,972
Enterprise Information Resources	16,636
Federal Geographic Data Coordination	3,501
Science Support Total	**67,382**
Bureau Operations	66,448
Payments to the National Business Center	934
Facilities Total	**95,472**

Proposed New Budget Structure (FY 2007 Request Funding, Dollars in Thousands)

Surveys, Investigations, and Research Total	**944,760**
Geographic Research, Investigations, & Remote Sensing Total	**76,614**
Land Remote Sensing	61,754
Geographic Analysis and Monitoring	14,860
Geologic Hazards., Resources, and Processes Total	**217,418**
Water Resources Investigations Total	**204,047**
Biological Research Total	**172,597**
Enterprise Information Total	**111,230**
Enterprise Information Security and Technology	25,972
Enterprise Information Resources	16,636
National Geospatial Program	68,622
Science Support Total	**67,382**
Facilities Total	**95,472**

If the Activity is displayed on a single line, no budget restructure is being proposed. Explanations are included in the General Statement; Fixed Costs and Related Changes; Geographic Research, Investigations, and Remote Sensing; Enterprise Information; and Science Support portions of the budget.

Crosscuts — Science support for Department crosscutting activities is preserved within funding levels in this budget. Activities range from environmental issues such as the Everglades restoration and coral reef protection in the Pacific Islands to resource management issues such as salmon recovery in the Pacific Northwest. Other activities include the National Invasive Species Management Plan, Glen Canyon Dam Adaptive Management Plan, Great Lakes Deepwater Fisheries Program, California Bay-Delta, global change, Geospatial One-Stop and other electronic government initiatives, and the Klamath River Basin Federal Working Group, to name but a few. See section F – Science on the Landscape for more information.

Five-Year Program Plans — Five-year program plans are the heart of the bureau planning model, providing the basis for annual decisionmaking. These plans support the USGS Strategic Plan and articulate program goals, priorities, outcomes, measures of success, and products over a 5-year period. Customers, cooperators, and partners play a key role in providing input on science needs, emerging issues, and priorities; these participants also provide external review of the plans. Annual project decisions flow from bureau 5-year program plans. Plans are completed for each USGS program on a staggered cycle that results in a new plan for each program every 5 years. In addition to an operational plan that describes the decisionmaking processes for the program, each 5-year plan is designed to —

- Evaluate the **quality** of USGS Science,
- Ensure **communication and collaboration** among USGS scientists during the review process,
- Determine the **relevancy** of USGS science,
- Evaluate USGS efforts in meeting **partner needs,**
- Evaluate performance in meeting **program goals,** and
- Guide future scientific endeavors.

Research and Development (R&D) — The Department is using the Administration's R&D investment criteria to assess the value of R&D programs. See section C for the description and how USGS is applying it in its budget decisions.

Landsat Base Funding — In FY 2006, the President's budget requested $6 million to provide the additional base funds necessary to continue operations of Landsat 7. The additional funds requested in FY 2006 were to have enabled the USGS to meet requirements under the Land Remote Sensing Policy Act of 1992 (P.L. 102–555) and continue to provide medium resolution data to the Nation at the cost of fulfilling user requests. The failure of a scan line corrector aboard the Landsat 7 satellite in 2004 reduced revenue from image sales and resulted in an annual shortfall of approximately $6 million in revenue used to cover operating costs. In FY 2006, the Congress provided $4 million of the requested $6 million and directed USGS to absorb the remaining $2 million by making "reductions in travel, administrative streamlining, and buyout savings throughout the bureau." As a result, in FY 2006, the USGS will move $2 million from the Cooperative Topographic Mapping (CTM) program to the Land Remote Sensing program (LRS). The funds will remain in the LRS program in FY 2007, and FY 2007 performance information has been adjusted accordingly. This stop-gap measure is proposed only for FY 2006 and FY 2007.

Program/Project Support of Bureau, Department, and Governmentwide Costs — As required by section 405 of the Department of the Interior, Environment, and Related Agencies Appropriations Act, 2006, the budget justification includes disclosure of current amounts and

practices with respect to overhead charges, deductions, reserves, or other holdbacks in section P – Sundry Exhibits.

President's Management Agenda

Budget and Performance Integration

The integration of budget and performance is critical to the planning for and evaluation of success achieved by the USGS in the application of its science to building long term bodies of data and ensuring their relevance to partner and customer need. Since FY 2002, USGS has worked with the Department and the Administration to establish accurate and meaningful performance measures for its programs in accordance with the President's Management Agenda (PMA). The USGS has been particularly successful in this endeavor, owing to the physical integration of its budget, regional, and planning and performance teams in its Office of Budget and Performance (OBP). Working in constant contact, these teams jointly develop and produce budget and performance documents that are fully integrated with respect to description of base programs and analyses, their funding and FTE implications, what the standards of their performance will be and how they will be evaluated. The three teams work closely with bureau program staff to understand, evaluate, and plan the science programs' budget and performance levels, ensuring responsiveness to USGS executive management decisions, departmental concerns, and Administration policies.

The Assistant Secretary – Policy, Management, and Budget has commended the functional organization and coordination of budget and planning for USGS within the OBP, asking the Department's Office of Budget and Office of Planning to provide the USGS submission as an example to the Department's nine other bureaus and offices of how to complete their submissions as successfully. The USGS was also commended for its rigorous program evaluation efforts, particularly with respect to the OMB PART evaluations.

Program Assessment Rating Tool (PART) — The USGS has a long and rigorous record of conducting external peer reviews for research, performance evaluations for programs, and management control reviews. To this suite has been added the OMB PART. Both peer and management reviews, as well as PART evaluations, are conducted to improve the accountability and quality of programs; identify and address gaps in programs; redirect or reaffirm program direction; identify and provide guidance for development of new programs; and reward and (or) motivate managers and scientists. The National Academy of Sciences/National Research Council (NAS/NRC) has conducted recent program reviews of the Landslide Hazards Program, Coastal and Marine Geology Program, and Water Resources Research. Recent Scientific Advisory Committee reviews include Earthquake Hazards, the National Cooperative Geologic Mapping Program, the Cooperative Water Program, and the Water Resources Research Institutes. The PART was introduced in FY 2002 by the Administration as a means to evaluate program level performance across Government, with a goal of reviewing 20 percent of our programs each year. Of nine USGS programs evaluated since 2002, eight have rated "moderately effective" and one "effective."

During FY 2005, OMB introduced a new PART Improvement Plan Process. Every program that had been PARTed was given a PART Summary and set of follow-up actions, which address PART findings and improved program performance published on the OMB PARTWeb. In essence, PART Improvement Plans replaced previous PART Action Plans. OMB intends to pursue continuous improvement in all evaluated programs.

Cost and Performance — The Department and its bureaus have been implementing a Unified Strategic Plan and Activity Based Costing (ABC) since FY 2004.

In addition to continuing to verify and validate data and improve understanding and process application, USGS has also worked to standardize ABC, Strategic Plan, and PART outputs. USGS believes that close linkages will enable better costing of outputs, understanding of relationships, and leveraging of management information. The process of developing these standardized outputs further refined the definition templates and further contributed to more consistent application.

Analysis of ABC data led USGS to conclude that more granularity was needed to begin to make appropriate use of the data for cost analysis. USGS began capturing ABC data at the task level rather than project level in FY 2006, and is also refining the way we capture IT costs in FY 2006, creating a process that is useful for extracting Exhibit 53 IT information for the Department at a detail level that has not been possible to retrieve until now. General ABC reports and data can be extracted by all managers at all levels on a daily basis for verifying and validating and for performing analyses for decisionmaking. Continued efforts are being applied to standardize processes and ensure consistency of interpretation before ABC data can be confidently used to manage.

Examples of how USGS is using ABC/M data follow. Additional examples are provided for each budget activity.

- In the geologic hazards programs USGS wants to make sure that investments in data collection (monitoring networks); data management (Web sites, national databases, data consortia); and assessments (hazard assessment and mitigation) do not impact robust research on improving our understanding of landslides, earthquakes and volcanoes. It is this research that is critical in creating the next generation of monitoring and assessment methodologies. In earthquake hazards, for example, USGS tries to retain a steady investment of at least 20 percent of the funding for research through its external grants program and internal research activities. **ABC/M data enable USGS to maintain the correct balance of monitoring, assessment, data management and research for long term viability of the programs.**

- In the coastal States there has been a growing need for technical assistance, hazard monitoring, and hazard assessments with the increase in fires, hurricanes, flooding and population growth. These increases impact investments in other areas, which means a need to shift priorities and funding, create a sustainable increase in emphasis in those areas, plan efficiencies, and leverage coastal State and Federal resources more to ensure investments in supporting activities like coastal hazard research. **ABC/M data enable USGS to monitor long term trends and define regional patterns for the kinds of work our partners need.**

- ABC data for Serving Communities – Advance Knowledge for FY 2004 and FY 2005 demonstrate that the cooperative water program has maintained a rough proportion of half data collection activities and half research. Given Administration priorities and PART recommendations for emphasizing data collection, USGS has chosen to reduce research studies (systematic investigations) to maintain data collection (number of streamgages reporting real-time) to the extent possible. **ABC/M data enable USGS to monitor operations to mitigate the affect of erosion of buying power on priorities.**

- One cost USGS is concerned about in the geologic hazards arena is the cost of planning and evaluating programs. There are many stakeholders who wish to have a voice in planning and evaluation. Also, costs in this area have increased over time. During FY 2004 these costs were 13 percent of the budget. Subsequent object class analysis of that ABC coded cost revealed that travel was a culprit. So looking for efficiencies in travel through more conference calls and fewer attendees, but still meeting planning and evaluation goals has provided more money for education and technical assistance for landslide hazard mitigation in Southern California. During FY 2005 planning and evaluation costs were reduced to 11 percent of the budget. **ABC/M data enable USGS to identify efficiencies in operations to increase funding toward new priorities.**

Several years of implementation will be needed to standardize processes, ensure consistency of interpretation and application of work activity definitions across the organization and across the scientific disciplines, and to identify trends in the data that can lead to programmatic decisions.

Capital Asset Planning and Investment Control — Interior has implemented capital planning and investment control processes to ensure that investments (costs) in capital assets best advance mission goals with minimal risk and lowest life-cycle costs. The USGS IT Capital Planning Coordinator is responsible for developing a maturity framework and goals to ensure effective capital planning procedures and policies are developed and implemented consistently throughout the bureau. The IT Capital Planning Coordinator manages the process to review and submit USGS capital asset plans for major IT investments, non-major IT investments, and contributions to Department and E-Gov initiatives. This review includes validation of business cases against current plans by subject matter area experts for records management, privacy, IT security, IT budget, and IT architecture. The USGS Investment Review Board (IRB) meets regularly to review both IT and construction investments. The USGS IT portfolio business cases approved by the USGS IRB are provided to the Department's Information Technology Management Council and IRB for review. Successful business cases are then included in the Department IT portfolio as part of the Interior budget submission to OMB.

Under the direction of the IRB, USGS has adopted the GAO Information Technology Investment Management (ITIM) Framework as the USGS maturity model. The USGS has completed an ITIM self assessment and developed an ITIM plan and maturity goals for enhancing IT investment management practices within USGS to coincide with the Department ITIM Strategic Plan goals. The USGS achieved compliance with Stage Two of the GAO ITIM Framework prior to the end of FY 2005.

GPRA Performance Data Validation and Verification — In keeping with departmental and OMB policy for performance data validation and verification, USGS complies with requirements for performance data credibility. The USGS approach to achieving performance data credibility includes providing extensive budget and performance integration and ABC training, GPRA performance measures linked to all employee work plans, and implementation of the Department data validation and verification assessment matrix. During 2005, USGS completed data validation and verification to include USGS-specific measures, outputs, and all PART and Management Excellence performance measures. Data validation and verification will continue in FY 2006. To support auditors, USGS provided documentation of data sources for all key Interior strategic plan measures and definition templates. This extends assurance of credibility to performance data, ensuring usability for management decisionmaking and oversight.

Strategic Management of Human Capital

A critical aspect of achieving USGS science goals is an effective human capital management strategy for recruiting, developing, retaining, and managing a highly skilled, flexible, motivated, and diverse workforce. During FY 2006 and into FY 2007, human capital initiatives will focus largely on workforce planning and adjustments, implementing diversity activities in support of Equal Employment Opportunity Commission (EEOC) Management Directive 715 (MD–715), and developing competencies for supervisors and managers with additional emphasis on partnering and collaboration skills.

The workforce planning strategy implemented by USGS aligns with USGS science and science support goals; identifies areas in which USGS needs to build internal capacity, forecast future critical skill needs and identify mechanisms for recruiting, developing, and retaining a diverse workforce with those critical skills; aligns and balances organizational initiatives to achieve science excellence; and makes effective use of technology.

In FY 2006, USGS continued to advance bureau workforce planning efforts with specific emphasis on the approval of six separate Voluntary Separation Incentive Payment and Voluntary Early Retirement authorities. These incentives were offered to over 1,200 employees and resulted in more than 200 separations. The impact of these separations served as the focus for FY 2006 organizational workforce plans and the development of staffing strategies needed to address long-term science and science support goals. The USGS also invigorated its exit survey program to produce additional data to better address recruitment and retention issues for strategic workforce planning.

Another USGS workforce planning priority in FY 2006 was the completion of business strategies in various management and administrative program areas. The business strategies served as the preliminary studies for competitive sourcing consideration in FY 2007. Finally, the USGS began the migration of the employee skills data collected in previous years as a part of the workforce planning process to the Department's learning management system. During FY 2007, this system will extend automated workforce planning desktop tools available to managers.

During FY 2006, the USGS continued to provide leadership training for the purpose of developing a critical mass of leaders at all levels of the organization. The Management/ Supervisory Program implemented a 360-degree evaluation process for supervisors based on the Human Resources competencies identified in the Core Competency Model for Managers. The USGS also implemented the full suite of Core Competencies for Managers with the goal of improving managerial performance at all levels of the USGS. This effort has been linked with the USGS workforce planning effort and with the long-term leadership development goals of USGS.

During FY 2006, USGS continued development of workforce strategies that support the new EEOC MD–715. A major emphasis in FY 2006 was the identification of specific processes, rules, and strategies that inhibited growth in diverse employment, and development of specific actions to correct those barriers. During FY 2007, the provisions of MD–715 will fully migrate into human capital and workforce planning procedures across the bureau.

In FY 2006, USGS enhanced succession planning strategies with an emphasis on the development of supervisory and managerial competencies identified in the USGS Core Competency Model for Managers. Of particular importance to USGS during FY 2006,

succession strategies were developed for key managerial and technical positions across all levels and functions of the bureau. This planning will be essential in FY 2007 for the successful implementation of new organizations based on competitive sourcing and program restructuring.

The accountability for achieving the outcomes of a viable workforce plan, diversity in the workforce, succession planning, and managerial development in the bureau is featured under the management excellence performance goals for the SES members in the USGS. These human capital goals align the workforce plan outcomes to other PMA initiatives, such as diversity, E-Government, and the linkage of budget and performance.

Competitive Sourcing

The USGS performs scientific and support activities through a combination of Federal employees and external capabilities and staff. The current workforce balance will require competitive sourcing aspects of scientific and administrative activities in response to mandates contained in the Federal Activities Inventory Reform (FAIR) Act.

The USGS will continue execution of its Business Strategy Review (BSR) process, outlined in the USGS Competitive Sourcing Green Plan FY 2005–2008. All full time equivalent (FTE) positions have been grouped into nine functional business areas. In FY 2007, USGS will complete a BSR on *Information Technology* and launch a BSR on *Science*, accounting for approximately 50 percent of total positions on the USGS FAIR Act Inventory. During FY 2006, USGS will have completed a BSR on Administrative Management, accounting for approximately 1,710 FTE, and launched a BSR on Information Technology.

Studies will have been ongoing for Hydrologic Data Collection, accounting for approximately 124 FTE, and the National Geospatial Technical Operations Center (NGTOC), accounting for approximately 400 FTE (the largest study announced to date by Interior). Both studies will be completed in FY 2007. The USGS will have launched on March 1, 2006, four studies in the *Science Technician and Science Technical Support* business area, accounting for approximately 119 FTE. Studies will be conducted on activities involving physical and biological science technical support and the maintenance of scientific equipment in Lakewood, CO; Reston, VA; Cook, WA; and Menlo Park, CA. Additional studies may be launched based on the results of completed BSRs.

Funds will be required for external expertise for these reviews and studies. The USGS anticipates expending up to $500,000 in base funds to support contractor costs (support of Performance Work Statement and Most Efficient Organization development teams), travel, and training in support of the PMA. FTE resources are required to implement and manage the USGS competitive sourcing initiative, including the oversight of contractor support, development of competitive sourcing plans and management of the FAIR Act inventory collection process.

Financial Management

Enhanced communications and coordination with field operations, revised policies and procedures, increased training for administrative staff, and a more skilled and knowledgeable workforce have enabled USGS to make substantial improvements in financial management activities. The results of these endeavors are an unqualified financial audit opinion expressed by our independent auditors on the bureau's FY 2005 Annual Financial Report (included in the bureau's Performance and Accountability Report). During FY 2005, the bureau successfully cleared two previously identified reportable conditions and one non-compliance with laws and

regulations. The bureau was substantially in compliance with the Federal Financial Management Improvement Act of 1996. The bureau expects to receive an unqualified financial audit opinion in FY 2006 and will comply with laws and regulations.

During FY 2006, USGS effectively implemented revised OMB Circular A–123, "Management's Responsibility for Internal Control." During FY 2006, USGS provided well attended training on various financial topics to administrative staff and cost center managers by conducting bureauwide workshops for cost center managers in November 2005 and for administrative staffs in March 2006.

The USGS will continue to pursue excellence in financial management, identifying opportunities to streamline and automate functions and improve internal controls. The bureau has developed a comprehensive training plan to ensure that administrative officers and other financial staff receive ongoing training in various bureau specific procedures, as well as general areas such as appropriation law and management skills. The bureau will train at least 25 percent of the identified population during FY 2005, increasing the percentage trained to 50 percent in FY 2006, and 80 percent in FY 2007. The bureau expects to have trained all administrative officers and other financial staff by FY 2008.

In September 2005, the Department severed contractual relationships with Bearing Point as the integrator to implement the new Financial and Business Management System (FBMS). Interior plans to award a contract to a new integrator by March 2006. The scope of the project remains as previously defined: provide a departmentwide solution that significantly improves access to reliable, accurate, current, and complete financial and business management information to support the decisionmaking process throughout all levels of the Department, affecting all employees and operations. FBMS will replace current systems for budget formulation, core finance, personal and real property, financial assistance, acquisition, fleet management, and executive management information system. Budget formulation and project planning at the highest level currently exists in the Strategic Enterprise Management (SEM) module, where "what if" scenario building can be performed. Based on a departmentwide revised schedule, USGS is scheduled to deploy FBMS in FY 2009.

Expanding Electronic Government

Geospatial One Stop (GOS) — The USGS anticipates that the number of monthly visitors to the GOS Web portal will increase significantly in FY 2006 with the release of version 2 of the portal and has a goal of between 20,000 and 25,000 users per month in FY 2007. The USGS anticipates that the portal catalog will contain more than 100,000 geospatial references by the end of FY 2006. In 2006, GOS is closely coordinated with Federal agency partners to implement a fee-for-service business model, based upon a multi-tiered agency model.

In 2007, in lieu of this model, USGS will host, lead, and manage GOS to ensure discovery of, and access to, geospatial data resources to enhance sharing and reduce duplication. The GOS will transition from being an E-Government project to become an institutional part of the National Geospatial Program (NGP). The USGS will provide operational funds for the GOS portal. The USGS has fully integrated GOS with *The National Map* and the Department's Enterprise Geographic Information Management (EGIM), to align geospatial systems development activities and related functionality. This integration is a success story in NGP, with the intent to achieve eventual complete Federal geospatial system integration.

Through funding, in-kind technical expertise, collaboration, and scientific data, the USGS also contributes to other E-Government Initiatives, including Disaster.Gov, Recreation One-Stop, SAFECOM, and E-Records Management.

Enterprise Geographic Information Management (EGIM) — The USGS has a leadership role in developing two of the five initiative areas identified as high priorities under the Department's EGIM and Analytical Tools to Support Advanced Integrated Science. Key focus areas of EGIM include reduced overall GIS training costs, consolidated GIS Help Desk operations, consolidated GIS software test lab functions, more effective software release/update distribution mechanisms, easy access across bureaus to information on best management practices for GIS, and increased emphasis on cross-bureau sharing and reuse of GIS tools, techniques, and data. It is estimated that implementation of EGIM within the Department over the next 5 years will result in reduced costs for the Department of approximately $9.5 million in cumulative savings. Savings will also be achieved by leveraging capabilities of Geospatial One-Stop, ensuring that Interior bureaus will not have to develop duplicative GIS portals, servers, and services.

Information Security — In 2007, USGS will continue to maintain compliance with the Federal Information Security Management Act (FISMA). The resulting improvements to the USGS security infrastructure will include (1) improved IT security plans, (2) enhanced computer incident response capabilities including reporting of security incidents to the Federal Computer Incident Response Center, (3) annual incident response training of all USGS personnel, and (4) standard procedures for system configuration and patch management.

Assuring that bureau networks and systems are secure and protecting the integrity of the data are two of the most critical issues facing USGS. The IT Security Steering Committee will continue to serve as the focal point for all IT security activities; oversee policy formulation and appropriate review of policy, standards, and guidelines; ensure policies are consistently applied throughout USGS; and balancing the requirement of IT security with the needs of scientific activities.

Ongoing activities will consist of training and awareness, including both annual IT security awareness training for users and role-based training for employees and contractors with significant IT security responsibilities, as well as assurance and compliance. Management control reviews will be conducted, as well as internal site reviews.

Performance measures and reporting will continue and, in addition to FISMA, will include the Government Accountability Office annual report, plans of actions and milestones, internal reporting, response to audits, semi-annual submission of documentation to the Department, and various scorecards.

The IT Security Operations Team will continue to focus on providing the necessary standards, guidelines, procedures, and training to ensure that effective information security practices are carried out throughout the bureau. This team is also responsible for maintaining the bureau's existing network security systems, including monitoring and assessment of systems and networks to ensure security compliance, to identify potential vulnerability, to detect security intrusions, and to respond effectively to IT security events and incidents, including network penetration testing. This includes (1) responsibility for IT security operations, (2) implementation of bureau, Department, and Federal guidelines, policies, and standards, and (3) best practices to ensure the confidentiality, integrity, and availability of USGS data and

information assets. The USGS continues to emphasize the improvement of the information security program as one of the bureau's highest overall priorities.

The acquisition, management, and oversight of these technologies and tools in a comprehensive, integrated, enterprisewide basis continues to provide significant long-term cost and operational efficiencies to the bureau, as opposed to a piece meal or ad hoc implementation of certain tools in certain USGS offices or programs.

Security Certification and Accreditation — In FY 2007, USGS will continue to maintain certification and accreditation (C&A) of all twelve major IT systems. In addition, the bureau will support the recertification of systems as mandated by Federal law and regulations. Systems scheduled for recertification in 2007 include financial management, inventory property management systems, Landsat ground system, and infrastructure system categories. The USGS continues to maintain its systems in compliance with FISMA. All twelve C&A documentation packages are current and independently validated. The USGS C&A manager will continue to work closely with system owners across the bureau to ensure that all requirements are satisfied. The USGS submits all twelve C&A documentation packages on a semi-annual basis to the Department's Office of the Chief Information Officer and updates the Department's Command Center and Enterprise Architecture Repository databases as needed. Improving the quality of IT contingency plan documents and testing procedures continue to be high priority activities for USGS.

Federal Enterprise Architecture — In 2007, the USGS architecture team will be working closely with the bureau Investment Review Board, National Geospatial Program Office (including Geospatial One-Stop, Federal Geographic Data Committee, and the Enterprise Geospatial Information Management projects) and the National Geospatial Enterprise Architecture Management Advisory Council in developing the geospatial blueprint for the Department.

The USGS Enterprise Architecture builds upon the Federal Enterprise Architecture (FEA) and Department of the Interior Enterprise Architecture (IEA) frameworks and identifies requirements that are unique to USGS. This includes documenting the architecture for USGS scientific and administrative systems of high strategic value. The USGS Enterprise Architecture team will continue to identify major USGS IT investment projects and business process re-engineering efforts that are planned or underway. The USGS EA team works closely with the USGS Investment Review Board and the bureau C&A team to ensure alignment between investments, systems security, and the architecture. A major accomplishment planned for FY 2006 is the development of a modernization blueprint for geospatial activities in the Department.

Capital Planning and Investment Control — The USGS will maintain successful, repeatable processes in the selection, evaluation, and control of major IT investments in 2007. The Capital Planning and Investment Control (CPIC) program will continue to address major IT investments, non-major IT investments, and bureau-specific infrastructure IT investments in the CPIC selection, evaluation, and control process.

Enterprise Services Network (ESN) — By 2006, the Department's ESN project will have gained critical mass, as all bureaus will have (1) passed the connection approval process and will have connected for Internet 1 services at the five Department ESN Internet 1 nodes, (2) connected to the Intranet, and (3) started to "flatten" their networks to ESN. During 2006, USGS will complete connecting all field offices to the ESN, which previously had dedicated

circuit connections. Thus, by the end of FY 2006, all field offices should be monitored and managed by ESN with full 24x7x365 support.

During 2007, USGS will selectively "flatten" some field office connections to ESN, using the selection criteria of cost, need for higher bandwidth, need for a fully meshed network environment, and availability of vBNS+ (very high-speed backbone network services). As the Department provides remote access and virtual private network (VPN) services in 2007, USGS will be aggressive in migrating its many remote access servers to the Department service, avoiding duplicate expenditures and making management of the remote access sites easier. With growing use of Internet 2 services, USGS will work with Interior to propose institutionalizing Internet 2 as a departmentwide service, not just a USGS-provided service.

Asset Management

The USGS continues its efforts to manage both real property and other assets and to implement Executive Order 13327, Real Property Asset Management. Asset management principles and practices provide the tools that help USGS provide the space and facilities that are appropriate for world-class science while controlling costs.

Inventory — In FY 2005, USGS modified its existing real property inventory system to accommodate the 23 data elements required by the Federal Real Property Council for the governmentwide Federal Real Property Profile (FRPP) and began the process of collecting data for the new elements. In FY 2006, USGS completed this inventory of all USGS real property assets and provided this data to the FRPP. The USGS will continue to refine this inventory and participate in Department of the Interior efforts to house inventory information in the Financial and Business Management System.

Planning — In FY 2005, USGS participated in the planning and development of the Department of the Interior Asset Management Plan. Also, USGS worked with a contractor to complete a Strategic Facilities Master Plan, which looked at the adequacy of USGS facilities to meet mission needs and made recommendations to control costs.

In FY 2006, USGS will complete its first asset management plan. The plan will follow the example and guidance established in the Department of the Interior Asset Management Plan. The focus of the plan will be ensuring that USGS space and facilities meet the needs of USGS science programs, are well maintained within the budget allowed, and are used effectively. The USGS Asset Management Plan will build upon the Strategic Facilities Master Plan delivered by the contractor in FY 2005.

In FY 2007, USGS will complete detailed asset business plans for key science centers and office complexes. These plans will contain operations and maintenance sustainment plans for owned facilities and space consolidation/collocation plans for all facilities.

Governance — The USGS has implemented capital planning and investment control procedures to manage more effectively the entire USGS real property portfolio. The USGS Investment Review Board (IRB) reviews proposed facility renovation and construction investments valued at $2 million or more and proposed leases and GSA occupancy agreements costing $1 million or more annually. Each USGS region also has a regional investment review board that reviews projects before they are sent to the bureauwide IRB and reviews projects below the dollar thresholds established for USGS-level review.

Maintaining Facilities — The USGS conducts comprehensive condition assessments of owned facilities on a 5-year cycle. The first cycle was completed in FY 2004. The second cycle of assessments began in FY 2005; and nine of 41 condition assessments are completed or are in progress. The USGS has targeted to complete 24 more assessments in FY 2007. These assessments provide baseline information on facility deficiencies and are used to develop a rolling 5-year deferred maintenance plan.

Fleet Management — In 2006, USGS developed a fleet management plan and established a field-based Fleet Management Improvement Team to develop fleet management strategies. In 2006, USGS will implement strategies recommended by the team that are designed to reduce fleet costs, reduce the age of the fleet, and reduce fossil fuel consumption. The USGS will implement a vehicle replacement plan and optimize the use of working capital funds for vehicle procurement. The Fleet Management Plan will require cost center managers to justify retention of vehicles. Fleet fuel efficiency goals and other performance indicators will be utilized.

Performance Summary

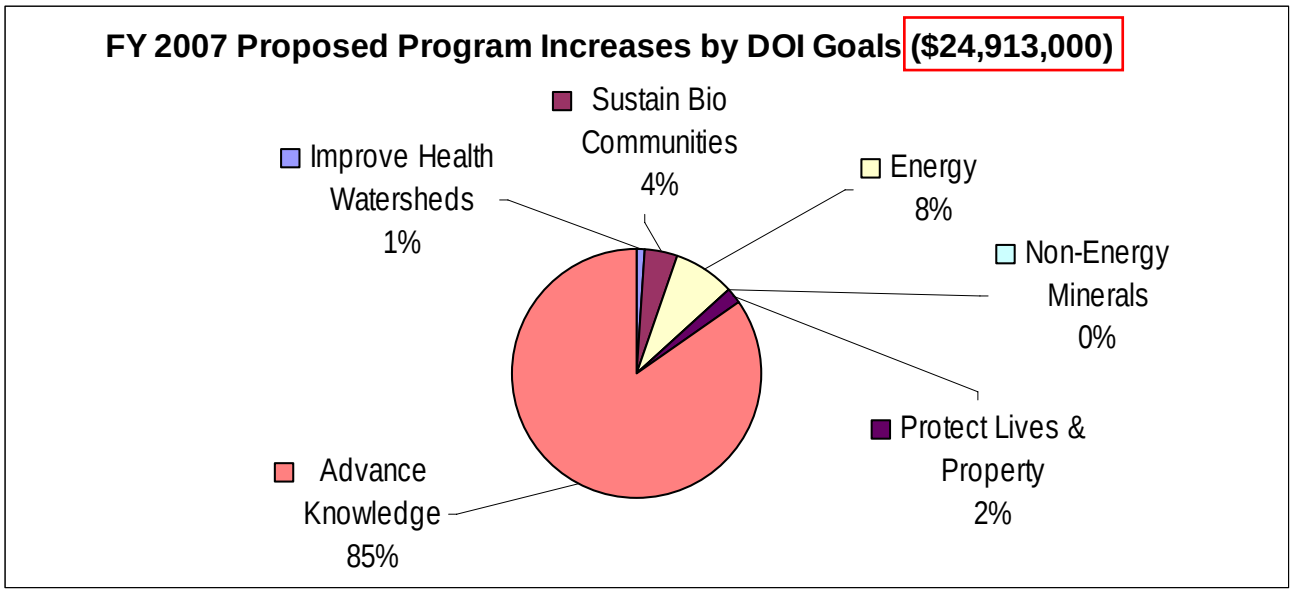
Achieving Department Mission Goals

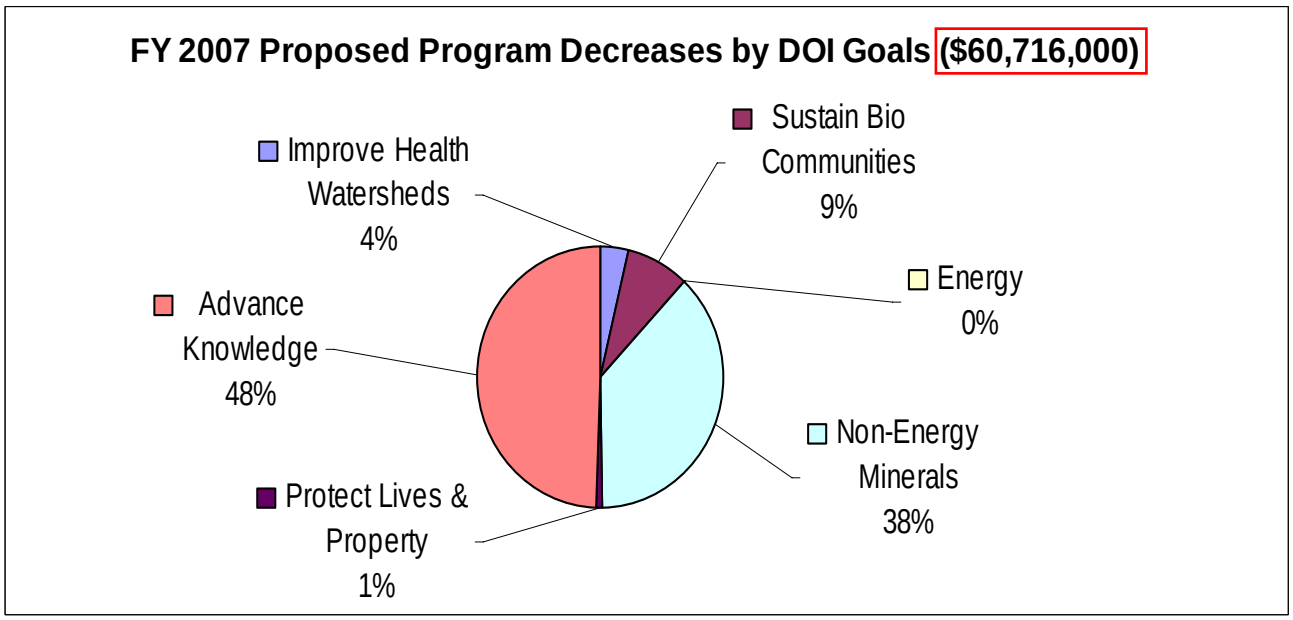
The FY 2007 budget requests $147.4 million for **Resource Protection**, a net programmatic decrease of $6.0 million from 2006, including increases totaling $1.3 million for the wildfire portion of the Integrated Multi-Hazards Demonstration Project and for NatureServe and decreases totaling $7.3 million for the Pacific Northwest Forest Program, biological assistance to the National Water-Quality Assessment Program, the wildlife program, and elimination of several unrequested earmarks. Resource Protection goals represent 5 percent of proposed USGS increases, 13 percent of proposed decreases, and 15 percent of the total USGS Budget.

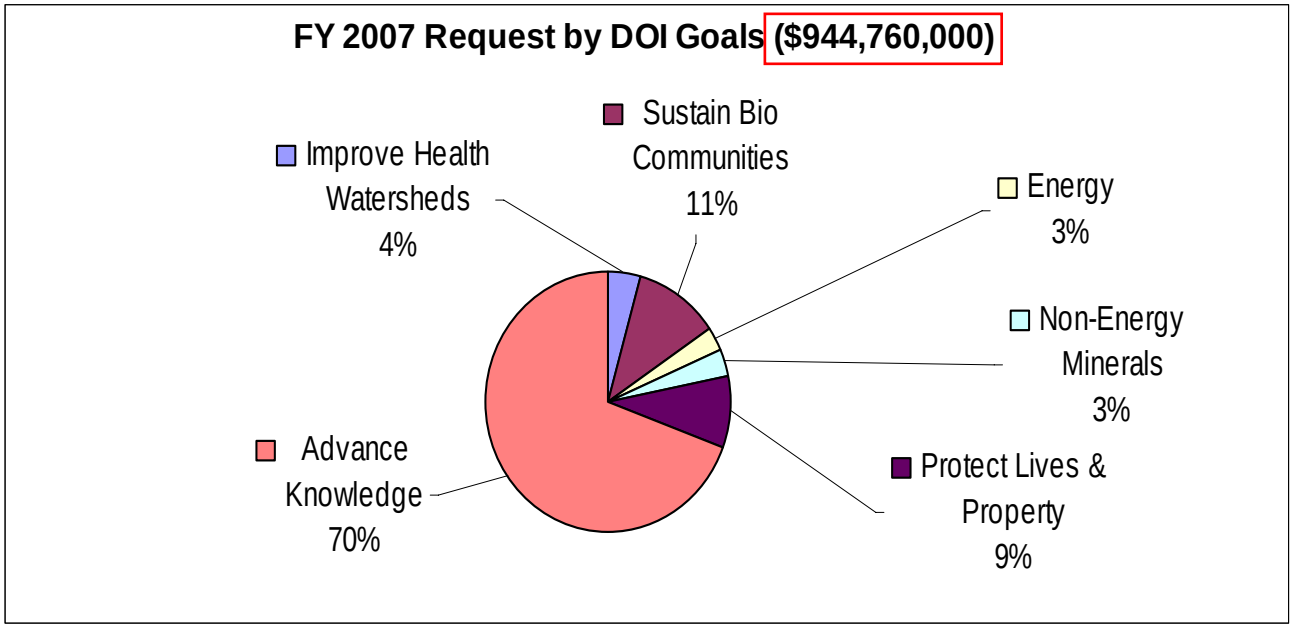
The FY 2007 budget requests $56.9 million for **Resource Use**, a net programmatic decrease of $20.9 million from 2006, including increases totaling $2.0 million for gas hydrate research and energy initiatives and a decrease of $22.9 million in mineral research and assessment activities. The decrease will be most evident in data collection and management work activities with all growth eliminated in "Average square miles of the United States with non-energy mineral information available to support management decisions." This will result in a decline in customer satisfaction with data timeliness and the data's usefulness for decisionmaking, as the focus and role of the Mineral Resources Program changes. Resource Use goals represent 8 percent of the proposed USGS increases, 38 percent of the proposed decreases, and 6 percent of the total USGS Budget.

The FY 2007 budget requests $740.5 million for **Serving Communities**, a net programmatic decrease of $8.8 million from 2006, including programmatic increases totaling $21.6 million for the Integrated Multi-Hazards Demonstration Project, streamgages, Departmental Working Capital Fund, and the Landsat Data Continuity Mission developmental costs explained further in the capital asset plan/business case. These increases are more than offset by decreases totaling $30.4 million for elimination of the AmericaView and Water Resources Research Act programs, support for the Long-Term Estuary Assessment Group and a petroleum contamination study, and several unrequested earmarks, along with reductions in geographic research, NAWQA technical support, the NBII program, concluding projects from the Cooperative Water Program, one-time funding from the avian influenza supplemental, funds related to the Landsat anomaly and its revenue consequences, space management savings, and geospatial data integration and operational efficiencies in the Enterprise Information budget

activity. Serving Communities goals represent 87 percent of the proposed increases, 49 percent of the proposed decreases, and 79 percent of the total budget.







The USGS vision, mission, and strategic direction focus on responsiveness and customer service, underscoring the application of science to customer, partner, and other stakeholder needs. They direct the combined expertise of the bureau's scientific disciplines and define its commitment to pursuing a multidisciplinary approach to providing science for a changing world. An overview of how the USGS science and information support Interior's Strategic Plan follows.

Resource Protection

PEO.1. Improve the health of watersheds, landscapes, and marine resources that are DOI managed or influenced in a manner consistent with obligations regarding the allotment and use of water.

The Department has direct jurisdiction over about 20 percent of the U.S. land area. Within that area, Interior administers resource protection programs on thousands of upland, wetland, and aquatic parcels. A principal protection concern is environmental degradation. The causes of degradation on Interior lands are both internal and external. In addition to threats posed by invasive species, illegal disposal of waste materials on or near public lands is an all too common occurrence. The USGS provides the natural resource management community with scientific information to improve the health of watersheds and landscapes. USGS biologists work toward program goals in collaboration with other scientists, customers, and

Hilary Neckles Awarded for Professional Excellence in Natural Resource Research

USGS scientists Dr. Hilary Neckles received the National Park Service Northeast Regional Director's Award for Professional Excellence in Natural Resource Research for 2004 at the George Wright Society biennial meeting held March 2005.

Hilary was recognized for developing a comprehensive protocol for monitoring Estuarine Responses to Nutrient Inputs for the Inventory and Monitoring Network. Her dedication and contributions to Park science are outstanding, and her pioneering efforts have resulted in tools for local communities to use in understanding potential impacts of planning scenarios on estuarine nutrient inputs into parks, especially Acadia National Park.

partners. Biologists combine their expertise with that of the other USGS disciplines in interagency ecosystem initiatives across the United States, from South Florida to the Puget Sound, where scientists are working together to understand, evaluate, and provide options for better resource management decisions.

PEO.2. Sustain biological communities on DOI managed and influenced lands and waters in a manner consistent with obligations regarding the allocation and use of water.

Interior's responsibilities to protect fish, wildlife, and plant communities are diverse and often without geographic bounds. The Department is responsible for protecting literally thousands of native plant and animal species. Among those species, more than 1,200 (from ambrosia to wallflower and albatross to wolf) have special status under the Endangered Species Act. In addition, Interior plays a major role in helping to ensure the continued viability of hundreds of species of waterfowl, songbirds, and shorebirds that periodically migrate to or through the United States. Just as the biological resources that Interior protects are varied and large, so are the influences that pose threats to the continued viability of those resources. Invasive species adversely affect over 40 percent of our endangered species, and impose substantial costs on the U.S. economy.

The USGS provides scientific information through research, inventory, and monitoring investigations to the natural resource management community to support sound resource management decisions for sustaining biological communities on Department managed and influenced land and waters. Biological studies develop new methods and techniques to identify, observe, and manage fish and wildlife, including invasive species, and their habitats; to inventory populations of animals, plants, and their habitats; and to monitor changes in abundance, distribution, and health of biological resources through time. The development of new methods and techniques allow USGS scientists to work more efficiently and cost effectively. For example, the USGS developed data collection protocols for use with palm pilots/personal digital assistants in the field for collecting amphibian information. This technology allows field scientists to collect data in real time for the Amphibian Research and Monitoring Initiative database without having to return to the office to enter the data on computers.

Because resources and species cross many jurisdictional boundaries and often have little short-term commercial appeal, no other entity has the capability or interest to ensure continuity of these long-term research and information management priorities. The Federal Government is the only entity engaged in such long-term, non-profit-driven research and monitoring, such as the Breeding Bird Survey and amphibian research and monitoring.

Cathy Beck, Cathy Langtimm, and Mike Runge Receive STAR Awards from the U.S. Fish and Wildlife Service (FWS)

In February 2005, three USGS scientists Cathy Beck, Cathy Langtimm, and Michael Runge received STAR awards from the FWS for their work in manatee recovery efforts in Florida.

The awards were given for assistance offered to the FWS in response to a Marine Mammal Protection Act Special Rule affecting manatees. Specifically, these were Mike's negligible-impact model, which offers insights into Florida manatee management practices, Cathy Langtimm's manatee adult survival rates, which were vital in creating that model, and the Manatee Individual Photo-identification System, on which Cathy Beck has spent 25 years of work.

Resource Use

UEO.1. Manage or influence resource use to enhance public benefit, promote responsible use, and ensure optimal value – Energy.

The Energy Resources Program (ERP) conducts national and global energy research on and assessments of oil, natural gas, coalbed methane, gas hydrates, coal, and geothermal resources; evaluates environmental and human health impacts associated with production, use, and occurrence of energy resources; and provides information to enable the Nation to make sound decisions regarding increases or changes in domestic energy production or mix with an understanding of potential impacts on the environment. The Federal Government manages about one-third of the Nation's land area. The USGS is the primary provider of earth science energy resource information and assessments for a variety of stakeholders, including Federal agencies such as the Bureau of Land Management (BLM) and the U.S. Department of Agriculture Forest Service (USDA-FS), which are responsible for managing these areas.

The USGS cooperates with many local and State agencies and coal and electric power producers to assess the availability and quality of coal resources. The ERP has recently revised its coal assessment methodology, and a group comprising coal scientists from Federal agencies, State geological surveys, industry, and academia has vetted this revised methodology through external peer review. The ERP works closely with the BLM, the Minerals Management Service (MMS), the USDA-FS, the U.S. Department of Energy and the Energy Information Administration to implement National Energy Policy (1) as described in Section 604 of the Energy Policy and Conservation Act (EPCA) Amendments of 2000 and (2) as specified within the new requirements of the Energy Policy Act of 2005.

The USGS World Petroleum Assessment assessed the 76 most productive oil and gas provinces of the world that contain about 95 percent of the world's oil and gas resources. This assessment was the first of its kind to include a rigorous geologic foundation for remaining resource volumes and the first to make those data available to the entire geoscience, business, and research community. Since then, the ERP routinely updates these assessments with estimates for new areas, as data become available or need arises.

The 1999 National Research Council (NRC) review of the ERP recommended that the program broaden its portfolio to include geologically based energy resources beyond oil, gas, and coal. This recommendation is fully consistent with the program's mission to provide information on energy resources, and as a result, the program has focused on and broadened its expertise in gas (methane) hydrates. The NRC, under its purview to review work related to the Methane Hydrate Research and Development Act 2000, reviews USGS research on gas hydrates. This Act was reauthorized in the Energy Policy Act of 2005. USGS experience in geologically based energy resources, combined with this expanded focus on alternative fuels, have strategically positioned the USGS to support the Energy Policy Act of 2005 by building on research efforts in gas hydrates, geothermal and coal. A requested funding increase will also allow for the start of new work described in the Energy Policy Act of 2005 legislation, such as conducting a national oil shale assessment.

A panel composed of senior energy scientists, both internal and external to the program, annually reviews work proposals submitted to the ERP for funding. The panel makes recommendations on project progress and ensures that the targets are appropriate, ambitious, and obtainable so that they will support the accomplishment of long-term goals.

UEO.2. Manage or influence resource use to enhance public benefit, promote responsible use, and ensure optimal value – Non-energy Minerals.

The United States is the world's largest user of mineral commodities. Processed materials of mineral origin accounted for more than $478 billion in the U.S. economy in 2005. This represents an increase of 14 percent in a year when the GDP increased by just under 8 percent. U.S. manufacturers and consumers of mineral products depended on other countries for 100 percent of 16 mineral commodities and for more than 50 percent of 42 mineral commodities that are critical to the U.S. economy. Current and reliable information about both domestic and international mineral resources and the consequences of their development informs decisions about supply and development of mineral commodities requires .

The Mineral Resources Program (MRP) is the sole Federal provider of scientific information for objective resource assessments and unbiased research results on mineral potential, production, consumption, and environmental effects. Land managers and policymakers use this information to support resource use decisions to enhance public benefit, promote responsible use, and ensure optimal value. For example, the MRP will conduct three site-specific mineral resource projects and mineral resource assessments for Federal land management agencies in the lower 48 States, provide regional-scale geologic data and mineral resource assessments in three areas of Alaska, complete collection of national-scale data characterizing earth materials, collect data only on domestic production and utilization of 100 mineral commodities, and manage four national-scale long term databases.

In its most recent review of the MRP (2003), the National Research Council identified four Federal roles in mineral science and engineering: an unbiased national source of science and information, basic research on mineral resources, advisory, and international (undertaking or supporting international activities that are in the national interest). MRP addresses these roles through two major functions: a research and assessment function that provides information for land planners and decisionmakers about either known or expected locations of mineral commodities in the Earth's crust, and a data collection, analysis, and dissemination function that describes current production and consumption of about 100 mineral commodities. Among the tools and technologies available in each of these functions are new robotic technologies that automate geochemical analyses, saving both time and money, and Web-based data delivery tools that serve 125 years of mineral resource, geochemical and geophysical data to land managers, Federal agencies responsible for national security and economic policy, the public, and other research scientists. Each function supports the other, and each meets the needs of different parts of the diverse community of mineral resource information users. Together these activities provide information ranging from that required for land planning decisions on specific management units to that required for national and international economic decisions.

Serving Communities

SEO.1. Protect lives, resources and property.

Through programs within the Geologic Hazards, Resources, and Processes Activity, the USGS provides for the earth science information needs of a wide variety of partners and customers, including Federal, State, and local agencies, non-government organizations, industry, and academia. This information is used by the USGS and its partners and customers in evaluating resource potential, defining and mitigating risks associated with natural hazards, and characterizing the potential impact of natural geologic processes on human activity, the economy, and the environment. A comprehensive science strategy, entitled "Geology for a Changing World," was developed with program partners and customers and sets forth the science goals, objectives, strategic actions, and products expected to result from scientific activities through 2010. Each year, all ongoing and new project work and results undergo peer and management review for progress toward meeting the goals of the science strategy. Also reviewed are the accomplishments of each program's detailed 5-year plan that directly supports the science strategy.

USGS geologic hazards programs conduct basic and applied research, gather long-term data, operate monitoring networks, perform assessments and modeling, and disseminate findings to the public, enabling the Nation's emergency response capabilities to warn of impending disasters, better define risk, encourage appropriate response, and mitigate damage and loss. These programs are designed to produce information and understanding that will lead to a reduced impact of natural hazards and disasters on human life and the economy. The United States is subject to a variety of natural hazards (earthquakes, volcanic eruptions, landslides, tsunamis) that can result in considerable human suffering and billions of dollars in property and business losses. The occurrence of these hazardous events is inevitable and largely uncontrollable. However, the extent of damage and loss of life can be reduced through preventative planning; social, economic, and engineering adaptations; real-time warning capabilities; and more effective post-event emergency response. Central to this preplanning is the availability of accurate, scientifically based geologic hazards assessments and real-time warning systems that define the nature and degree of risk or potential damage. The more precisely risks can be defined the greater the likelihood that appropriate mitigation strategies will be adopted (e.g., building codes for new construction and retrofitting; land-use plans; and design and location/routing of critical infrastructure such as highways, bridges, subways, water, sewer, gas, electric, local zoning regulations, and petroleum-distribution networks). The sooner information reaches emergency response centers the sooner teams can be dispatched to resolve time-sensitive medical, utility, or other infrastructure problems.

Brian Atwater Recognized Among the World's 100 Most Influential People

In April 2005, *TIME Magazine* released a special issue with the cover title "The TIME 100: The lives and ideas of the world's most influential people." USGS scientist Brian Atwater is featured in the category of Scientists and Thinkers. Brian earned his place on the list from a seemingly humble place, a well-used aluminum canoe.

The *TIME* article, by J. Madeleine Nash, describes how Brian paddled around the salt marshes and tidal flats of Washington State, discovering devastating evidence of past tsunamis. Brian was studying the 600-mile-long Cascadia Subduction Zone that was once thought by some to be relatively harmless, but his findings helped demonstrate that the fault line is capable of producing powerful earthquakes and tsunamis that can not only infiltrate and change the landscape in Washington, but also travel across the ocean, inflicting widespread damage to distant shorelines.

The USGS has sole Federal responsibility for recording and reporting earthquake activity nationwide. The USGS fulfills this role by operating the U.S. National Seismographic Network, the National Earthquake Information Center and the National Strong Motion Program and by supporting 15 regional seismic networks. The USGS is building the Advanced National Seismic System (ANSS), a nationwide network of modern seismometers and data linkages. Through the ANSS, emergency-response personnel are provided with real-time earthquake information immediately following an earthquake. In regions with sufficient seismic stations, emergency response personnel receive—within minutes—a ShakeMap, which shows the distribution of potentially damaging shaking, information used to target post-earthquake response efforts. In addition, scenario ShakeMaps for likely future earthquakes, combined with USGS National Seismic Hazard Maps, help land-use planners develop safer building practices in earthquake-prone regions.

SEO.2. Advance knowledge through scientific leadership and inform decisions through applications of science.

The Department recognizes the value of science as the foundation for informed decisionmaking on natural resources and land-use planning. As the Department's science bureau, the USGS provides knowledge through research and scientific information and leadership in transferring knowledge to decisionmakers. This goal also recognizes that a broad community of decisionmakers, including the Department, other Federal agencies, State and local agencies, industry, academia, and the public, uses science information.

Susan Russell-Robinson Recognized by U.S. Fish & Wildlife Service (FWS)

At the 2004 Chesapeake Bay-Susquehanna Ecosystem Team meeting, Susan Russell-Robinson, staff scientist for external coordination, Eastern Region Geology, received a Certificate of Special Appreciation from the Division of Wildlife and Habitat Management, National Wildlife Refuges System, FWS.

The citation, signed by FWS Northeast Region Director Marvin Moriarity, states, "in profound appreciation for Susan's outstanding scientific support to the U.S. Fish and Wildlife Service resource programs and ecosystem teams in coastal and estuary areas in the Northeast." She has been instrumental in acquainting fishery offices, ecological services teams, refuge managers, and law enforcement officers with current and historical USGS resources, especially Web-based data and remote-sensing programs.

Society needs knowledge of the Earth's natural processes and cycles—their rates, frequencies, magnitudes, and how they affect one other. The USGS provides scientific data to understand issues such as coastal erosion and pollution, sea-level rise, loss of wetlands and marine habitats, the geologic processes controlling the invasion of cheat grass, and the role of dust in desert ecosystem health. Armed with this knowledge, decisionmakers can respond better to both natural and human-induced changes. Extreme changes in the environment are less costly if their likely effects can be mapped, quantified, and anticipated. Resources can be more efficiently used if the impacts of their extraction can be predicted and mitigated. Damaged or endangered ecosystems can be repaired more effectively if the natural processes that form and maintain them are accounted for in remediation and restoration plans. Strategies for conserving and using the Nation's lands and resources are improved when the natural processes at work are incorporated into predictive models and management plans in an adaptive manner.

The USGS meets with customers, cooperators, and others who have a major role or interest in science to help define needs and priorities. USGS also participates in interagency and intergovernmental programs designed to assess, document, and monitor ecological and

socio-economic conditions and trends. The USGS uses the input received and communicates the results of the research and monitoring in the form of new scientific knowledge that contributes to the Nation's health and welfare, helps resolve environmental issues, and assists in effective Federal land management and natural resource decisionmaking. The USGS is committed to making available the data and information that are critical to scientific discovery and application. Databases, maps, and publications are vital sources of this information. In addition, the USGS is committed to the development and easy accessibility of tools, models, visualizations, and applications to aid policy and resource managers in the analysis and synthesis of scientific data to support decisionmaking.

Dan Fagre Gets Top Honors from National Park Service

Dr. Dan Fagre, a USGS scientist serving as Global Change Research Coordinator for Glacier National Park in Montana, was chosen to receive the National Park Service Director's Award for Natural Resource Research.

Dan was selected because his research has focused on developing Glacier National Park staff's ability to explain, quantify, and predict what changes will occur in Parks and protected areas in respect to climate change. The scope of his efforts extends beyond park borders, into western North America and internationally.

The USGS works in cooperation with many organizations across the country to provide critical information to partners, stakeholders, customers, and the general public (see Partnerships, page A - 31, for examples).

USGS science programs work collaboratively to assist land and resource management agencies with specific research and information needs, by providing information to inform their decisionmaking and advancing the overall knowledge of the science at the same time. The USGS brings all pertinent science to bear on each issue addressed for each organization. Examples of Serving Communities programs support for other goals include:

- Water Resources Investigations programs often work collaboratively with the Resource Protection program, Contaminants, in investigations of the transport and fate of contaminants and hazardous materials through water systems and
- The National Cooperative Geologic Mapping Program (NCGMP) has strong ties to the Energy and Mineral Resources programs (both in Resource Use), providing basic information related to the distribution of geologic formations that may lead to an understanding of the location of energy and mineral resources.

Caroline Rogers Receives Award from U.S. Coral Reef Task Force

In March 2005, USGS biologist Caroline Rogers received a U.S. Coral Reef Task Force Award for Outstanding Scientific Advancement of Knowledge on Coral Reefs. This award reflects her significant contribution to coral reef science, the National Park Service, the USGS, and the broader coral reef community of scientists and managers during the course of her career.

Caroline's leadership has resulted in coral reef monitoring protocols used on coral reefs around the world. Her research and monitoring efforts and collaboration with others in academia, as well as Federal and territorial agencies, have improved the management of Virgin Islands National Park and Buck Island Reef National Monument and have given these parks some of the longest and most comprehensive data sets on coral reefs, reef fishes, and water quality in the western Atlantic.

Means and Strategies

USGS employs a robust and cyclic requirement for science planning, program reviews, cost center reviews, management control reviews, and peer reviews and continues to refine these processes. This array of tools is now supplemented further and coordinated with PART evaluations, and is also beginning to include the results of ABC/M to further instruct our planning processes.

Science Planning — During FY 2005, the Director formed a Bureau Program Council (BPC), which reports to the Director and consists of the Associate Directors, Regional Directors, and Director of Budget and Performance. The BPC:

- Conducts the annual program planning process across organizational structures and disciplines,
- Ensures the planning is responsive to the Director's Annual Guidance, meets DOI bureau science needs, and supports decision making by customers and partners,
- Seeks input from chief scientists, program coordinators, regional executives, and science center directors, as well as customers and stakeholders, and
- Reviews program 5-year plans and recommends approval by the Director.

Strategic Change — In a strategic move to strengthen geographic research and to consolidate geospatial data programs, the Director instituted a forward-looking program realignment. The decision to reorganize geospatial information and geographic research is in direct response to:

- Discussions with constituent groups about how best to meet their geospatial data needs and
- Recommendations from a report by the NRC of the National Academies.

The realignment builds on the program improvements generated in response to the FY 2002 PART assessment of *The National Map* and the rePART in FY 2004.

> The NRC report *Research Opportunities in Geography at the U.S. Geological Survey* recommends, the Geography Discipline should now expand its activities to assume its proper role among the other disciplines at the USGS by engaging in fundamental geographic research. A strong Geography Discipline with a productive research component will ensure recognition of the USGS as scientifically credible, objective, and relevant to society's needs.' The Associate Director for Geography will now focus efforts on developing USGS research and applications activities with the Geographic Analysis and Monitoring, Land Remote Sensing, and Science Impact programs as the centerpieces."

The reorganization was implemented in FY 2006 and an associated budget restructure is proposed in this FY 2007 Budget request.

Science Integrity — Integrity remains the foundation of all the Department's science: impartiality, honesty in all aspects of scientific enterprise, and a commitment to ensure that information is available to the public as a whole. The Department is committed to common standards for peer review for all scientific research across the Department. Departmental standards and practices, developed through an exercise in the 4–Cs among Interior scientists, have been introduced as *A Code of Scientific Conduct* with new, commonly agreed upon

guidelines on information quality, objectivity, utility, and integrity. The USGS took a leadership role in the development of the Code, which has undergone rigorous review by all bureaus and external stakeholders. A Departmental Manual Chapter is being drafted. As part of the code of scientific conduct, each bureau and office is required to establish procedures to provide appropriate scientific expertise to investigate allegations of misconduct and provide for due process in the conduct of such investigation. The Department asked the USGS to create a model procedure to handle allegations of misconduct. A USGS team of scientists, managers, and human resource specialists worked with Interior's human resource specialists and solicitors to craft the procedure. Violating the Department's Code of Scientific Conduct is currently identified as a violation under "general misconduct." The USGS also developed a process to readily identify employees covered by the code of scientific conduct using the personnel information.

Thorough and broad scientific review is central to the quality of USGS products. The Executive Leadership Team has developed a set of fundamental science practices, philosophical premises, and operational principles that are the foundation for all USGS research and monitoring activities. These fundamental science practices do not address what work the USGS should do but rather how the science is carried out and how the resulting information products are developed, reviewed, approved, and released. USGS is now developing the necessary bureauwide policies and guidelines for these fundamental science practices.

> It is the policy of the USGS to conduct its activities and to make the results of its scientific and engineering investigations available in a manner that will best serve the whole public, rather than the interest or benefit of any special group, corporation, or individual.
>
> *U.S. Geological Survey Manual,* 500.14

The USGS has been engaged in a departmental task force for the development of a policy on peer review, the quality assurance procedure for research. The task force reviewed the current status of peer review policies in Department bureaus and the adequacy of the guidelines developed and implemented in 1996. New peer review guidance documents are being developed as Survey Manual policy chapters and a comprehensive Handbook to guide peer and policy review. These respond to existing and new USGS policy on peer review, new departmental guidelines, the draft Code of Scientific Conduct, the growing interest in peer review by Congress, and OMB Memorandum M–05–03, dated December 15, 2004, "Final Information Quality Bulletin for Peer Review." USGS developed specific guidance to respond to OMB guidelines and posted required information on a Web site *http://www.usgs.gov/peer_review/*. This effort is maintained by the USGS senior liaison for Interagency Programs and Science Partnerships.

Program Evaluations — Program evaluations are an important tool in analyzing the effectiveness and efficiency of our programs, and evaluating whether they are meeting their intended objectives. These evaluations are the foundation on which USGS gages performance relative to the Interior End Outcome measure for soundness of methodology, accuracy, and reliability of science. Programs are evaluated through a variety of means, including performance audits, PART, financial audits, management control reviews, and external reviews from Congress, OMB, OIG, and other organizations, such as the National Academy of Public Administration and the National Academy of Science. These reviews, which may take several years to complete, are critical to maintaining the USGS reputation for scientific excellence and credibility as well as providing guidance for future research needs. The evaluations improve the accountability and quality of programs, but also identify and address gaps in programs; redirect or reaffirm program directions; identify and provide guidance for development of new programs;

and review and (or) motivate managers and scientists. For example, based on a number of factors, including the recommendations of the External Scientific Advisory Committee on Scientific Services (as contained in the March 2004 report, *The Future of Regional and National Scientific Services of the Water Resources Programs*), the USGS closed the water-quality laboratory in Ocala, FL, and transferred most of its functions to the National Water Quality Laboratory in Denver. Given the budget shortfalls at the Ocala Lab and projected continuing shortfalls, the USGS determined that consolidation of this function is more cost effective than maintaining two separate laboratories.

Reviews are both internal and external conducted by USGS and non-USGS scientists, technicians, or specialists who are not involved in the specific proposal, project, program, or product under review. The goal is to conduct an independent external peer review of ongoing programs about every 5 years, combined with more frequent independent internal management reviews.

Examples of program reviews completed in FY 2005 and planned for completion in FY 2006 and FY 2007, by external entities follow:

FY 2005

National Academy of Science/National Research Council

- Economic Benefits of Improved Seismic Monitoring
- Assessment of Water Resource Research
- Geography External Program Review (Association of American Geographers annual conference)
- Geography Science into K– 12 Curriculum
- Review Earth Surface Dynamics Program

Scientific Advisory Committees

- National Coop Geologic Mapping Program
- Earthquake Hazards Program
- Geomagnetism Program
- Geographic Analysis and Monitoring – DOI Land Cover Summit

OMB PART

- National Cooperative Geologic Mapping
- Biology Research and Monitoring
- Biological Information Management and Delivery

FY 2006

National Academy of Science/National Research Council

- Review of USGS Cooperative Water Program (Advisory Committee on Water Information)
- Research Priorities in Earth Sciences and Public Health
- Cost Benefit Analysis of WRD Streamgaging Program (National Hydrologic Warning Council)
- National Academy of Science "Beyond Mapping: The Challenges of New Technologies in the Geographic Information Sciences"

- American Society of Photogrammetry and Remote Sensing, "Panel Report to USGS on Digital Orthoimagery"
- External technical review of strategic issues facing USGS orthoimagery activities

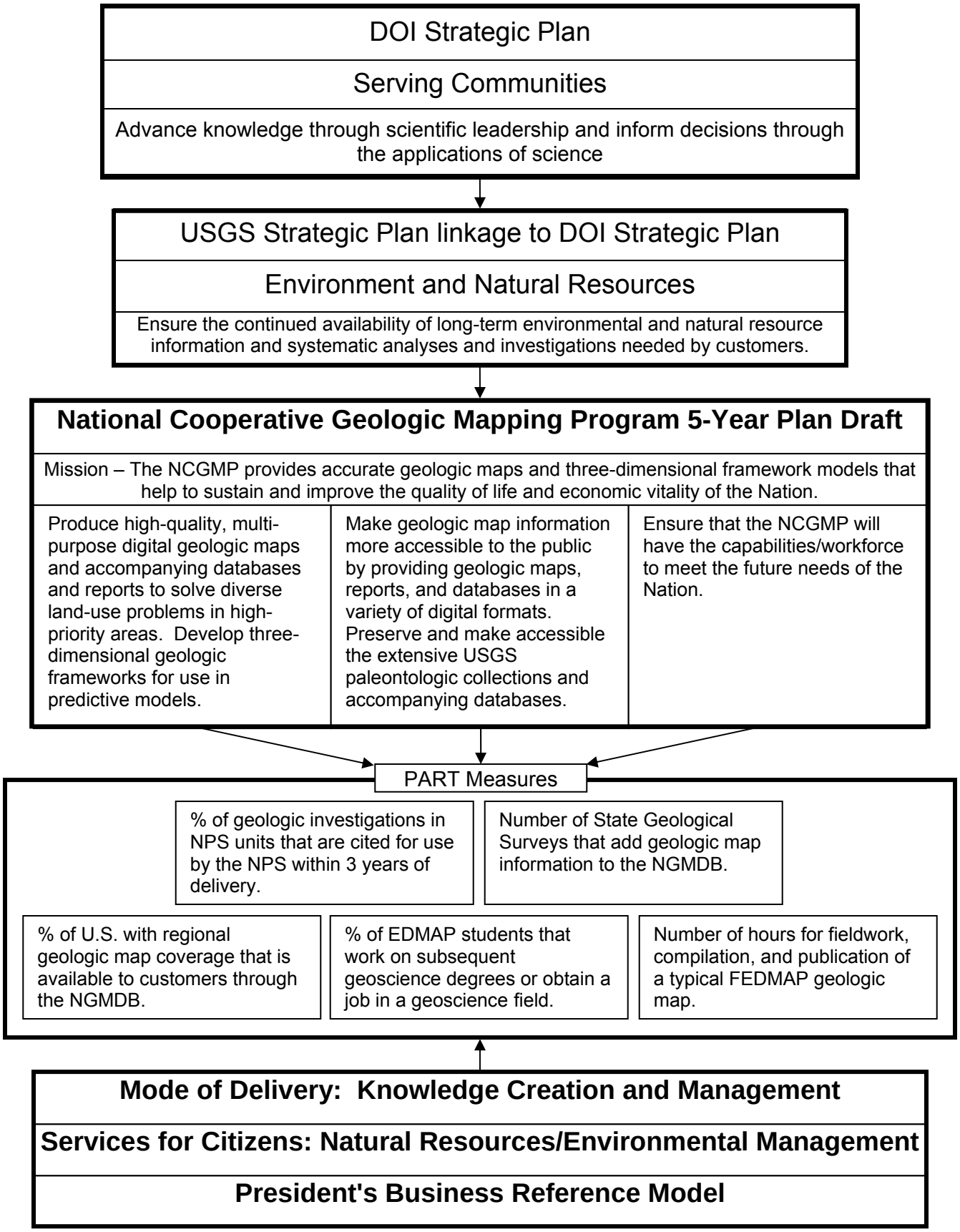
Scientific Advisory Committees
- National Cooperative Geologic Mapping Program
- Earthquake Hazards Program
- National Satellite Land Remote Sensing Data Archive (Archive Advisory Committee)

OMB PART
- Coastal and Marine Geology Program

FY 2007

National Academy of Science/National Research Council
- Earth Science Applications from Space
- River Science
- Water's Resources Program

Both program evaluations and the DOI Strategic Plan instruct the development of 5-year science plans for all programs. A diagram depicting relationships of one of the programs reviewed under PART this year follows.


DOI Strategic Plan
Serving Communities
Advance knowledge through scientific leadership and inform decisions through the applications of science
USGS Strategic Plan linkage to DOI Strategic Plan
Environment and Natural Resources
Ensure the continued availability of long-term environmental and natural resource information and systematic analyses and investigations needed by customers.
National Cooperative Geologic Mapping Program 5-Year Plan Draft
Mission – The NCGMP provides accurate geologic maps and three-dimensional framework models that help to sustain and improve the quality of life and economic vitality of the Nation.
Produce high-quality, multi-purpose digital geologic maps and accompanying databases and reports to solve diverse land-use problems in high-priority areas. Develop three-dimensional geologic frameworks for use in predictive models.
Make geologic map information more accessible to the public by providing geologic maps, reports, and databases in a variety of digital formats. Preserve and make accessible the extensive USGS paleontologic collections and accompanying databases.
Ensure that the NCGMP will have the capabilities/workforce to meet the future needs of the Nation.
PART Measures
% of geologic investigations in NPS units that are cited for use by the NPS within 3 years of delivery.
Number of State Geological Surveys that add geologic map information to the NGMDB.
% of U.S. with regional geologic map coverage that is available to customers through the NGMDB.
% of EDMAP students that work on subsequent geoscience degrees or obtain a job in a geoscience field.
Number of hours for fieldwork, compilation, and publication of a typical FEDMAP geologic map.
Mode of Delivery: Knowledge Creation and Management
Services for Citizens: Natural Resources/Environmental Management
President's Business Reference Model

Partnerships

The USGS values collaborative relationships and actively seeks out opportunities to build mutually productive partnerships. The importance of partnerships in keeping science relevant and in leveraging scarce resources has been demonstrated throughout the description of achieving mission goals. Various types of partnership vehicles are and described at *http://www.usgs.gov/partnerships.html* to encourage and facilitate collaborative endeavors.

In FY 2005, the USGS reorganized the bureau to realign with collaborator-based regions to in part, promote collaboration with partners in the development of science and information management.

Additionally, the bureau continued to expand partnership capability by establishing new geospatial liaison officers in five additional States. The Secretary of the Interior's vision of performance excellence is depicted in her framework "The Four C's—consultation, cooperation and communication all in the service of conservation." The Acting Director has shown his commitment to these objectives by having senior managers participate on the Secretary's "Four C's Partnership and Collaboration Team." Additionally, the USGS was instrumental in the development of the Department's "partnership and collaboration" element of the SES performance standards. USGS also designed a "Partnership Development Tool" that promotes partnerships with purpose and has since become the benchmark for the Department, and is being used by our sister bureaus as well as other agencies. Their tool facilitates true partnering by drawing each collaborator into discussions and promoting shared ideas and growth opportunities.

USGS also employs a formal "listening session" approach and takes quite seriously the opportunity for dialog that regular engagement with customers and partners affords us. The bureau plans to strengthen that foundation of partnership and relationship and to make the opportunities for collaboration readily available and more robust. As evidence of the commitment to partners and collaborators, the entire USGS Executive Leadership (ELT) is involved in the listening sessions, as each of them is vigorously involved with their constituents throughout the year. The Director has charged each member of that team to actively pursue the feedback provided at the listening sessions and to address how to meet customer needs and input, underscoring this commitment with partnership-focused measures in ELT performance plans. Customer satisfaction surveys are routinely conducted for partnerships throughout our organization. The Survey works with partners to develop shared performance measures. Examples of the depth of partnerships are documented throughout the budget document. The breadth of USGS coordination may be demonstrated in the following representative listing of USGS crosscutting relationships with Federal, State, local, non-government, and international organizations.

EPA Honors USGS Cartographers for Contribution to Habitat Protection

In April 2005, the EPA awarded their highest honor, a Gold Medal, to USGS cartographers Mitch Bergeson and Gary Latzke, for their participation on an interagency team.
The EPA completed assessments and consulted with the National Marine Fisheries Service about pesticide products containing 54 active ingredients and their potential effects on 24 fish species in Washington, Idaho, Oregon, and California. Mitch and Gary developed an interactive, geographic Web tool to help pesticide users locate "buffer areas," the land near water bodies where pesticides cannot be applied. The Web tool can be used for fish and other protected species nationwide to assess the potential geographic overlap of pesticide-use sites with habitat and to inform the public of future pesticide limitations, thus helping to protect habitat.

In a partnership agreement between the National Science Foundation (NSF) and the USGS, 17 new stations will be added in FY 2005 and FY 2006 to the ANSS Backbone national seismic network, and 8 additional stations will be upgraded. As part of the NSF Earthscope initiative *(http://www.earthscope.org),* the NSF will purchase the equipment, and the USGS will install it with funding from the NSF. The USGS will focus on earthquake monitoring and reporting, and the NSF will focus on long-term Earth science research. NSF contributions represent significant leveraging of USGS funds with a cost offset to the development of the ANSS Backbone of approximately $1.5 million. The NSF will also pay for the operation and maintenance of the 25 stations until FY 2008.

NASA and USGS are working in partnerships to ensure continued acquisition and availability of Landsat-quality data to support long-term global monitoring and other important Land Remote Sensing programs of national significance (*http://ldcm.usgs.gov*). The National Geospatial Program Office has worked closely with the States, counties, and Local government to help coordinate geospatial data collection with Federal bureaus and private entities in support of Homeland Security and other critical national needs.

The USGS works closely with its partners and customers in defining priorities, developing science plans, and carrying out its biological research to support the needs of research management organizations. Key partners in many of these endeavors include Interior bureaus, other Federal agencies, States, and private organizations with regional and ecosystem-specific interests.

An example of such a partnership is the Science Support Partnership (SSP) program that addresses the priority science needs of the FWS. Since 2001, the USGS has undertaken more than 260 projects in support of FWS local, regional, and National programs such as:

- Migratory bird management,
- Endangered species recovery,
- Freshwater fisheries restoration,
- Ecosystem-based management,
- Coastal habitat conservation,
- Fish and wildlife law enforcement, and
- National Wildlife Refuge System management.

The SSP program has provided tremendous benefits to FWS efforts in conserving the Nation's fish and wildlife resources.

Another example is the Vegetation Mapping Program, a cooperative effort by the USGS and the NPS to classify, describe, and map vegetation communities in more than 250 national park units across the United States. The vegetation mapping program is an important part of the NPS Inventory and Monitoring Program, a long-term effort to develop baseline data for all national park units that have a natural resource component.

Each node of the NBII is developed through the collaboration of the partners and customers involved with that node. All together, NBII has over 250 partner organizations and agencies that help define the direction both of individual nodes and of the NBII as a whole.

The USGS serves as the primary source of hydrologic information to many other Federal agencies and to American Indian and Alaska Native governments. USGS work through

reimbursable and cost-share programs prevents the need to duplicate a hydrologic staff in the partner agencies and ensures that the collected data will be entered into a standardized national database so the information will be readily available to all potential users. The diverse programs also result in new techniques and capabilities that are then put to use in the appropriated programs of the USGS.

The breadth of USGS coordination may be demonstrated in the following representative listing of USGS cross-cutting relationships with Federal, State, local, and non-government, and international organizations.

Federal
National/Governmentwide: National Geospatial Program Office, The National Map**,** National Spatial Data Infrastructure, National Biological Information Infrastructure, National Earthquake Hazards Reduction Program, U.S. Global Change Research Program, National Atlas, Geographic Names, Imagery, elevation and hydrography data collection programs, Civil Applications Committee, lead implementation of Commercial Remote Sensing Space Policy for civilian agencies
Agriculture/Forest Service: Endangered Species, Conservation genetics, Habitat management, Forest planning, Wildlife, Invasive species, Fire science, National Forest maps, Drought/Fire fuel monitoring and management, Energy and mineral resources, Natural hazards, Mine lands, Land cover characteristics, Hydrologic data collection/studies. Topographic maps, digital orthophoto and elevation data, *The National Map,* National Hydrography Dataset, and geographic names.
Commerce/NOAA: Endangered Species, Salmonid restoration, Coral reefs, Hazards monitoring and research, Geomagnetism, Vegetation change, Coastal erosion, Fish habitat, Marine sanctuaries, GIS, Commerce/NIST: Earthquake Hazards, coastal and bathymetric mapping
Defense: Geospatial Coordination with States, Endangered Species, Salmonid restoration, Coral reefs, Coastal erosion, mapping support during conflict, Natural hazards, Test ban monitoring, Strategic minerals and energy resources, Geomagnetism, Terrain visualization, Hydrologic data collection/studies. Environmental contamination and remediation studies on military bases, NORTHCOMM, High-resolution imagery over urban areas
Defense/Army Corp of Engineers: Endangered Species, Habitat assessment, Fish behavior, Fish physiology, Dam impacts, Wetlands restoration, Seafloor mapping, Shoreline stability, Floodplain morphology, Mine lands, Energy resources, Natural Hazards, Hydrologic data collection/studies
Energy: Endangered Species, Bio-resource monitoring, Contaminant cause and effects, Gas Hydrates, Mining technology, Energy resources, Geologic hazards, Groundwater framework, Coalbed methane, Hydrologic data collection/studies
EPA: Endangered Species, Endocrine disruption, Contaminant effects, Status/Trends, Mine lands and drainage, Emissions modeling/clean air, Water quality, Seafloor mapping, Geochemical analyses, Coal resources and mining, Urban dynamics/land characterization, Hydrologic data collection/studies Remote sensing, Mineral baselines, GAP Analysis, National Hydrography Dataset
Homeland Security/Federal Emergency Management Agency: Hazards monitoring and mitigation, Hydrologic data collection/studies, Floodplain mapping, providing emergency maps, elevation data
Health and Human Services: Chemical Analyses
Intelligence Community: Information coordination, Environmental/ resource studies, Hazards Support, Geospatial data coordination.
Interior/BLM: Rangeland Health, Wild Horse Management, Invasive Species, Abandoned Mine Lands, Air Quality, Threatened and Endangered species, Water Quality, Mineral Resource Assessments, Prescribed Fire, mapping of National Petroleum Reserve/Alaska (NPR/A), mapping and geospatial data and analysis, National Hydrography Dataset
Interior/BOR: Water quality, Ecological models, Decision Support Systems, Seismic Monitoring, Geospatial data.
Interior/FWS: Inventory and Monitoring, Aquatics and Contaminants, Biological resources, Threatened and Endangered species, Water Quantity/Quality, GAP Analysis, Geospatial data
Interior/MMS: Gas hydrates
Interior/NPS: Water quantity/quality, Geologic mapping, Biological resources, Volcano hazard assessment, mapping and geospatial data, National Hydrography Dataset
Interior/OSM: Acid mine drainage
Justice: GIS
Labor: Energy resources
National Academy of Science: Hazards studies, Geographic research, Evaluating licensing of geospatial data, K-12 geography curricula

National Aeronautics and Space Administration (NASA): Planetary research, Landsats 5 and 7 operations, design of Landsat Data Continuity Mission (follow-on to Landsat). Natural hazards, Earth Science research, Data management, Land Processes Distributed Active Archive Center, GIS, United Nations Environment Program clearinghouse, Remote sensing, Spaceflight support; Shuttle Radar Topography Mission
National Institutes of Health: Human health and environment, West Nile virus mapping with CDC
National Science Foundation: Hazards studies, Antarctic research and mapping, Global seismology
Smithsonian Institution: North American vertebrate collections, Volcanic hazards
State: Natural hazards, Energy resources, Global seismology, Hydrologic data collection/studies, Famine Early Warning System, Pan American Institute of Geography and History, and Geospatial Support.
Tennessee Valley Authority: Hydrologic data collection/studies
Transportation/Federal Highway Administration: Hazards studies, Hydrologic data collection/studies
Transportation/Federal Aviation Administration: Volcanic hazards
U.S. Agency for International Development: Geologic hazards, Hydrologic data collection/studies, Energy resources, Atmospheric moisture index
State and Local Government
Airports: Volcanic hazards
American Indians/Alaska Natives: K-12 educational resources, Streamgaging, Water quality/ quantity, Technical training and capability upgrade, Environmental hazards, Fisheries research, Invasive species, NativeView for American Indian colleges and universities, and geospatial support
Civil Defense: Hazards mitigation
Departments of Natural Resources/Geographic Information Councils: Volcanic hazards, Map data integration, Hydrologic data collection/studies , Orthoimagery
Departments of Environmental Protection/Quality/Health: Hydrologic data collection/studies, Mapping data
Departments of Fish and Game/Conservation Commission/Wildlife and Parks: Endangered species, Population dynamics, Habitat requirements, Fire management, Fisheries, Wildlife disease, Invasive species, Waterfowl surveys, Bird banding, Aquaculture, GAP Analysis, Geospatial support
Offices of Emergency Management: Hazards monitoring and mitigation, Providing emergency maps
Planning Commissions/Transportation/Engineering/Municipalities: Conservation plans, Hydrologic data collection/studies, Topographic mapping, Hazards monitoring/assessment, Creating decision support systems for local decisionmaking
State Geological Surveys: Geologic and topographic mapping, Hazards assessment
Higher Education: University participation in AmericaView
Water Resources Authorities/Public Works/Sanitation: Contaminant Transport, Hydrologic data collection/studies
Non-government Organizations
American Farm Bureau/American Society of Civil Engineers/Chemical Manufacturers Association/etc.: Coordination of hydrologic programs
American Red Cross: Hazards monitoring and mitigation
Electric Power Research Institute: Coal quality
FERC Permittees/Licensees: Hydrologic data collection/studies, Restoration of Threatened and Endangered migratory fish
Industry: Spatial data modeling, Spatial data browsing and retrieval, Product development, registration, and production, Environmental monitoring, Acid rain deposition program, Hazard monitoring, research and assessments
The Nature Conservancy: Endangered species, Species at Risk, Ecological research, Biological Status/Trends, Coordination of hydrologic programs, GAP Analysis, Decision Support System
National Geographic: Print-on-demand studies, Geospatial information coordination
Universities/Cooperative Fish and Wildlife Research Units/State Water Resources Research Institutes: Planetary research, Space-based instrumentation, Natural science information delivery, Natural science research and applications, Hazards research and monitoring networks, Training/education, Geologic mapping, Hydrologic data collection/studies, GAP Analysis
Southern California Earthquake Center (University consortium): Earthquake hazard research and assessment
Utilities: Seismic studies, Hydrologic data collection/studies
NatureServe: NBII, Geospatial Support, Decision Support System
International Association of Fish and Wildlife Agencies: chronic wasting disease
Ducks Unlimited: database development and data access for Latin American And Caribbean waterfowl surveys
The General Public: Breeding bird survey, Bird banding, Water resources education/outreach, topographic maps, topographic mapping

International
Global: The USGS has conducted earth science studies and provided natural hazards support in foreign countries for over 50 years. Authorization is provided under the Organic Act, as revised, and the Foreign Assistance Act and related legislation when such studies are deemed by the U.S. Department of the Interior and Department of State to be in the interest of the U.S. Government.

Data Validation and Verification

In keeping with departmental and OMB policy for performance data validation and verification, USGS complies with requirements for performance data credibility. USGS approach to achieving performance data credibility includes providing extensive Budget and Performance Integration and ABC/M training, SES performance measures linked to appraisals, and implementation of the Department Data Validation and Verification Assessment Matrix. During FY 2005, USGS continued the Data Validation and Verification to include USGS-specific measures, outputs, PART and Management Excellence performance measures. This extends assurance of credibility to more performance data, ensuring usability for management decisionmaking and oversight.

Validation — During FY 2005, USGS GPRA coordinators for each Budget Activity/scientific discipline completed and certified validation criteria in the Department Validation and Verification Assessment Matrix for the key and non-key performance measures of the Department Strategic Plan, PART measures, USGS-specific measures and outputs. USGS demonstrated accountability by establishing a clear connection among mission, work, and work accomplishments for the funds that have been authorized and appropriated. Criteria include scrutiny to determine that goals are realistic and measurable, understandable to users, and ultimately used in decisionmaking. In addition, several of the Strategic Plan measures were assessed by the PART during FY 2004, including Water Resources programs and a re-PART for *The National Map*. This provided additional documentation and assurance of credibility and usability of USGS performance measures for management decisionmaking.

Verification — During FY 2005, USGS GPRA coordinators for each Budget Activity/scientific discipline completed and certified verification criteria in the Department Validation and Verification Assessment Matrix for the key and non-key performance measures of the Department Strategic Plan, PART measures, USGS-specific measures, and outputs. This included assessing data accuracy, completeness, consistency, availability, and inter-control practices that serve to determine the overall reliability of the data collected. GPRA coordinators documented any inconsistencies, inaccuracies or anomalies in performance data to ensure that problems are addressed so that integrity of the performance data is ensured.

During FY 2006 and FY 2007, the above process and procedures will continue for performance validation and verification. Completion of Department Data Validation and Verification Assessment Matrix for all performance data is vital to support audits ensuring that quality assurance measures are in place to verify and certify performance data accuracy. In fact this information was used with more extensive documentation to support an audit of a Hazards performance measure during the audit of the Department's FY 2004 Performance and Accountability Report.

This page intentionally left blank.

Goal Performance Table

Target Codes:
SP = Key Strategic Plan measures
NK = Non-Key measures
TBD =Targets have not yet been developed
NA = Long-term targets are inappropriate to determine at this time

PART = PART measures
UNK = Prior year data unavailable
BUR = Bureau specific measure

Type Codes: C = Cumulative Measures **A =** Annual Measures **F =** Future Measures

Resource Protection Goal Performance Summary

End Outcome Goal 1.1: Resource Protection. Improve Health of Watersheds, Landscapes, and Marine Resources

End Outcome Measures Intermediate or PART Measures/PART Efficiency or Other Outcome Measures	Type	FY 2004 Actual	FY 2005 Final Plan	FY 2005 Actual	FY 2006 Enacted	FY 2007 Plan	Change from 2006 Enacted to 2007 Plan	Long-term Target (2008) 2006 Pres. Request	Long-term Target (2008) Revised	Explanation of Changes: for changes from 2006 to 2007 and 2006 and 2008 target revisions
End Outcome Measures										
NA										
Intermediate Outcome Measures and Bureau and PART Outcome Measures Restore and maintain proper functions to watersheds and landscapes										
Restored Fire Adapted Ecosystem: X% satisfaction with scientific and technical products **(SP)**	A	100%	≥80%	100%	≥80%	≥90%	NA	≥80%	≥90%	
Intermediate Outcome Measures and Bureau and PART Outcome Measures Improve information base, information management and technical assistance										
Forge Effective Partnerships: Satisfaction score (# score) on resource protection partnerships **(SP)**	A	97%	≥80%	94%	≥80%	≥80%	0	≥80%	≥80%	
X% improvement in detectability limits for selected, high priority environmentally available chemical analyses **(PART)**	A	UNK	UNK	UNK	Baseline	12%	NA	NA	25%	

Goal Performance Table

End Outcome Measures Intermediate or PART Measures/PART Efficiency or Other Outcome Measures	Type	FY 2004 Actual	FY 2005 Final Plan	FY 2005 Actual	FY 2006 Enacted	FY 2007 Plan	Change from 2006 Enacted to 2007 Plan	Long-term Target (2008) 2006 Pres. Request	Long-term Target (2008) Revised	Explanation of Changes: for changes from 2006 to 2007 and 2006 and 2008 target revisions
End Outcome Measures										
Customer Satisfaction: X% satisfaction with scientific and technical products and assistance for improving health of watersheds, landscapes and marine resources **(PART)**	A	97%	≥90%	96%	≥90%	≥90%	0	NA	≥90%	
X% of targeted science products that are used by partners for species, habitat, and land management, and/or regulatory decision-making **(PART)**	A	UNK	60%	60%	60%	65%	+5%	NA	66%	Planned performance change within base funding.
Quality: X% of watershed and landscape studies validated through appropriate peer review **(SP)**	A	100%	100%	100%	100%	100%	0	100%	100%	
Facilities Condition: Conservation and biological research facilities are in fair to good condition as measured by the Facilities Condition Index (lower FCI is good) **(NK)**	A	.24	.24	.24	.24	.24	0	.24	.24	
PART Efficiency and Other Output Measures										
Average cost per sample for selected, high priority environmentally available chemical analysis **(PART Eff Measure)**	A	UNK	700	700	700	680	-20	NA	662	Planned performance change within base funding.
# of systematic analyses & investigations delivered to customers (Total)		**111**	**185**	**373**	**201**	**208**	**+7**	**197**	**205**	

End Outcome Measures Intermediate or PART Measures/PART Efficiency or Other Outcome Measures	Type	FY 2004 Actual	FY 2005 Final Plan	FY 2005 Actual	FY 2006 Enacted	FY 2007 Plan	Change from 2006 Enacted to 2007 Plan	Long-term Target (2008) 2006 Pres. Request	Long-term Target (2008) Revised	Explanation of Changes: for changes from 2006 to 2007 and 2006 and 2008 target revisions
End Outcome Measures										
# of systematic analyses & investigations delivered to customers **(Biology)**	F	111	163	342	175	178	+3	175	175	Increase from FY 2006 to FY 2007 is a results of research initiated in FY 2005. Proposed funding decreases in FY 2007 result in 12 fewer systematic analyses and investigations delivered in FY 2009. Change includes consolidation of performance for fire-adapted ecosystems.
# of systematic analyses & investigations delivered to customers **(PES)**	A	UNK	22	31	26	30	+4	22	30	Planned performance change within base funding.
# of formal workshops or training provided to customers (Total)	**A**	**1**	**24**	**98**	**30**	**33**	**+3**	**28**	**48**	

Goal Performance Table

End Outcome Measures Intermediate or PART Measures/PART Efficiency or Other Outcome Measures	Type	FY 2004 Actual	FY 2005 Final Plan	FY 2005 Actual	FY 2006 Enacted	FY 2007 Plan	Change from 2006 Enacted to 2007 Plan	Long-term Target (2008) 2006 Pres. Request	Long-term Target (2008) Revised	Explanation of Changes: for changes from 2006 to 2007 and 2006 and 2008 target revisions
End Outcome Measures										
# of formal workshops or training provided to customers **(Biology)**	A	1	16	84	20	21	+1	20	36	Increase from FY 2006 to FY 2007 is a result of the FY 2007 Multi-Hazards Pilot Initiative-Wildland Fires. Change includes consolidation of performance for fire-adapted ecosystems.
# of formal workshops or training provided to customers **(PES)**	A	UNK	8	14	10	12	+2	8	12	Planned performance change within base funding.

End Outcome Goal 1.2: Resource Protection. Sustain Biological Communities

End Outcome Measures Intermediate or PART Measures/PART Efficiency or Other Outcome Measures	Type	FY 2004 Actual	FY 2005 Final Plan	FY 2005 Actual	FY 2006 Enacted	FY 2007 Plan	Change from 2006 Enacted to 2007 Plan	Long-term Target (2008) 2006 Pres. Request	Long-term Target (2008) Revised	Explanation of Changes: for changes from 2006 to 2007 and 2006 and 2008 target revisions
End Outcome Measures										
NA										
Intermediate Outcome Measures and Bureau and PART Outcome Measures **Improve information base, information management and technical assistance**										
Forge Effective Partnerships: Satisfaction score (# score) on biological research partnerships **(SP)**	A	98%	≥80%	100%	≥80%	≥90%	NA	≥80%	≥90%	

End Outcome Measures Intermediate or PART Measures/PART Efficiency or Other Outcome Measures	Type	FY 2004 Actual	FY 2005 Final Plan	FY 2005 Actual	FY 2006 Enacted	FY 2007 Plan	Change from 2006 Enacted to 2007 Plan	Long-term Target (2008) 2006 Pres. Request	Long-term Target (2008) Revised	Explanation of Changes: for changes from 2006 to 2007 and 2006 and 2008 target revisions
End Outcome Measures										
Customer Satisfaction: X% satisfaction of scientific and technical products and assistance for sustaining biological communities **(PART)**	A	98%	≥90%	87%	≥90%	≥90%	0	NA	≥90%	
X% of targeted invasive species for which scientific information and decision support models are available to improve early detection (including risk assessments) and invasive species management **(PART)**	A	UNK	51.6%	51.6%	51.6%	52.5%	+0.9%	NA	53.3%	Planned performance change within base funding.
X% of targeted science products that are used by partners for species, habitat, and land management, and/or regulatory decision-making **(PART)**	A	UNK	60%	60%	60%	65%	+5%	NA	66%	Planned performance change within base funding.
Quality: X% of biological community studies validated through appropriate peer review **(SP)**	A	100%	100%	100%	100%	100%	0	100%	100%	
X% of North American migratory birds for which scientific information on their status (species distribution and number) and trend are available to inform and improve conservation **(PART)**	A	UNK	26%	26%	26%	26%	0	NA	27.1%	

Goal Performance Table

End Outcome Measures Intermediate or PART Measures/PART Efficiency or Other Outcome Measures	Type	FY 2004 Actual	FY 2005 Final Plan	FY 2005 Actual	FY 2006 Enacted	FY 2007 Plan	Change from 2006 Enacted to 2007 Plan	Long-term Target (2008) 2006 Pres. Request	Long-term Target (2008) Revised	Explanation of Changes: for changes from 2006 to 2007 and 2006 and 2008 target revisions
End Outcome Measures										
X% of targeted fish and aquatic populations for which information is available regarding limiting factors, including migratory barriers, critical habitat for at-risk species, and effects of disturbance (fire, flood, nutrient enrichment **(PART)**	A	UNK	31%	31%	31%	37%	+6%	NA	42%	Planned performance change within base funding.
Increase long-term trend precision (decrease bias) for existing species monitored through the Breeding Bird Survey to enable a detection of 50% population decline of relevant species within 20 years **(PART)**	A	UNK	0.0008	0.0008	0.0008	0.0008	0	NA	0.0008	
X% of CRU students that work on subsequent fish and wildlife science advance degrees or obtain employment in the fish and wildlife or other natural resources field, within targeted dates post-graduation **(CRU) (BUR)**	A	UNK	UNK	UNK	Baseline	TBD	NA	TBD	TBD	Under Development
X% of targeted science products that are used by Cooperators and partners for species, habitat, or land management and/or regulatory decision making within targeted dates following study completion **(CRU) (BUR)**	A	UNK	UNK	UNK	Baseline	TBD	NA	TBD	TBD	Under Development

End Outcome Measures Intermediate or PART Measures/PART Efficiency or Other Outcome Measures	Type	FY 2004 Actual	FY 2005 Final Plan	FY 2005 Actual	FY 2006 Enacted	FY 2007 Plan	Change from 2006 Enacted to 2007 Plan	Long-term Target (2008) 2006 Pres. Request	Long-term Target (2008) Revised	Explanation of Changes: for changes from 2006 to 2007 and 2006 and 2008 target revisions
End Outcome Measures										
X% of focal migratory bird populations for which scientific information is available to support resource management decisionmaking (USGS in coordination with FWS) **(PART)**	A	UNK	UNK	UNK	UNK	UNK	0	NA	UNK	Under Development
Facilities Condition: Conservation and biological research facilities are in fair to good condition as measured by the Facilities Condition Index (lower FCI is good) **(SP)**	A	.19	.19	.19	.19	.19	0	.19	.19	
PART Efficiency and Other Output Measures										
# of systematic analyses & investigations delivered to customers	F	848	862	1,177	876	882	+6	932	932	Increase from FY 2006 to FY 2007 is a result of research initiated in FY 2005. Proposed funding decreases in FY 2007 result in 17 fewer systematic analyses and investigations delivered in FY 2009. Change includes consolidation of performance for invasive species.

Goal Performance Table

End Outcome Measures Intermediate or PART Measures/PART Efficiency or Other Outcome Measures	Type	FY 2004 Actual	FY 2005 Final Plan	FY 2005 Actual	FY 2006 Enacted	FY 2007 Plan	Change from 2006 Enacted to 2007 Plan	Long-term Target (2008) 2006 Pres. Request	Long-term Target (2008) Revised	Explanation of Changes: for changes from 2006 to 2007 and 2006 and 2008 target revisions
End Outcome Measures										
# of formal workshops or training provided to customers (instances/issues/events)	A	71	56	174	56	50	-6	61	61	Proposed funding decreases in FY 2007 result in 3 fewer workshops. -3 workshops due to planned performance change. Change includes consolidation of performance for invasive species.
# of students complete degree requirements for MS, PhD, and post doctoral program under the direction and mentorship of Unit Scientists **(CRU) (BUR)**	A	106	100	100	100	95	-5	90	90	Planned performance change within base funding.

Resource Use Goal Performance Summary

End Outcome Goal 2.1: Resource Use: Manage or Influence Resource Use –Energy

End Outcome Measures Intermediate or PART Measures/PART Efficiency or Other Outcome Measures	Type	FY 2004 Actual	FY 2005 Final Plan	FY 2005 Actual	FY 2006 Enacted	FY 2007 Plan	Change from 2006 Enacted to 2007 Plan	Long-term Target (2008) 2006 Pres. Request	Long-term Target (2008) Revised	Explanation of Changes: for changes from 2006 to 2007 and 2006 and 2008 target revisions
End Outcome Measures										
NA										
Intermediate Outcome Measures and Bureau and PART Outcome Measures Improve information base, information management and technical assistance										
Baseline Information: # of targeted basins with oil and gas resource assessments available to support management decisions **(SP) (PART)**	A	5	6	7	6	6	0	5	5	
Quality & Utility of Information: X% of data is accessible **(NK)**	A	95%	≥80%	96%	≥80%	≥80%	0	≥80%	≥80%	
Customers Satisfaction: X% satisfaction with scientific and technical products and assistance for energy resources	A	93%	≥80%	95%	≥80%	≥80%	0	≥80%	≥80%	
Quality and Utility of Information: X% of energy studies validated through appropriate peer review **(SP) (PART)**	A	100%	100%	100%	100%	100%	0	100%	100%	
PART Efficiency and Other Output Measures										
# of systematic analyses & investigations delivered to customers (assessments)	A	5	6	7	5	5	0	5	7	FY 2008 target revised due to funding increases.
# of formal workshops or training provided to customers (instances/issues/events)	A	8	8	8	7	8	+1	8	9	FY 2008 target revised due to funding increases.

End Outcome Measures Intermediate or PART Measures/PART Efficiency or Other Outcome Measures	Type	FY 2004 Actual	FY 2005 Final Plan	FY 2005 Actual	FY 2006 Enacted	FY 2007 Plan	Change from 2006 Enacted to 2007 Plan	Long-term Target (2008) 2006 Pres. Request	Long-term Target (2008) Revised	Explanation of Changes: for changes from 2006 to 2007 and 2006 and 2008 target revisions
End Outcome Measures										
X% of targeted analyses/investigations delivered which are cited by identified partners within 3 years of delivery **(PART)**	A	80%	80%	86%	≥80%	≥80%	0	≥80%	≥80%	
Average cost of a systematic analysis or investigation **(PART Eff. Measure)**	A	$2.2M	$2.75M	$2.73M	$2.75M	$2.75M	0	$2.75M	$2.75M	
# of annual gigabytes collected	A	.745	42.038	97.793	20.038	20.038	0	TBD	TBD	
# of cumulative gigabytes managed	C	211.458	253.496	351.289	371.327	391.365	+20.038	TBD	TBD	Volume grows with annual increment.

End Outcome Goal 2.2. Resource Use Manage or Influence Resource Use – Non-Energy Minerals

End Outcome Measures Intermediate or PART Measures/PART Efficiency or Other Outcome Measures	Type	FY 2004 Actual	FY 2005 Final Plan	FY 2005 Actual	FY 2006 Enacted	FY 2007 Plan	Change from 2006 Enacted to 2007 Plan	Long-term Target (2008) 2006 Pres. Request	Long-term Target (2008) Revised	Explanation of Changes: for changes from 2006 to 2007 and 2006 and 2008 target revisions
End Outcome Measures										
NA										
Intermediate Outcome Measures and Bureau and PART Outcome Measures Improve information base, information management and technical assistance										
Baseline Information: Average square miles of the United States with non-energy mineral information available to support management decisions **(SP) (PART)**	C	2,401,329	2,987,340	3,097,647	3,332,038	3,346,737	+14,699	2,987,340	3,346,737	Proposed funding decreases in FY 2007 decrease rate of data growth.
Quality & Utility of Information: X% of U. S. with geologic, geochemical, geophysical and mineral locality data **(BUR)**	C	68%	84%	87%	94%	94%	0	84%	94%	Proposed funding decreases in FY 2007 decrease rate of data growth.

End Outcome Measures Intermediate or PART Measures/PART Efficiency or Other Outcome Measures	Type	FY 2004 Actual	FY 2005 Final Plan	FY 2005 Actual	FY 2006 Enacted	FY 2007 Plan	Change from 2006 Enacted to 2007 Plan	Long-term Target (2008) 2006 Pres. Request	Long-term Target (2008) Revised	Explanation of Changes: for changes from 2006 to 2007 and 2006 and 2008 target revisions
End Outcome Measures										
Customers Satisfaction: X% satisfaction with scientific and technical products and assistance for mineral resources	A	93%	≥80%	100%	≥80%	≥50%	->30%	≥50%	≥50%	
Quality & Utility of Information: X% of mineral studies validated through appropriate peer review **(SP) (PART)**	A	100%	100%	100%	100%	100%	0	100%	100%	
PART Efficiency and Other Output Measures										
# of systematic analyses & investigations delivered to customers (assessments) **(PART)**	A	5	3	3	6	1	-5	3	3	Proposed funding decreases in FY 2007 result in 5 fewer systematic analyses and investigations delivered to customers.
# of cumulative gigabytes managed	C	15.420	16.021	16.131	16.221	16.3	+0.08	16.5	16.5	Planned performance change within base funding.
# of formal workshops or training provided to customers (instances/issues/events) **(PART)**	A	8	8	8	8	3	-5	2	4	Proposed funding decrease in FY 2007 result in 5 fewer workshops.
# of mineral commodity reports available for decisions **(BUR)**	A	733	720	746	720	700	-20	700	700	Due to proposed decrease.
X% of expected responses for which canvass forms have been converted to electronic format	C	58%	80%	81%	88%	100%	+12%	80%	100%	Expected project completion.

Goal Performance Table

End Outcome Measures Intermediate or PART Measures/PART Efficiency or Other Outcome Measures	Type	FY 2004 Actual	FY 2005 Final Plan	FY 2005 Actual	FY 2006 Enacted	FY 2007 Plan	Change from 2006 Enacted to 2007 Plan	Long-term Target (2008) 2006 Pres. Request	Long-term Target (2008) Revised	Explanation of Changes: for changes from 2006 to 2007 and 2006 and 2008 target revisions
End Outcome Measures										
X% of targeted analyses delivered which are cited by identified partners within 3 years after analysis delivered **(PART)**	A	80%	80%	87%	≥80%	≥80%	0	80%	≥80%	
Average cost of a systematic analysis or investigation **(PART Eff. Measure)**	A	$4.31M	$4.18M	$4.18M	$4.4M	$12.4M	+$8M	$8M	$3.5M	Proposed funding decreases will terminate projects without completing a product from FY 2006 to FY 2007; increasing average cost of those that are completed. Projects left to complete in FY 2008 are smaller than others already completed.

Serving Communities Goal Performance Summary

End Outcome Goal 4.1. Serving Communities Protect Lives, Resources and Property

End Outcome Measures Intermediate or PART Measures/PART Efficiency or Other Outcome Measures	Type	FY 2004 Actual	FY 2005 Final Plan	FY 2005 Actual	FY 2006 Enacted	FY 2007 Plan	Change from 2006 Enacted to 2007 Plan	Long-term Target (2008) 2006 Pres. Request	Long-term Target (2008) Revised	Explanation of Changes: for changes from 2006 to 2007 and 2006 and 2008 target revisions
End Outcome Measures										
Hazards: X% of communities using DOI science on hazard mitigation, preparedness and avoidance for each hazard management activity **(SP)**	C	43.2%	45.9%	44.6%	47.5%	49%	+1.5%	49.1%	50.2%	Recalculation of Landslide Component.
Intermediate Outcome Measures and Bureau and PART Outcome Measures Improve public safety and security and protect public resources from damage										
Facilities Condition: Hazard Buildings (administrative, employee housing) are in fair to good condition as measured by the Facilities Condition Index (FCI) **(SP)**	A	0.20	0.20	0.20	0.20	0.20	0	0.20	0.20	
Intermediate Outcome Measures and Bureau and PART Outcome Measures Provide information to assist communities in managing risks from natural hazards										
Use Rate: Earthquakes: X% of communities using DOI science on hazard mitigation, preparedness and avoidance for each hazard management activity **(NK)**	C	62.7%	63.4%	63.4%	63.9%	64.0%	+0.1%	63.9%	65.1%	Planned performance change within base funding.
Use Rate: Landslides: X% of communities using DOI science on hazard mitigation, preparedness, and avoidance for each hazard management activity **(NK)**	C	3.7%	3.9%	3.9%	4.4%	4.9%	+0.5%	5.4%	5.4%	Planned performance change within base funding.
Use Rate: Volcanoes: X% of communities using DOI science on hazard mitigation, preparedness, and avoidance for each hazard management activity **(NK)**	C	63.3%	70.3%	66.4%	74.2%	78.1%	+3.9%	78.1%	80.1%	Planned performance change within base funding.

Goal Performance Table

End Outcome Measures Intermediate or PART Measures/PART Efficiency or Other Outcome Measures	Type	FY 2004 Actual	FY 2005 Final Plan	FY 2005 Actual	FY 2006 Enacted	FY 2007 Plan	Change from 2006 Enacted to 2007 Plan	Long-term Target (2008) 2006 Pres. Request	Long-term Target (2008) Revised	Explanation of Changes: for changes from 2006 to 2007 and 2006 and 2008 target revisions
End Outcome Measures										
Use Rate: Landslide Hazards: # of responses to inquiries from the public, educators, and public officials to the National Landslide Information Center on hazard mitigation, preparedness and avoidance strategies for landslide hazards **(BUR)**	A	1,600	1,600	5,200	1,600	1,600	0	1,600	1,600	
Adequacy: X% of sampled stakeholders reporting adequacy of science base to inform decision-making for each hazard management activity (volcanoes, earthquakes, etc.) **(SP)**	A	98%	≥80%	99%	≥80%	≥90%	NA	≥80%	≥90%	
PART Efficiency and Other Output Measures										
# of systematic analyses & investigations delivered to customers (risk/hazard assessments)	A	3	5	6	6	6	0	7	7	Increase from FY 2007 to FY 2008 is a result of the FY 2007 Multi-Hazard Pilot Initiative.
# of systematic analyses & investigations delivered to customers (risk/hazard assessments) Avian Flu	A	NA	NA	NA	NA	NA	0	0	3	Increased outputs as a result of the FY 2006 Supplemental funding for Avian Influenza.
% of earthquake monitoring global seismic network stations that have telemetry (increase reporting speed from one hour to 20 minutes)	A	80%	80%	86%	89%	93%	+4%	95%	95%	

End Outcome Measures Intermediate or PART Measures/PART Efficiency or Other Outcome Measures	Type	FY 2004 Actual	FY 2005 Final Plan	FY 2005 Actual	FY 2006 Enacted	FY 2007 Plan	Change from 2006 Enacted to 2007 Plan	Long-term Target (2008) 2006 Pres. Request	Long-term Target (2008) Revised	Explanation of Changes: for changes from 2006 to 2007 and 2006 and 2008 target revisions
End Outcome Measures										
# of real-time ANSS earthquake sensors (reported yearly and cumulative at the end of the year **(PART)** (EHP)	C	95 (cum 523)	40 (cum. 563)	40 (cum. 563)	106 (cum. 669)	40 (cum. 709)	+40	Targets set Annually	16 (cum. 725)	Re-targeted FY 2006 based on recommendation for structure instrumentation by the ANSS SRMC in Sept. 2005 Revised 2008 estimate accordingly.
# of formal workshops or training provided to customers (instances/issues/events)	A	14	14	21	13	11	-2	14	Targets set Annually	Planned performance change within base funding.
# of formal workshops or training provided to customers (instances/issues/events) Avian Flu	A	UNK	0	0	3	3	0	3	3	
# of sites (mobile or fixed) monitored for ground deformation to identify volcanic activity (VHP)	C	85	86	88	98	114	+16	130	130	
# of urban areas for which detailed seismic hazard maps are completed **(PART)** (EHP) (cumulative)	C	2	3	3	3	3	0	5	5	
# of areas or locations for which geophysical models exist that are used to interpret monitoring data **(PART)** (LHP)	C	4	4 1/3	4 1/3	4 2/3	5	+1/3	5	5 1/3	Planned performance change within base funding.

Goal Performance Table

End Outcome Measures Intermediate or PART Measures/PART Efficiency or Other Outcome Measures	Type	FY 2004 Actual	FY 2005 Final Plan	FY 2005 Actual	FY 2006 Enacted	FY 2007 Plan	Change from 2006 Enacted to 2007 Plan	Long-term Target (2008) 2006 Pres. Request	Long-term Target (2008) Revised	Explanation of Changes: for changes from 2006 to 2007 and 2006 and 2008 target revisions
End Outcome Measures										
# of metropolitan regions where Shakemap is incorporated into emergency procedures **(PART)** (EHP) (cumulative)	C	5 (cum 5)	5	5	5	5	0	Targets set Annually	6	Growth of the hazards initiative sufficient to allow instrumentation of another urban area.
# of volcanoes for which information supports public safety decisions **(PART)** (VHP)	C	49	+2 (cum 51)	+2 (cum 51)	0 (cum 51)	+1 (cum 52)	+1	2 (cum 57)	1 (cum 53)	Reduction of $1M FAA funds slows additional expansion of network.
X% of potentially active volcanoes monitored (x number of 70) **(PART)** (VHP)	C	67%	72%	72.9% (51/70)	72.9% (51/70)	74.3% (52/70)	+1.4%	73%	75.7% (53/70)	Reduction of $1M FAA funds slows additional expansion of network. FY 2006 instrumentation of Pagan will be prevented by typhoon season.
X% of potentially hazardous volcanoes with published hazard assessments **(PART)** (VHP) Says increment is 1.428 per year	C	61.4%	62.8%	62.8% (44/70)	64.3% (45/70)	65.7% (46/70)	+1.428%	68.6%	68.5% (48/70)	Planned performance change within base funding.
# of counties, or comparable jurisdictions, that have adopted improved building codes, land-use plans, emergency response plans, or other hazard mitigation measures based on USGS **earthquake** hazards information **(PART)**	C	559	565	565	569	570	+1	569	580	Expect continuing growth of building code adoptions.

End Outcome Measures Intermediate or PART Measures/PART Efficiency or Other Outcome Measures	Type	FY 2004 Actual	FY 2005 Final Plan	FY 2005 Actual	FY 2006 Enacted	FY 2007 Plan	Change from 2006 Enacted to 2007 Plan	Long-term Target (2008) 2006 Pres. Request	Long-term Target (2008) Revised	Explanation of Changes: for changes from 2006 to 2007 and 2006 and 2008 target revisions
End Outcome Measures										
# of counties, or comparable jurisdictions, that have adopted improved building codes, land-use plans, emergency response plans, or other hazard mitigation measures based on USGS **landslide** hazards information **(PART)** (Baseline is 1,800 counties and parks with moderate to high landslide susceptibility in the U.S.	C	68	71	71	80	89	+9	98	98	Planned performance change within base funding.
# of counties, or comparable jurisdictions, that have adopted improved building codes, land-use plans, emergency response plans, or other hazard mitigation measures based on USGS **volcano** hazards information **(PART)**	C	162	180	170	190	200	+10	200	205	Planned performance change within base funding.
X% data availability for real-time data from the GSN **(PART)**	A	90.5	90%	89%	90%	87%	-3%	90%	90%	Decrease in FY 2007 due to aging equipment.
Data processing and notification costs per unit volume of input data from sensors in monitoring networks (in cost per gigabyte) **(PART Eff. Measure)**	A	0.90 $k/GB (-1%)	0.99 $k/GB	0.79 $k/GB	1.42 $k/GB	1.33 $k/GB	-0.09 $k/GB	TBD	$1,033 $k/Gb	FY 2006 increases are due to increase in contractor costs. These are ameliorated in FY 2007 due to expected increased data volume. Level cost efficiency in FY 2007 depends on installation of 4 additional stations.

End Outcome Goal 4.2: Serving Communities: - Advance Knowledge through Scientific Leadership

End Outcome Measures Intermediate or PART Measures/PART Efficiency or Other Outcome Measures	Type	FY 2004 Actual	FY 2005 Final Plan	FY 2005 Actual	FY 2006 Enacted	FY 2007 Plan	Change from 2006 Enacted to 2007 Plan	Long-term Target (2008) 2006 Pres. Request	Long-term Target (2008) Revised	Explanation of Changes: for changes from 2006 to 2007 and 2006 and 2008 target revisions
End Outcome Measures										
Research: Soundness of methodology, accuracy, and reliability of science (program evaluation) **(SP)**	A	80%	100%	100%	100%	100%	0	100%	100%	
Inform decisions through the application of science: Improved access to needed science information (# score) **(SP)**	A	90%	90%	92%	90%	90%	0	90%	90%	
Inform decisions through the application of science: Stakeholders reporting that information helped achieve goal (# score) **(SP)**	A	93%	90%	95%	90%	90%	0	90%	90%	
Inform decisions through the application of science: Improved access to needed science information, # of USGS science publications cataloged in master USGS publications database **(BUR EI))**	C	66,626	67,000	68,945	67,500	70,000	+2,500	72,500	72,500	Planned performance change within base funding.
Inform decisions through the application of science: Improved access to needed science information, # of associated USGS science publications accessible on-line **(BUR EI)**	C	25,909	35,000	35,869	45,000	51,000	+6,000	65,000	57,000	Planned performance change within base funding. The reduced number of publications in FY 2008 reflects the operational efficiencies reduction.

End Outcome Measures Intermediate or PART Measures/PART Efficiency or Other Outcome Measures	Type	FY 2004 Actual	FY 2005 Final Plan	FY 2005 Actual	FY 2006 Enacted	FY 2007 Plan	Change from 2006 Enacted to 2007 Plan	Long-term Target (2008) 2006 Pres. Request	Long-term Target (2008) Revised	Explanation of Changes: for changes from 2006 to 2007 and 2006 and 2008 target revisions
End Outcome Measures										
Inform decisions through the application of science: Improve access to needed science information (# of cumulative biological partnership links **(BUR BIMD)**	C	36,000	38,500	76,155	83,770	87,959	+4,189	46,000	92,356	Planned performance change within base funding. The long-term target has been revised because the program experienced a greater-than-expected increase in the number of links in FY 2005.
Intermediate Outcome Measures and Bureau and PART Outcome Measures Improve information base, information management and technical assistance										
Content and expanse of knowledge base: X% of surface area with temporal and spatial monitoring, research, and assessment/data coverage to meet land use planning and monitoring requirements **(SP)**	C	54.74%	59.76%	58.9%	70.25%	76.7%	+6.43%	80.13%	78.5%	
Content and expanse of knowledge base: X% of data accessible: X% of satellite data available from archive within 24 hours of capture **(PART Geography)**	A	90%	90%	97.2%	90%	90%	0	90%	90%	
Quality: X% of studies validated through appropriate peer review **(SP)**	A	100%	100%	100%	100%	100%	0	100%	100%	

Goal Performance Table

End Outcome Measures Intermediate or PART Measures/PART Efficiency or Other Outcome Measures	Type	FY 2004 Actual	FY 2005 Final Plan	FY 2005 Actual	FY 2006 Enacted	FY 2007 Plan	Change from 2006 Enacted to 2007 Plan	Long-term Target (2008) 2006 Pres. Request	Long-term Target (2008) Revised	Explanation of Changes: for changes from 2006 to 2007 and 2006 and 2008 target revisions
End Outcome Measures										
X% of US land with land characterization and species distribution information available for resource management decision-making updated in the last 5 years **(BIMD PART)**	C	18.3%	23.3%	23.3%	28.3%	34.0%	+5.7%	NA	39%	Cumulative Growth.
X% of North American migratory birds for which scientific information on their status (species distribution and number) and trends are available in a standardized and exchangeable format, to improve conservation plans of federal and state agencies **(BIMD PART)**	C	15%	20%	20%	25%	30%	+5%	NA	35%	Cumulative Growth.
X% of North American amphibians and reptiles for which scientific information on their status (species distribution) are available in a standardized and exchangeable format, to improve conservation plans of federal and state agencies **(BIMD PART)**	C	88%	90%	90%	91%	92%	+1%	NA	93%	Cumulative Growth.
X% of North American mammals for which scientific information on their status (species distribution) are available in a standardized and exchangeable format, to improve conservation plans of federal and state agencies **(BIMD PART)**	C	91%	93%	93%	94%	94%	0	NA	95%	

End Outcome Measures Intermediate or PART Measures/PART Efficiency or Other Outcome Measures	Type	FY 2004 Actual	FY 2005 Final Plan	FY 2005 Actual	FY 2006 Enacted	FY 2007 Plan	Change from 2006 Enacted to 2007 Plan	Long-term Target (2008) 2006 Pres. Request	Long-term Target (2008) Revised	Explanation of Changes: for changes from 2006 to 2007 and 2006 and 2008 target revisions
End Outcome Measures										
X% of US federally-listed threatened and endangered or indicator fish species for which scientific information on A species status is available in a standardized and exchangeable format to improve conservation plans of federal and state agencies **(BIMD PART)**	C	2.6%	7.5%	7.5%	12.5%	17.5%	+5%	NA	22.5%	Cumulative Growth.
X% of river basins that have streamflow stations **(WRD PART)**	C	77%	79%	82%	81%	84%	+3%	85%	83%	Due to increase in the National Streamflow Information Program (NSIP).
X% of streamflow stations with real-time measurement/reporting of water quality **(WRD PART)**	C	6%	7%	7%	8%	6%	-2%	11%	6%	Due to decreases in Cooperative Water Program.
X% of ground-water stations that have real-time reporting capability in the ground water climate response network **(WRD PART)**	C	57%	62%	67%	67%	63%	-4%	77%	60%	Due to decreases in Cooperative Water Program.
X% of the Nation's 65 principal aquifers with monitoring wells used to measure responses of water levels to drought and climatic variations to provide information needed for water-supply decisionmaking **(WRD PART)**	C	60%	61%	61%	62%	60%	-2%	65%	58%	Due to decreases in Cooperative Water Program.
X% of U.S. with ground water quality status and trends information to support resource management decisions **(WRD PART)**	C	0	39%	39%	45%	51%	+6%	30%	51%	Planned performance change within base funding.

Goal Performance Table

End Outcome Measures Intermediate or PART Measures/PART Efficiency or Other Outcome Measures	Type	FY 2004 Actual	FY 2005 Final Plan	FY 2005 Actual	FY 2006 Enacted	FY 2007 Plan	Change from 2006 Enacted to 2007 Plan	Long-term Target (2008) 2006 Pres. Request	Long-term Target (2008) Revised	Explanation of Changes: for changes from 2006 to 2007 and 2006 and 2008 target revisions
End Outcome Measures										
X% of States with web based Streamflow statistics tools to support water management decisions **(WRD PART)**	C	4%	11%	10%	18%	20%	+2%	40%	25%	Planned performance change within base funding.
X% of U.S. with ground water availability status and trends information to support resource management decisions **(WRD PART)**	C	5%	7%	7%	8%	7%	-1%	10%	6%	Due to decreases in Cooperative Water Program.
X% of targeted contaminants for which methods are developed to assess potential environmental and human health significance **(WRD PART)**	C	10%	20%	20%	30%	33%	+3%	50%	50%	
X% improvement in accuracy of watershed (SPARROW) model prediction for total nitrogen and total phosphorus (measured as reduced error) **(WRD PART)**	C	40%	36%	31%	32%	32%	0	25%	32%	Planned performance change within base funding.
X% of geologic investigations in National Park Service (NPS) units that are cited for use by the NPS within three years of delivery **(NCGM PART)**	A	UNK	Baseline	80%	80%	80%	0	80%	80%	
X% of EDMAP students that work on subsequent geoscience degrees or obtain a job in a geoscience field **(NCGM PART)**	A	95%	95%	94%	95%	95%	0	95%	95%	
# of counties or comparable jurisdictions that have adopted hazard mitigation measures based in part on geologic mapping and research **(NCGM PART)**	C	UNK	10	10	12	14	+2	14	14	Planned performance change within base funding.

End Outcome Measures Intermediate or PART Measures/PART Efficiency or Other Outcome Measures	Type	FY 2004 Actual	FY 2005 Final Plan	FY 2005 Actual	FY 2006 Enacted	FY 2007 Plan	Change from 2006 Enacted to 2007 Plan	Long-term Target (2008) 2006 Pres. Request	Long-term Target (2008) Revised	Explanation of Changes: for changes from 2006 to 2007 and 2006 and 2008 target revisions
End Outcome Measures										
X% of U.S. with geologic maps that are being integrated into ground-water availability status and trends to support resource management decisions **(NCGM PART)**	A	3%	5%	5%	6%	8%	+2%	9%	9%	Program growth. In FY 2006 NCGMP will establish baselines for new PART measures that link to work done with major program partners—primarily the NPS, the Ground-Water Resources Program, and communities that are trying to mitigate against natural hazards.
Facilities Condition: Facilities are in fair to good condition as measured by the Facilities Condition Index (FCI) **(SP)**	A	.17	.17	.17	.17	.17	0	.17	.17	
X% of time that all WAN and internet access locations are up and running and accessible **(BUR EI)**	A	99.7%	99%	99.217%	98.992%	98.992%	0	98.992%	98.992%	
IT Investment: X% of major IT investment projects for which cost estimates, established in project or contract agreement, meet actual costs with a variance of X% (established in Exhibit 300 business case meet actual costs within a variance of 5%) **(BUR EI)**	A	100%	100%	100%	100%	100%	0	100%	100%	

End Outcome Measures Intermediate or PART Measures/PART Efficiency or Other Outcome Measures	Type	FY 2004 Actual	FY 2005 Final Plan	FY 2005 Actual	FY 2006 Enacted	FY 2007 Plan	Change from 2006 Enacted to 2007 Plan	Long-term Target (2008) 2006 Pres. Request	Long-term Target (2008) Revised	Explanation of Changes: for changes from 2006 to 2007 and 2006 and 2008 target revisions
End Outcome Measures										
PART Efficiency and Other Output Measures										
# of annual gigabytes collected **(EI)**	A	34,815	62,622	6,023	26,728	25,428	1,300	28,389	24,700	Reflects the redirection of $2 million to support Landsat activities.
# of cumulative gigabytes managed **(EI)**	C	85,857	148,479	108,035	175,207	200,635	25,428	233,285	225,335	Reflects the redirection of $2 million to support Landsat activities.
# of annual terabytes collected **(Geography)**	A	527.2	527.2	438.8	534.0	534.0	0	589.0	589.0	
# of cumulative terabytes managed **(Geography)**	C	2,448.3	2,975.8	2,887.4	3,509.8	4,043.8	+534.0	4,641.8	4,632.8	Planned performance change within base funding.
# of annual gigabytes collected **(Geology)**	A	407.2	210.8	117.8	210.8	210.8	0	TBD	TBD	
# of cumulative gigabytes managed **(Geology)**	C	898.2	1,109	1,016.0	1226.8	1,437.6	+210.8	TBD	TBD	
# of cumulative gigabytes managed **(Biology) (PART)**	C	360	380	791.25	800	820	+20	440	840	The long-term target has been revised because the program experienced a greater-than-expected increase in FY 2005.
# of systematic analyses and investigations delivered to customers	A	571	556	576	555	511	-44	551	505	
# of formal workshops or training provided to customers (instances/issues/events)	A	107	116	131	121	106	-15	136	126	
# of conceptual or numerical models developed **(Puget Sound GD)**	F	2	0	0	0	0	0	0	1	Results from FY 2006 Initiative.

End Outcome Measures Intermediate or PART Measures/PART Efficiency or Other Outcome Measures	Type	FY 2004 Actual	FY 2005 Final Plan	FY 2005 Actual	FY 2006 Enacted	FY 2007 Plan	Change from 2006 Enacted to 2007 Plan	Long-term Target (2008) 2006 Pres. Request	Long-term Target (2008) Revised	Explanation of Changes: for changes from 2006 to 2007 and 2006 and 2008 target revisions
End Outcome Measures										
# of hours for fieldwork, compilation, and publication of a typical geologic map **(NCGM PART Eff. Measure)**	A	3,160	3,070	3,070	2,980	2,890	-90	2,810	2,810	Time to produce a map lessened by new technology applied (GPS, hand-held).
# of State Geological Surveys that add geologic map information to the NGMDB **(NCGM PART)**	C	47	48	48	49	50	+1	51	51	Planned performance change within base funding.
# of EDMAP students trained each year **(NCGM PART)**	A	60	60	62	60	60	0	60	60	
# real-time streamgages reporting in NWIS-Web **(PART)**	A	5,978	5,187	6,246	6,165	6,195	+30	4,738	5,960	Due to increase in NSIP.
# real-time ground-water sites reporting in NWIS-Web	A	799	700	796	692	685	-7	656	664	Planned performance change within base funding.
# real-time water-quality sites reporting in NWIS-Web	A	1,062	900	1,125	896	887	-9	843	860	Planned performance change within base funding.
X% of WRD streamflow stations with 30 or more years of record **(WRD PART)**	C	60% baseline	61%	58%	62%	63%	+1%	65%	62%	Due to increase in NSIP.
X% of daily streamflow measurement sites with data that are converted from provisional to final status within 4 months of day of collection **(WRD PART Eff)**	C	0% baseline	10%	10%	20%	25%	+5%	40%	23%	Planned performance change within base funding.
Average cost per analytical result, adjusted for inflation, is stable or declining over a 5-year period **(WRD PART Eff. Measure)**	A	$8.64	$8.64	$8.63	$8.64	$8.64	0	$8.64	$8.64	

End Outcome Measures Intermediate or PART Measures/PART Efficiency or Other Outcome Measures	Type	FY 2004 Actual	FY 2005 Final Plan	FY 2005 Actual	FY 2006 Enacted	FY 2007 Plan	Change from 2006 Enacted to 2007 Plan	Long-term Target (2008) 2006 Pres. Request	Long-term Target (2008) Revised	Explanation of Changes: for changes from 2006 to 2007 and 2006 and 2008 target revisions
End Outcome Measures										
LDCM: X% of ground system designed, built, and tested **(Geography)**	C	UNK	UNK	UNK	28%	44%	+16%	73%	83%	Design is further along than expected.
# of partnerships formed to link scientific information and societal decisions **(Science Impact - Geography)**	C	UNK	3 (cum 9)	2 (cum 8)	0 (cum 8)	1 (cum 9)	+1	5	9	Increase in funding from Hazards Initiative.
# of mapping nodes (publicly available Web mapping services available through *The National Map*) **(EI)**	C	90	140	152	155	200	+45	250	250	Planned performance change within base funding.
# of partnerships for *The National Map* built with State and local governments that collect and maintain higher resolution, more current data **(PART EI)**	A	30	28	35	20	20	0	27	20	Reflects the redirection of $2 million to support Landsat activities.
# of data standards used in implementing *The National Map* partners **(PART EI)**	C	17	22	22	22	22	0	22	22	
X% of total cost saved through partnering for data collection of high resolution imagery **(PART Eff. measure)**	A	71%	42%	72%	44%	46%	+2%	50%	48%	Long-term target reflects less data coverage resulting from decrease in data integration funding.
X% of the nation's surface for which hydrography, elevation, and orthoimagery data are available through the NSDI Clearinghouse and supported through partnerships **(PART EI)**	C	62%	83%	71%	86%	89%	+3%	93%	90%	Long-term target reflects less data coverage resulting from decrease in data integration funding.

End Outcome Measures Intermediate or PART Measures/PART Efficiency or Other Outcome Measures	Type	FY 2004 Actual	FY 2005 Final Plan	FY 2005 Actual	FY 2006 Enacted	FY 2007 Plan	Change from 2006 Enacted to 2007 Plan	Long-term Target (2008) 2006 Pres. Request	Long-term Target (2008) Revised	Explanation of Changes: for changes from 2006 to 2007 and 2006 and 2008 target revisions
End Outcome Measures										
X% of the area of 11 Western States for which orthoimagery have been acquired through a FSA/USGS partnership with other entities to achieve a 5-year cycle for 1-meter NAIP imagery **(EI)**	C	UNK	Baseline	Baseline	36%	62%	+26%	56%	62%	Long-term target reflects less data coverage resulting from decrease in data integration funding.
X% of total cost FSA and USGS saved through partnering with other entities for imagery acquisition of 1-meter NAIP orthoimagery **(EI)**	A	UNK	Baseline	Baseline	40%	36%	-4%	UNK	0	Planned performance change within base funding.
# of bureauwide data integration practices and/or policies adopted **(EI)**	A	1	3	4	3	4	+1	5	5	Planned performance change within base funding.
# of new NSDI Clearinghouse nodes established for serving data **(EI)**	A	82	50	43	50	50	0	25	25	
# of informal NSDI conference outreach exhibits **(EI)**	A	52	50	56	50	50	0	50	50	
# of new NSDI standards developed **(EI)**	C	20	25	22	30	32	+2	34	34	Routine adjustment in standards' approval process.
# of new NSDI partnership agreements **(EI)**	A	52	60	36	60	60	0	150	40	Reflects fewer agreements but for strategic purposes and larger dollar amounts.
# of IT help desks operational in major USGS offices **(EI)**	A	5	4	5	4	4	0	3	3	
# of significant websites co-located on consolidated hardened, secure, and redundant Internet servers **(EI)**	C	167	200	189	225	253	+28	280	310	Planned performance change within base funding.

Goal Performance Table

End Outcome Measures Intermediate or PART Measures/PART Efficiency or Other Outcome Measures	Type	FY 2004 Actual	FY 2005 Final Plan	FY 2005 Actual	FY 2006 Enacted	FY 2007 Plan	Change from 2006 Enacted to 2007 Plan	Long-term Target (2008) 2006 Pres. Request	Long-term Target (2008) Revised	Explanation of Changes: for changes from 2006 to 2007 and 2006 and 2008 target revisions
End Outcome Measures										
X% of Internet hosts potentially vulnerable to unauthorized access **(EI**)	A	5%	<1%	2.01%	<1%	<1%	0	<1%	<1%	
# of workshops/short courses/training provided to Tribal Colleges & Universities (TCUs) and Tribes **(SS)**	A	7	UNK	6	5	5	0	5	5	
# of Native American internships/students **(SS)**	A	8	UNK	9	10	11	+1	11	11	Planned performance change within base funding.
# of bureau conditional assessments in progress or completed (within a 5-year cycle **(Facilities)**	C	41	9	9	15	24	+9	41	9	Cumulative growth.
# of deferred maintenance and capital improvements (cumulative) **(Facilities)**	C	36	54	53	67	74	+7	88	84	Cumulative growth.
Amount of fire-related data and information available online via the NBII, to assist land managers in fire management decision making **(BIMD PART)**	C	.5 gb	1.5 gb	1.5 gb	2.0gb	2.5gb	+0.5gb	NA	3gb	Cumulative Growth.
X% of Natural History Museum specimen data records available online via the NBII, to assist researchers in identifying and addressing threats to human and animal health **(BIMD PART)**	C	5%	17%	17%	25%	29%	+4%	NA	33%	Cumulative Growth.

End Outcome Measures Intermediate or PART Measures/PART Efficiency or Other Outcome Measures	Type	FY 2004 Actual	FY 2005 Final Plan	FY 2005 Actual	FY 2006 Enacted	FY 2007 Plan	Change from 2006 Enacted to 2007 Plan	Long-term Target (2008) 2006 Pres. Request	Long-term Target (2008) Revised	Explanation of Changes: for changes from 2006 to 2007 and 2006 and 2008 target revisions
End Outcome Measures										
# of cumulative NBII Clearinghouse metadata records **(BIMD) (PART)**	C	7,500	8,000	17,937	18,000	18,500	+500	9,500	21,000	Cumulative Growth. The long-term target has been revised because the program experienced a greater-than-expected increase in FY 2005.
Amount of invasive species data and information available online via the NBII, to assist in modeling and forecasting the spread of invasives **(BIMD PART)**	C	750 mb	800 mb	800 mb	900 mb	920 mb	+20 mb	NA	940 mb	Cumulative Growth.
Average cost per gigabyte of data available through servers under Program control **(BIMD PART Eff Measure)**	A	$66,000	$63,000	$63,000	$60,000	$55,000	-$5,000	NA	$52,000	Planned performance change within base funding.
# of NBII nodes **(BIMD) (PART)**	A	14	14	14	14	14	0	18	18	
# of Natural History Museum specimen data records available online via the NBII, to assist researchers in identifying and addressing threats to human and animal health **(BUR)**	C	UNK	20 million	20 million	30 million	35 million	+5 million	NA	40 million	Cumulative Growth.

Management Excellence Goal Performance Summary

End Outcome Goal 5.1: Workforce Has Job-related Knowledge and Skills Necessary to Accomplish Organizational Goals

End Outcome Measures Intermediate or PART Measures/PART Efficiency or Other Outcome Measures	Type	FY 2004 Actual	FY 2005 Final Plan	FY 2005 Actual	FY 2006 Enacted	FY 2007 Plan	Change from 2006 Enacted to 2007 Plan	Long-term Target (2008) 2006 Pres. Request	Long-term Target (2008) Revised	Explanation of Changes: for changes from 2006 to 2007 and 2006 and 2008 target revisions
End Outcome Measures										
X% of managers who indicate that their workforce has the job-relevant knowledge and skills necessary to accomplish organizational goals **(SP)**	F	65%	70%	65%	65%	65%	0	70%	65%	
Intermediate Outcome Measures and Bureau and PART Outcome Measures Human capital management										
Human Capital Plan Implementation: *Performance-based management* – X% of SES executives and direct reports that have performance agreements containing GPRA performance-based elements **(SP)**	A	100%	100%	100%	100%	100%	0	100%	100%	
Human Capital Plan Implementation: *Enhanced Management Skills* – %of all managerial/supervisory positions (SES/non-SES) with training involving the Secretary's 4C's (including use of volunteers) **(SP)**	C	360	460	435	510	585	+75	760	660	Long term target based on 100 employees per year. Reduced class availability reduced the target.
Diversity: women & minorities is X% over baseline levels **(BUR)**	C	42.2%	43%	41.80%	42.72%	42.44%	-0.32%	43.5%	41.2%	Targets reduced by the average decrease in the USGS workforce from FY 2001 to FY 2004.

End Outcome Measures Intermediate or PART Measures/PART Efficiency or Other Outcome Measures	Type	FY 2004 Actual	FY 2005 Final Plan	FY 2005 Actual	FY 2006 Enacted	FY 2007 Plan	Change from 2006 Enacted to 2007 Plan	Long-term Target (2008) 2006 Pres. Request	Long-term Target (2008) Revised	Explanation of Changes: for changes from 2006 to 2007 and 2006 and 2008 target revisions
End Outcome Measures										
Diversity: people with disabilities is X% over baseline levels **(BUR)**	C	6.8%	7.92%	9.56%	7.87%	7.82%	-0.05%	7.93%	7.6%	Targets reduced by the average decrease in the USGS workforce from FY 2001 to FY 2004.

End Outcome Goal 5.2: Accountability

End Outcome Measures Intermediate or PART Measures/PART Efficiency or Other Outcome Measures	Type	FY 2004 Actual	FY 2005 Final Plan	FY 2005 Actual	FY 2006 Enacted	FY 2007 Plan	Change from 2006 Enacted to 2007 Plan	Long-term Target (2008) 2006 Pres. Request	Long-term Target (2008) Revised	Explanation of Changes: for changes from 2006 to 2007 and 2006 and 2008 target revisions
End Outcome Measures										
Obtain unqualified audit **(SP)**	A	Unqualified Opinion	Unqualified Opinion	Unqualified Opinion	Unqualified Opinion	Unqualified Opinion	0	Unqualified Opinion	Unqualified Opinion	
Intermediate Outcome Measures and Bureau and PART Outcome Measures Improved financial management										
Establish and maintain an effective, risk-based internal control environment as defined by the Federal Manager's Financial Integrity (FMFIA) and revised OMB Circular A-123	A	UNK	UNK	UNK	100%	100%	0	NA	100%	
Core Competencies Training for Fiscal Community: X% of fiscal community personnel trained in core competencies **(BUR)**	C	UNK	25%	50%	75%	100%	+25%	100%	100%	Target to increase by 25% was achieved.

End Outcome Goal 5.3: Modernization

End Outcome Measures Intermediate or PART Measures/PART Efficiency or Other Outcome Measures	Type	FY 2004 Actual	FY 2005 Final Plan	FY 2005 Actual	FY 2006 Enacted	FY 2007 Plan	Change from 2006 Enacted to 2007 Plan	Long-term Target (2008) 2006 Pres. Request	Long-term Target (2008) Revised	Explanation of Changes: for changes from 2006 to 2007 and 2006 and 2008 target revisions
End Outcome Measures										
X% of mission critical IT systems completing the IT security certification and accreditation process **(SP)**	A	100%	100%	100%	100%	100%	0	100%	100%	
Intermediate Outcome Measures and Bureau and PART Outcome Measures Citizen-centered E-government and information technology management										
IT Investment Management: X% of IT investments reviewed/approved through the CPIC process **(SP)**	A	100%	100%	100%	100%	100%	0	100%	100%	
IT Investments meet business/program needs: Business cases established for X% of USGS IT Investments **(BUR) (NK)**	A	100%	100%	100%	100%	100%	0	100%	100%	
Intermediate Outcome Measures and Bureau and PART Outcome Measures Citizen-centered E-government and information technology management										
Competition: # of FTE in competitive sourcing studies completed during the fiscal year **(SP)**	F	0 FTE	0 FTE	0 FTE	119FTE	524 FTE	+405 FTE	571 FTE	0 FTE	The targets gets for commercial-type FTE involved in competitive sourcing studies are not linear and cannot be compared on an annual basis on a trend analysis. Targets are based on the USGS Competitive Sourcing Green Plan FY 2005-2008 and are developed solely based on the number of FTE associated with the Business Areas selected for study.

End Outcome Measures Intermediate or PART Measures/PART Efficiency or Other Outcome Measures	Type	FY 2004 Actual	FY 2005 Final Plan	FY 2005 Actual	FY 2006 Enacted	FY 2007 Plan	Change from 2006 Enacted to 2007 Plan	Long-term Target (2008) 2006 Pres. Request	Long-term Target (2008) Revised	Explanation of Changes: for changes from 2006 to 2007 and 2006 and 2008 target revisions
End Outcome Measures										
Intermediate Outcome Measures and Bureau and PART Outcome Measures Performance/process improvement										
Facilities Management: X% of facilities that have a calculated Facilities Condition **(SP)**	A	95%	95%	100%	100%	100%	0	100%	100%	

Funding Goals Table

(Dollars in thousands)

Account/Budget Activity	RES. PROTECTION 1.1 Improve Health of Watersheds, Landscapes, and Marine Resources	RES. PROTECTION 1.2 Sustain Desired Biological Communities	RESOURCE USE 2.1 Manage or Influence Resource Use to Enhance Public Benefit, Promote Responsible Use, and Ensure Optimal Value - Energy	RESOURCE USE 2.2 Manage or Influence Resource Use to Enhance Public Benefit, Promote Responsible Use, and Ensure Optimal Value - Non-Energy Minerals	SERVING COMMNITIES 4.1 Protect Lives, Resources and Property	SERVING COMMNITIES 4.2 Advance Knowledge Through Scientific Leadership and Inform Decisions Through the Applications of Science	TOTAL
Surveys, Investigations, and Research							
Geog Res, Investigations, & Remote Sensing						76,614	76,614
Geologic Hazards., Resources, and Processes			26,131	30,785	82,396	78,106	217,418
Water Resources Investigations						204,047	204,047
Biological Research	39,923	107,437			3,270	21,967	172,597
Enterprise Information						111,230	111,230
Science Support						67,382	67,382
Facilities						95,472	95,472
SIR Appropriation, Total	39,923	107,437	26,131	30,785	85,666	654,818	944,760
Category total		*147,360*		*56,916*		*740,484*	*944,760*

Please note that the following DOI goals were not applicable to USGS and therefore were not displayed in the table above: Resource Protection 1.3; Resources Use 2.3, 2.4, 2.6, and 2.7; Recreation 3.1, 3.2, and 3.3; Serving Communities 4.3, 4.4, and 4.5;

Research and Development Criteria

The Department is using the Administration's Research and Development (R&D) investment criteria to demonstrate the value of its R&D programs. The criteria were developed by OMB in response to limited financial resources and the multitude of R&D opportunities that exist governmentwide. The criteria are used to rigorously justify new programs and to re-evaluate existing programs for modification, redirection, or termination, in keeping with national priorities and needs. The investment criteria evaluate the **relevance, quality, and performance** for all R&D programs.

To assure the best value of its limited R&D resources, the Department has created an R&D Council to assist in planning, coordinating, and assessing agency R&D activities. When necessary, the R&D Council will recommend the redirection of resources or a change in the scope of activities if it believes such a change is warranted. Council membership includes one program and one budget representative from each bureau, as well as representatives from the Department. The Office of the Assistant Secretary for Water and Science leads the Council. As part of the FY 2007 budget process, the bureaus identified their research and development activities and presented their budget requests for such activities to the Council, explaining their use of the investment criteria when making budgetary recommendations. During its first year, the Council accepted a definition for R&D for the Department based on the OMB Circular A–11 definition and is ensuring that all bureaus are interpreting the definition in the same manner, reviewed all FY 2007 budget submissions relating to R&D activities, approved guidelines for peer review across the Department, based on OMB's Quality Information Bulletin, and will publish a chapter in the Departmental Manual that will institutionalize the Science Code of Conduct.

USGS provides the Knowledge Creation and Management mode of delivery for the Government's Environmental Management, Natural Resources, and Disaster Management services for citizens as defined by the OMB Business Reference Model. The USGS primary product is scientific information. Quantitative measures of our **performance** are tangible and directly related to inputs, but they are primarily outputs (e.g., number of scientific papers published, data collected). The ultimate outcome related to our providing scientific information is that a stakeholder has the information (land manager's inputs) with which to make an informed decision. Quantitative impact measures (e.g., the acreage of ecosystems restored by a land manager) are only indirectly linked to USGS outcomes. To get at the impact of USGS science on land and resource decisionmaking and therefore its **relevance**, USGS measures customer satisfaction with quality, availability and utility of our science products and measures the use of information in decisionmaking processes such as the Energy Resources program tracking use of investigations by partners within 3 years of science product delivery and Geologic Hazards programs tracking the percent of communities using our science on hazard mitigation, preparedness and avoidance. USGS also takes our ability to leverage resources through partnerships as an additional indication of relevance.

To further advance measurement of relevance, USGS has in the PART process pursued development of shared or paired performance measures with other bureaus or agencies. For the current PART year, the following relationships were formalized:

The National Cooperative Geologic Mapping Program has developed shared or linked measures with the National Park Service, the USGS Ground Water Resources Program, and the hazard mitigation community. This linkage is possible because geologic maps are multi-

purpose products (outputs) that contribute directly to a large variety of useful derivative products needed by decisionmakers. The three linked outcome measures will demonstrate how communities use these derivative products to (1) make informed management decisions in National Parks, (2) find and protect ground water resources necessary for the Nation's future, and (3) mitigate against a variety of natural hazards, such as landslides and earthquakes.

USGS NCGMP	Linked program
X% of geologic investigations in National Park Service (NPS) units that are cited for use by the NPS within three years of delivery	**NPS**: X% of completed data sets of natural resource inventories
X% of U.S. with geologic maps that are being integrated into ground-water availability status and trends to support resource management decisions	**USGS Water Resources**: X% of U.S. with ground-water availability status and trends information to support resource management decisions
# of counties or comparable jurisdictions that have adopted hazard mitigation measures based in part on geologic mapping and research	**USGS Geologic Hazards**: X% of communities using DOI science on hazard mitigation, preparedness and avoidance

Biological Research has developed phased, paired measures with the U.S. Fish and Wildlife Service Migratory Bird Program (FWS–MBP). During their PART process in FY 2004 FWS–MBP established as a goal a net increase in the percent of migratory bird species at healthy and sustainable levels. Interior bureaus responsible for managing birds and bird habitat require scientific information from USGS to draft and execute effective management and species recovery plans. During the PART process in FY 2005, the USGS engaged the FWS–MBP in a dialog on how best to support USFWS migratory bird conservation. By the end of FY 2005, FWS MBP finalized the list of focal species of concern, and is developing a complete list of necessary management actions for these focal species by the end of FY 2006. The FWS and USGS agreed to a phased approach for the shared performance measure, in which the USGS and FWS are developing draft targets for the wildlife subprogram measure based on the list of FWS focal species. A review of the USGS science portfolio showed that USGS is currently conducting research on all nine of the initially identified focal species. Targets for the performance measure would be updated, and the performance measure refined, after the FWS completes action plans for focal species and works toward assembling the universe of management actions for migratory bird conservation.

To provide an indication of the increase in delivery of scientific information and technical assistance to natural resource managers to make decisions regarding management of high priority migratory bird species identified by the FWS, the USGS wildlife program based their measure on a critical factor analysis (state of available knowledge) of five biological factors: distribution/status; life history/demography; habitat; breeding biology; and conservation and management limitations. The USGS Status and Trends subprogram also developed a linked measure based on the Breeding Bird Survey, where extending the number of routes monitored with qualified volunteers increases the amount and quality (detectability/sensitivity) of status and trend data for an increasing proportion of migratory bird species, including FWS-identified focal species. The USGS Biological Information Management and Delivery program focused on making information available in a useful and useable manner. The paired measures are as follows:

USGS Biological Research	Linked program
Biological Research and Monitoring: Wildlife Subprogram — improve the % of focal migratory bird species for which scientific information is available to support resource management decisionmaking	**FWS:** Improve the % of migratory bird populations at healthy and sustainable levels
Biological Research and Monitoring: Status and Trends Subprogram — improve the % of North American migratory birds for which scientific information on their status (species distribution and number) and trend are available to inform and improve conservation	
Biological Information Management & Delivery — % of North American migratory birds for which scientific information on their status (species distribution and number) and trends are available in a standardized and exchangeable format to improve conservation plans of Federal and State agencies	

Peer review has been the **quality** standard for USGS scientific publications and a documented component of USGS policy throughout its 126-year history. USGS programs are cyclically evaluated to ensure the quality and timeliness of its science. The evaluations not only improve the accountability and quality of programs, but also identify and address gaps in programs; redirect or reaffirm program directions; identify and provide guidance for development of new programs; and review and motivate managers and scientists. All USGS programs evaluated by the OMB PART process have a "moderately effective" rating or better. These evaluations are the foundation on which USGS gages performance relative to the Department end outcome measure for soundness of methodology, accuracy, and reliability of science.

Thorough and broad scientific review is central to the quality of USGS products. The USGS has developed a set of fundamental science practices, philosophical premises, and operational principles that are the foundation for all USGS research and monitoring activities. These fundamental science practices do not address what work the USGS should do but rather how the science is carried out and how the resulting information products are developed, reviewed, approved, and released. The USGS is now developing the necessary bureau-wide policies and guidelines for these fundamental science practices.

> It is the policy of the USGS to conduct its activities and to make the results of its scientific and engineering investigations available in a manner that will best serve the whole public, rather than the interest or benefit of any special group, corporation, or individual.
>
> From the *U.S. Geological Survey Manual (500.14)*

The USGS has been engaged in a departmental task force for the development of a policy on peer review, the quality assurance procedure for research. The task force reviewed the current status of peer review policies in Department bureaus and the adequacy of the guidelines developed and implemented in 1996. New peer review guidance documents are being developed as Survey Manual policy chapters and a comprehensive handbook to guide peer and policy review. These respond to existing and new USGS policy on peer review, new departmental guidelines, the draft Code of Scientific Conduct, the growing interest in peer review by Congress, and OMB memorandum M–05–03, dated December 15, 2004, "Final Information Quality Bulletin for Peer Review." USGS developed specific guidance to respond to OMB guidelines and posted required information on a Web site *http://www.usgs.gov/peer_review/* in June 2005 with a second phase due in December 2005. USGS announced products that will be peer reviewed as "highly influential scientific assessments."

> "Influential scientific information" means scientific information that USGS reasonably determines will have or does have a clear and substantial impact on important public policies or private sector decisions.

An "assessment" is defined by OMB as: "an evaluation of a body of scientific or technical knowledge, which typically synthesizes multiple factual inputs, data, models, assumptions, and/or applies best professional judgment to bridge uncertainties in the available information."

A scientific assessment is a subset of "influential scientific information" and is considered "highly influential" by OMB if: "the agency or the OIRA Administrator [Office of Information and Regulatory Affairs in OMB] determines the dissemination could have a potential impact of more than $500 million in any one year on either the public or private sector or that the dissemination is novel, controversial, or precedent setting, or has significant interagency interest."

The following titles will be peer reviewed as "highly influential science" and have Peer Review Plans posted on the Web site:

- *Land and Air Management Impacts on Methylmercury Contamination of the Everglades*
- *Southeast Extension of the Southern Whidbey Island Fault, Washington: Implications for Earthquake Hazards*
- *Initial Application of a Petroleum Play-Based Assessment of CO_2 Storage Capacity in the Uinta-Piceance Basin, Utah and Colorado, USA*

This effort is maintained by the USGS senior liaison for Interagency Programs and Science Partnerships.

R&D Investment Review Process

The bureau reviews R&D investments across its disciplines and weighs the value of existing programs against changing needs and priorities. In general, the USGS Director establishes program priorities for the budget year and issues a call for new initiatives in response to those priorities. He also accepts recommendations for all new ideas, regardless of whether they address the priorities. The Director prioritizes the proposed initiatives on the basis of the following criteria: interdisciplinary science; collaboration and partnerships with Department bureaus, other government agencies, and universities (**relevance**); results of program evaluations; and demonstration of progress toward meeting the Department's **performance** goals and objectives. He selects from the prioritized initiatives those that he feels he can accommodate within the funding target. The amount of increase is directly related to whether there is an allowance within the target for growth, whether all increases must be offset, whether the target itself requires reductions from base, and whether fixed cost increases can be requested or must be offset. The request also addresses those items specifically required by the Department. The Capital Planning and Investment Control process provides support for decisions on technology necessary to support science and the business processes of the bureau.

R&D Funding

Research and development is the core of USGS mission. The USGS FY 2007 R&D funding request is $532 million or 56.3 percent of the USGS budget, a net decrease of $26.5 million or 1.2% from the FY 2006 enacted level. For the most part this net decline is due to decreases in research programs such as Mineral Resources, Water Resources Research Act Program, and Biological Research offset by lesser total increases for research and development initiatives such as Energy Resources and Landsat Data Continuity Mission respectively. Administration priorities and PART recommendations for emphasizing data collection have resulted in proposing increases in some programs that do not increase the level of R&D such as the $2.8 million increase for the National Streamflow Information Program also contribute to the lower net R&D funding.

Budget Activity	FY 2005 Actual	FY 2006 Enacted 1/	FY 2007 Request 1/
Geographic Research, Investigations, & Remote Sensing	**36,498**	**40,016**	**46,196**
Provides scientific information to describe and interpret America's landscape by mapping the Nation's terrain, monitoring changes over time, and analyzing how and why these changes have occurred.			
Geologic Hazards, Resources, & Processes	**209,678**	**212,266**	**194,029**
Geologic hazards programs gather long term data, operate monitoring networks, perform assessments and modeling, and disseminate findings to enable planners to design hazard resistant buildings in areas at risk and emergency responders to warn of impending disasters. Geologic resources programs assess the availability and quality of the Nation's energy and mineral resources. Geologic processes programs research, monitor, and assess the landscape to understand geologic processes to help distinguish natural change from those resulting from human activity.			
Water Resources Investigations	**126,225**	**126,292**	**115,115**
Conducts a wide variety of work related to water availability, water quality, and flood hazards, with efforts including: (1) collection, management, and dissemination of hydrologic data; (2) analysis of hydrologic systems through modeling or statistical methods; and (3) research and development leading to new methods and new understanding.			
Biological Research	**172,445**	**178,544**	**172,596**
Generates and distributes scientific information needed in the conservation and management of the Nation's biological resources.			
Enterprise Information	**1,370**	**1,476**	**4,136**
Conducts information science research to enhance *The National Map* and National Spatial Data Infrastructure. Investigates methods to derive, display, and utilize seamless, generalized, consistent geospatial data from distributed Federal, State, and local government and private sector data sources. Federal Geospatial Data Committee grants fund developmental research on geospatial data topics.			
TOTAL R&D	**546,216**	**558,594**	**532,072**
TOTAL BUDGET	**948,564**	**970,645**	**944,760**

1/ The USGS is conducting a review of R&D. These figures are subject to change based on the results of the review.

USGS R&D Increases — The FY 2007 budget proposed R&D funding for USGS strategic initiatives focused on:

- Merging the information about disparate hazards into integrated products to support land-use planning, hazards mitigation, emergency response, and business recovery;
- Ensuring the continuity of Landsat data availability to support research applications and change detection, and
- Supporting gas hydrate research and assessment in a joint effort with MMS and BLM.

Integrated Multi-Hazards Demonstration Project

Relevance — On November 3, 2004, USGS held a listening session with a broad spectrum of partners on *Reducing the Risks of Natural Hazards,* defining roles and scoping partners' contributions in a facilitated process. Relevance was the cornerstone of what developed into the proposed multi-year, multi-hazard initiative, focusing on understanding the cause and consequences of natural hazards; merging the information about the disparate hazards into integrated products to support land-use planning, hazards mitigation, emergency response, and business recovery; and sharing that information with the community to help society prepare for and recover from natural disasters.

Science in a Time of Need — Relevance

December 26, 2004, saw one of the worst natural disasters in recent history, as an incredibly powerful earthquake and subsequent tsunami caused widespread destruction throughout the Indian Ocean. The loss of life and property was astounding, and concerned individuals and organizations worldwide have resolved to assist the victims and mitigate the impacts. The USGS is no exception.

The USGS provided real-time earthquake information to government authorities in the Indian Ocean, and freely distributed many types of tsunami-related satellite imagery and geospatial data to support the needs of U.S. and international aid organizations. USGS scientists are in the Indian Ocean basin, assessing impacts and assisting in the creation of systems to deal with possible future events..

In a time of crisis and need, USGS science was brought to the forefront with a direct and beneficial impact at the time of the disaster, and subsequently as USGS technology upgrades and research play a crucial role in the President's plans for a new tsunami detection and warning system.

Performance was guided by PART and National Research Council evaluations and metrics defined within the context of the Department of the Interior's Strategic Plan Serving Communities mission area, and Protect lives, resources, and property end outcome goal. Activities were defined within the framework of activity based cost/management and include —

- Monitoring efforts to collect data about the hazard,
- Research to better predict and assess the impact, and
- Technical assistance in the form of mitigation and partnership programs to prepare the community to use our data.

EROS Team Wins Interagency Resources Management Conference Award — Quality

In April 2005, The National Center for Earth Resources and Observation and Science (EROS) Emergency Response Team won the Interagency Resources Management Conference 2005 Team Award for its support of Indian Ocean tsunami relief, response, and recovery efforts. The Award is presented each year to those who have demonstrated exceptional ability to operate across organizational boundaries to improve the Government's services to citizens. The selection was based on demonstrated leadership in operating across organizational boundaries, willingness and ability to treat obstacles as challenges and not barriers, and measurable improvements in performance linked to mission objectives and results.

The EROS Emergency Response Team's day-to-day working-level staff consists of a handful of individuals. However, to respond to the emergency tsunami effort, its ranks swelled to over 65 people, representing nearly every department at EROS. The expanded team provided emergency support to many Federal and international organizations that were helping the victims of the tsunami.

Quality — Peer review and customer satisfaction with new products will define the quality framework.

Landsat Data Continuity Mission (LDCM)

Relevance — On August 13, 2004, the President's Science Advisor released a memorandum outlining the Administration's strategy for continuing the availability of Landsat data into the future. The LDCM (Landsat 8) will require augmentation of the existing data archiving, processing, and distribution systems within the USGS, and this budget accordingly requests an increase of $15.95 million to fund those activities. Coordination and

development of agreements with potential Landsat-continuity partners, including international cooperators and a Science Advisory Panel defining the suite of products ensures relevance.

Performance — The rePARTing of *The National Map* for the FY 2006 budget process resulted in a score of "effective." Among the findings, the assessment suggested that, while the USGS had met its responsibilities for collecting and distributing medium- and high-resolution land remote sensing data, it needed to develop long term measures for the land remote sensing program in consultation with the Department and OMB. The LDCM project's performance measures will fulfill this objective. Performance for the developmental efforts is vetted through the Capital Planning and Investment Control Process. Performance metrics for the program are defined within the context of the Department of the Interior's Strategic Plan's Serving Communities mission area, Advance knowledge and inform decisions end outcome goal.

Quality — Developmental reviews with NASA ensure quality. Customer satisfaction will define the quality framework.

Energy Policy Act of 2005 — Research

Relevance — The joint Office of Management and Budget/Office of Science and Technology Policy Research and Development priorities for FY 2007 note that the Administration's energy and environmental research initiatives are critical for achieving sustained economic growth while ensuring national energy security and a healthy environment. The Energy Policy Act of 2005 calls for several major activities for which performance is critical for success and mandated to conduct the work. First, the Act focuses on the use of all energy sources, with an emphasis on assessment of geothermal energy (Section 226), and unconventional energy sources such as gas hydrates and oil shale (Sections 968 and 369). Further, the Act calls for creation of a National Geological and Geophysical Data Preservation Program (Section 351) to rescue, curate, and preserve materials and data related to energy and minerals. It also requires a sea-floor and sub-bottom characterization of the geologic, regulatory, human utilization, and environmental setting of Outer Continental Shelf (OCS) lands (Section 388).

Evaluating New Energy Resources to Meet Future Needs: Gas Hydrates — Performance

Summer 2005 marked the release of a special volume detailing recent research efforts associated with the Mallik Drilling Project, a project to investigate the ability to produce natural gas from natural gas (methane) hydrates. Natural gas hydrates, which are unconventional accumulations of natural gas (methane) trapped in ice-like structures with water, represent an immense energy resource underlying large portions of the world's arctic continental areas and marine continental shelves. While these accumulations ultimately may yield important sources of energy for the world, additional scientific and engineering research needs to be undertaken to render feasible gas production from these accumulations. The USGS was a scientific co-lead in this effort and is co-editor of this landmark publication.

Performance — The PART found the Energy Resources Program working effectively with partners and fulfilling its mission, with a rating of "moderately effective," an indication of the program's ability to deliver performance goals. Performance metrics for the two programs are defined within the context of the Department of the Interior's Strategic Plan Resource Use mission area, Management or influence resource use to enhance public benefit, promote responsible use, and ensure optimal value and end outcome goal Serving Communities mission area, Advance knowledge through scientific leadership and inform decisions through the application of science end outcome goal.

Quality — Quality is ensured not only by peer review but also by annual reviews by the following: USGS gas hydrates research by NRC as required under the Methane Hydrate

Research and Development Act 2000; review of preservation work by the USGS National Cooperative Geologic Mapping Program FACA.

Basic, Applied, and Development

In accordance with OMB Circular A–11, USGS research activities are classified as basic, applied, or developmental research. A definition of each of the categories follows.

Basic — defines activities as systematic studies directed toward fuller knowledge or understanding of the fundamental aspects of phenomena and observable facts without specific applications toward processes or products in mind.

Hurricane Impact, Restoration, Mitigation Research

The Gulf of Mexico and southeast Atlantic coasts of the United States, the most hurricane prone regions of the Nation, have been battered by severe hurricanes in the last 2 years. Hurricane Katrina, one of the largest and most destructive storms in recent years, has wreaked havoc on New Orleans and coastal Mississippi, causing widespread devastation to lives, property, and the economy. The USGS responds to hurricanes, and other natural hazard disasters, working in partnership with other Federal, State, and local agencies to provide long-term assessments of coastal vulnerability to hurricanes, real-time assessments of vulnerability immediately prior to storm landfall, and rapid post-storm assessments of coastal change to support post-storm recovery efforts.

The USGS currently is working to merge forecast simulations of waves and storm surge, developed collaboratively with NOAA's National Hurricane Center, with detailed interpretations of coastal elevation, morphology, and geology from cooperative mapping efforts to assess coastal vulnerability and forecast coastal change as hurricanes continue to threaten the U.S. southeast Atlantic and Gulf of Mexico mainland. Models of hurricane processes, observations of storm-driven coastal response, and systematic characterization of the threatened coastal setting support research efforts to improve the USGS-led development of coastal vulnerability and change models applicable nationwide.

Applied — defines activities as systematic studies to gain knowledge or understanding necessary for determining the means by which a recognized and specific need may be met.

Development — defines activities as systematic application of knowledge or understanding, directed toward the production of useful materials, devices, and systems or methods, including design, development, and improvement of prototypes and new processes to meet specific requirements.

Of USGS $529.6 million R&D funding request for FY 2007, 7 percent is classified as basic research, 84 percent applied research, and 9 percent development. The distribution of basic, applied, and developmental research to goals is provided at the end of this section. USGS science is being used increasingly more often in decisionmaking, which demonstrates increasing relevance. That does not mean that the entirety of USGS science needs to be applied; as former Director Walter C. Mendenhall said, "There can be no applied science unless there is science to apply."

The following example demonstrates the relationship of USGS **development** and **applied research** in Alaska, the most seismically active State in the Nation. Today, Alaskans have a better network of seismic stations and an improved ability to monitor earthquake activity as a result of USGS partnerships with the State, the University of Alaska Fairbanks Geophysical Institute, and the city of Anchorage. In March 2004, as part of the commemoration of the anniversary of the 1964 magnitude 9.2 Good Friday earthquake in Anchorage (Prince William Sound), USGS and partners installed a 32-channel strong motion instrument array in the Atwood Building, one of the tallest structures in Alaska, and installed instrument packages in six nearby boreholes in the ground. The borehole sensors and the instrumentation in the building will determine how the ground and the building respond to future earthquake shaking,

information essential for engineers to mitigate property damage and loss of life. This was a critical first step in making the cities and the people in Alaska safer from the devastating effects of earthquakes. This enhanced seismic network is now allowing USGS and partners to implement ShakeMap (available at: *http://earthquake.usgs.gov/shakemap/*) in the City of Anchorage. This tool will provide first responders with the information they need to assess the intensity and distribution of strong ground shaking in the critical minutes following an earthquake. The USGS scientist who developed ShakeMap—a rapidly generated computer map that shows the location, severity, and extent of strong ground shaking within minutes of an earthquake earned the prestigious Legacy Award for his work. He not only developed the methodology behind ShakeMap, but also coordinated implementation of the system in emergency response centers across the western United States.

Efforts in restoring the Everglades provide an outstanding example of **basic** research with science applications that address issues resulting from nearly a century of wetland drainage and impoundment and that provide the information needed to restore the health of this unique ecosystem. The USGS provides the primary science support to the Department for resource management and restoration in South Florida. These and other studies are providing the highest quality scientific research and scientific information so that our partners at Interior and State and local agencies can fulfill their resource management and technical responsibilities.

Over the past few years, changes have been made by one or another of the disciplines in the use of these definitions in classifying their activities. The USGS has created a team consisting of the chief scientists for each of the disciplines and an OBP representative to analyze the classification of R&D across the bureau to ensure consistency in interpretation and application of the OMB definitions.

DOI Goals By R&D Type FY 2004 to 2007
(Dollars in Thousands)

DOI Goals and R&D Type	FY 2004 Actual	FY 2005 Actual	FY 2006 Enacted	FY 2007 Request
Resource Protection				
1.1 Improve health of watershed and landscapes				
R&D Basic	1,213	1,193	2,881	2,795
R&D Applied	37,214	36,732	37,043	35,931
R&D Development	2,778	2,732	1,235	1,197
Subtotal, R&D for 1.1	**41,205**	**40,657**	**41,159**	**39,923**
1.2 Sustain biological communities				
R&D Basic	3,945	3,901	7,841	7,675
R&D Applied	97,351	96,603	98,196	96,010
R&D Development	7,366	7,285	3,884	3,823
Subtotal, R&D for 1.2	**108,662**	107,789	109,921	107,508
Subtotal, Resource Protection				
R&D Basic	5,158	5,094	10,722	10,470
R&D Applied	134,565	133,335	135,239	131,941
R&D Development	10,144	10,017	5,119	5,020
Subtotal, R&D for 1.X	**149,867**	**148,446**	**151,080**	**147,431**
Resource Use				
2.1 Manage or influence resource use - energy				
R&D Basic	5,014	4,650	4,752	5,226
R&D Applied	20,054	18,600	19,008	20,904
R&D Development	0	0	0	0
Subtotal, R&D for 2.1	**25,068**	**23,250**	**23,760**	**26,130**
2.2 Manage or influence resource use - non-energy				
R&D Basic	11,096	10,803	10,555	6,158
R&D Applied	44,385	43,211	42,219	24,632
R&D Development	0	0	0	0
Subtotal, R&D for 2.2	**55,481**	**54,014**	**52,774**	**30,790**
Subtotal, Resource Use				
R&D Basic	16,110	15,453	15,307	11,384
R&D Applied	64,439	61,811	61,227	45,536
R&D Development	0	0	0	0
Subtotal, R&D for 2.X	**80,549**	**77,264**	**76,534**	**56,920**
Serving Communities				
4.1 Protect lives, resources, and property				
R&D Basic	1,978	2,072	2,404	2,391
R&D Applied	32,144	33,074	38,084	38,284
R&D Development	17,270	21,015	21,162	21,530
Subtotal, R&D for 4.1	**51,392**	**56,161**	**61,650**	**62,205**
4.2 Advance knowledge through scientific leadership & informed decisions				
R&D Basic	13,423	13,068	13,400	13,456
R&D Applied	236,238	232,669	235,237	229,263
R&D Development	21,261	18,608	20,693	22,797
Subtotal, R&D for 4.2	**270,922**	**264,345**	**269,330**	**265,516**
Subtotal, Serving Communities				
R&D Basic	15,401	15,140	15,804	15,847
R&D Applied	268,382	265,743	273,321	267,547
R&D Development	38,531	39,623	41,855	44,327
Subtotal, R&D for 4.X	**322,314**	**320,506**	**330,980**	**327,721**
Total				
R&D Basic	36,669	35,687	41,833	37,701
R&D Applied	467,386	460,889	469,787	445,024
R&D Development	48,675	49,640	46,974	49,347
Subtotal, R&D for All DOI Goals	**552,730**	**546,216**	**558,594**	**532,072**
USGS Budget Authority	937,984	948,564	970,645	944,760

2007 Budgetary Changes at a Glance
(Dollars in Thousands)

	FY 2005 Actual	FY 2006 Enacted	Fixed Costs Changes	Internal Transfers	Program Changes	2007 President's Budget
Appropriation: Surveys, Investigations and Research						
Geographic Research, Investigations, & Remote Sensing						
Cooperative Topographic Mapping	**71,393**	**68,855**	**0**	**-68,855**	**0**	**0**
Land Remote Sensing	**32,730**	**45,713**	**293**	**2,768**	**12,980**	**61,754**
1 LDCM Development Costs	NA	NA			15,950	[15,950]
2 Eliminate AmericaView	[3,000]	[2,970]			-2,970	[0]
Geographic Analysis and Monitoring	**14,628**	**14,705**	**369**	**1,786**	**-2,000**	**14,860**
1 Integrated Multi-Hazards Demonstration Project	NA	NA			300	[300]
2 Reduce Geographic Research	[2,300]	[2,300]			-2,300	[0]
Total, GRIRS	**118,751**	**129,273**	**662**	**-64,301**	**10,980**	**76,614**
Geologic Hazards, Resources, & Processes						
Geologic Hazard Assessments	**84,079**	**81,000**	**896**	**0**	**500**	**82,396**
Integrated Multi-Hazards Demonstration Project	NA	NA			500	[500]
Geologic Landscape & Coastal Assessments	**76,253**	**77,752**	**992**	**0**	**-638**	**78,106**
1 Integrated Multi-Hazards Demonstration Project	NA	NA			200	[200]
2 Reduce Global Dust Study – Unrequested Earmark	[734]	[726]			-247	[479]
3 Eliminate Florida Shelf Research – Unrequested Earmark	NA	[591]			-591	[0]
Geologic Resource Assessments	**77,014**	**76,534**	**1,325**	**0**	**-20,943**	**56,916**
1 Gas Hydrate Research	[1,500]	[1,970]			500	[2,470]
2 Energy Studies and Assessments (Oil Shale)	NA	NA			500	[500]
3 Preservation of Data	NA	NA			1,000	[1,000]
4 Reduce Minerals Research and Assessment Activities	[53,764]	[52,774]	[954]		-22,943	[30,785]
Total, GHRP	**237,346**	**235,286**	**3,213**	**0**	**-21,081**	**217,418**
Water Resources Investigations						
Hydrologic Monitoring, Assessments & Research	**142,454**	**142,527**	**2,805**	**0**	**-3,456**	**141,876**
1 Integrated Multi-Hazards Demonstration Project	NA	NA			200	[200]
2 National Streamflow Information Program	[13,814]	[13,944]	[295]		2,325	[16,564]
3 Memphis Aquifer Study – Unrequested Earmark	NA	[493]			-493	[0]
4 Ozark Aquifer Study – Unrequested Earmark	NA	[227]			-227	[0]
5 NAWQA Technical Support	[954]	[940]			-940	[0]
6 Petroleum Contamination Study (Oklahoma)	[227]	[227]			-227	[0]
7 Roubidoux Aquifer (Oklahoma) – Unrequested Earmark	[1,460]	[1,231]			-1,231	[0]
8 Hood Canal Fish Mortality Study (Washington) – Unrequested	[345]	[99]			-99	[0]
9 San Pedro Partnership – Unrequested Earmark	[247]	[296]			-296	[0]
10 Long-Term Estuary Assessment Group (Louisiana)	[859]	[846]			-846	[0]
11 Reduce Water Quality Monitoring at Lake Champlain	[453]	[448]			-291	[157]
12 Complete Collection of Hydrologic Data at Tongue River (Montana)	[877]	[887]			-887	[0]
13 Reduce Monitoring of Water Resources in Hawaii	[437]	[444]			-444	[0]
Cooperative Water Program	**62,337**	**62,833**	**1,338**	**0**	**-2,000**	**62,171**
Reduce Cooperative Water Program	[62,337]	[62,833]	[1,338]		-2,000	[62,171]
Water Resources Research Act Program	**6,409**	**6,404**	**0**	**0**	**-6,404**	**0**
Eliminate Funding for 54 State Water Resource Institutes	[6,409]	[6,404]	[0]		-6,404	[0]
Total, WRI	**211,200**	**211,764**	**4,143**	**0**	**-11,860**	**204,047**

Program Changes

		FY 2005 Actual	FY 2006 Enacted	Fixed Costs Changes	Internal Transfers	Program Changes	2007 President's Budget
Biological Research							
Biological Research and Monitoring		**133,130**	**140,086**	**2,036**	**0**	**-6,430**	**135,692**
1	NatureServe	NA	NA			1,000	[1,000]
2	Integrated Multi-Hazards Demonstration Project	NA	NA			300	[300]
3	Pacific Northwest Forest Program	[2,922]	[2,879]			-1,000	[1,879]
4	Biological Assistance to NAWQA	[603]	[594]			-594	[0]
5	Wildlife Resources Program	[509]	[509]			-509	[0]
6	Reduction to Avian Influenza Funding	NA	[3,670]			-400	[3,270]
7	Molecular Biology at Leetown (West Virginia)-Unrequested Earmark	[779]	[788]			-788	[0]
8	Mark Twain National Forest Lead Mining – Unrequested Earmark	[731]	[345]			-345	[0]
9	Diamondback Terrapin Study (Maryland) – Unrequested Earmark	[195]	[197]			-197	[0]
10	Pallid Sturgeon Research – Unrequested Earmark	[296]	[345]			-345	[0]
11	DNA Bear Sampling in Montana – Unrequested Earmark	[974]	[394]			-394	[0]
12	Multidisc. Water Study at Leetown (West Virginia) – Unrequested Earmark	[292]	[197]			-197	[0]
13	Great Lakes Science Center Boat Dock – Unrequested Earmark	NA	[1,409]			-1,409	[0]
14	Equipment at Anadromous Fish Lab (Massachusetts) – Unrequested Earmark	NA	[148]			-148	[0]
15	Tunison Lab – Unrequested Earmark	NA	[247]			-247	[0]
16	Potomac Snakehead Program – Unrequested Earmark	NA	[172]			-172	[0]
17	Upper Midwest Environmental Science Center – Unrequested	NA	[197]			-197	[0]
18	Science Excellence with FWS – Unrequested Earmark	NA	[197]			-197	[0]
19	Ivory-billed Woodpecker Survey Equipment – Unrequested Earmark	NA	[394]			-394	[0]
20	Wetland Ecology Center at Univ. of Missouri – Unrequested Earmark	NA	[197]			-197	[0]
Biological Information Management & Delivery		**23,999**	**23,794**	**173**	**0**	**-2,000**	**21,967**
	Reduce Funding for the National Biological Information Infrastructure	[8,592]	[8,349]			-2,000	[6,349]
Cooperative Research Units		**14,570**	**14,664**	**274**	**0**	**0**	**14,938**
Total, BR		**171,699**	**178,544**	**2,483**	**0**	**-8,430**	**172,597**
Enterprise Information							
Enterprise Information Security and Technology		**22,714**	**24,866**	**309**	**0**	**797**	**25,972**
1	DOI WCF Increase	NA	NA			1,297	[1,297]
2	Operational Efficiencies	[500]	[500]			-500	[0]
Enterprise Information Resources		**16,989**	**16,900**	**225**	**0**	**-489**	**16,636**
1	DOI WCF Increase	NA	NA			11	[11]
2	Operational Efficiencies	[500]	[500]			-500	[0]
National Geospatial Program		**4,670**	**4,628**	**863**	**64,301**	**-1,170**	**68,622**
1	DOI WCF Increase	NA	NA			150	[150]
2	Integrated Multi-Hazards Demonstration Project	NA	NA			680	[680]
3	Geospatial Data Integration	[2,000]	[2,000]			-2,000	[0]
Total, EI		**44,373**	**46,394**	**1,397**	**64,301**	**-862**	**111,230**
Science Support		**65,584**	**69,302**	**2,090**	**0**	**-4,010**	**67,382**
1	Landsat Pay-back	NA	[3,941]			-3,941	[0]
2	Bureau Support Staff	[69]	[69]			-69	[0]
Facilities		**94,611**	**94,782**	**1,230**	**0**	**-540**	**95,472**
	Space Management Savings	[540]	[540]			-540	[0]
SIR, TOTAL		**943,564**	**965,345**	**15,218**	**0**	**-35,803**	**944,760**

Program Increases

(Dollars in thousands)

Component	FY 2007 Program Change ($000)	Page Reference
Landsat Data Continuity Mission	15,950	G - 5
Energy Resources	2,000	H - 101
National Streamflow Information Program	2,325	I - 46
NatureServe	1,000	J - 8
Departmental Working Capital Fund	1,458	K - 5, K - 15, K - 24
Integrated Multi-Hazard Demonstration Project	2,180	G - 21, H - 5, H - 29, H - 71, I - 45, J - 8, K - 24
Total	**$24,913**	

Geographic Research, Investigations, and Remote Sensing
Land Remote Sensing Subactivity

Landsat Data Continuity Mission **+$15,950,000**

The Landsat Data Continuity Mission (LDCM), also known as Landsat 8, will acquire and deliver highly calibrated, moderate resolution remotely sensed data that will extend the legacy of continuous collection of Landsat-like data. The Interior/USGS pivotal role in the mission is to design, implement and operate ground systems to provide the user community easy, reliable, and long-term access to geo-corrected products generated from the Landsat 8 data.

Between now and the launch of the satellite, the USGS will conduct engineering studies, develop a design, and implement a system capable of supporting the LDCM requirements. The USGS is responsible for designing, developing, and integrating a complex ground processing system that will acquire, process, archive, radiometrically and geometrically correct, and distribute Landsat 8 data to a well-established worldwide remote sensing community. Landsat 8 data and products will be available to the user community during FY 2011. The volume of data will be four times greater than that collected by Landsat 7, due to a combination of more daily acquisitions, additional spectral bands, and higher radiometric (brightness) resolution. This initiative meets both USGS and Department of Interior strategic objectives.

Geologic Hazards, Resources, and Processes
Geologic Resources Assessments

Energy Resources +$2,000,000

- **Energy Program —** The proposed increase of $500,000 is to expand work for which Congress provided $498,000 in FY 2006 to the Energy Resources Program (ERP) for study of gas hydrates on the North Slope of Alaska. The Department proposes increasing this $498,000 to $998,000 in FY 2007, for a coordinated effort with the Bureau of Land Management (BLM) and Minerals Management Service (MMS). The additional funds will enable a more comprehensive, cooperative effort with the BLM and MMS that includes (1) additional studies in hydrate-bearing areas of Federal jurisdiction (such as the Gulf of Mexico and Alaska), (2) a growth in the data processed, interpreted, and made available for hydrate research, and (3) study of the properties of gas hydrates in a variety of geologic and climatic settings to determine those settings and properties of greatest advantage in making hydrates a viable energy resource
- **Green River Oil Shale Assessment —** The proposed increase of $500,000 is to support Energy Policy Act 2005 legislation requiring a national assessment of the oil shale resources in the United States. USGS will begin the assessment in 2007 with USGS geologists in concert with IT or Geographic Information System (GIS) contractors and experts from State surveys. The proposed funding is necessary to procure contractual digitizing services (no past oil shale information is digital), build GIS databases, and partner with State surveys to conduct the evaluation and assessment efforts. The first analysis will be to determine the location, quality, and quantity of the Green River oil shale deposits of Colorado, Utah, and Wyoming (a 2-year effort). The proposed funding would be used to (1) determine the status and quality of all existing assessment data and maps, and locations of same, for these deposits, (2) determine areas of inadequate coverage of assessment data and gather additional data needed for better evaluation of the deposits, (3) evaluate the geophysical logs of oil and gas wells drilled on oil shale lands to understand the oil shale distribution, (4) digitize existing USGS oil shale resource maps, prepared in the 1980s, for immediate public distribution, (5) work on a new series of maps, sections, and tables using GIS programs to update the older oil shale quality analyses, which are central to an oil shale assessment, and (6) produce an assessment of the thickness, grade, and abundance of these oil shale deposits as well as create and compile digital (GIS) maps with overlays showing overburden thickness, grade, and abundance of the Green River oil shale resources in Colorado, Utah, and Wyoming.
- **Preservation of Geological and Geophysical Data —** The proposed increase of $1,000,000 would be used to meet mandates in the Energy Policy Act of 2005. The USGS plans a multistage response. The first stage will be undertaken in FY 2006 starting with the formation of an ad hoc Preservation Subcommittee under the Federal Advisory Committee (FAC) for the National Cooperative Geologic Mapping Program. The Subcommittee will develop an implementation plan, which must be submitted to Congress within one year of enactment of the law, for the new preservation program. This plan will set priorities for several funding scenarios within the proposed funding level. A survey of Department of the Interior agencies and State geological surveys will be undertaken in FY 2006 to discover the risk to geological and geophysical data holdings managed by these agencies, and estimate the resources needed to rescue and make available these materials. Finally, the Office of the Chief Scientist for Geology will create a position to

coordinate the preservation program and work with National Science Foundation (NSF) and the geologic community on common geoinformatics data issues.

In the second stage, several high-priority preservation efforts will be undertaken in FY 2007 with the proposed increase:

- A national data archive of geologic and geophysical information, including maps, well logs, engineering data and samples will be designed and started,
- Approximately 1,000 pallets of important oil shale cores, currently inaccessible and stored in the Anvil Mine, west of Denver, CO, will be brought to the USGS core repository at the Denver Federal Center, curated, and made available to researchers both within USGS and private industry,
- An expansion of the effort to preserve and make accessible on-line the extensive offshore seismic reflection data along the west coast of the United States donated by private industry,
- Begin addressing the Department of the Interior preservation and data rescue needs recognized in the survey conducted during FY 2006,
- Fund the program position on the Chief Scientist's staff to coordinate all data/sample preservation efforts and geoinformatics, and
- Initiate curation of critical paleontologic and other energy-related collections.

Water Resources Investigations

Hydrologic Monitoring, Assessments and Research Subactivity

National Streamflow Information Program **+$2,325,000**

The funds requested would enable the USGS to continue operation of 114 streamgages that would otherwise have been shut down due to anticipated loss of partner contributions. The funds would also allow the number of streamgages to increase by 30. Also, funding would give the USGS the flexibility to continue operations at high-priority sites identified in the NSIP plan as "Federal interest" streamgages, in the event that non-USGS funding partners decrease their contributions in FY 2007. Though the total number of streamgages has increased over the past 3 years, the loss of partner funding has caused a number of streamgage shut-downs in the last few years, and this trend is expected to continue in FY 2007, especially in Mississippi and Louisiana, where the budgets of State and local partner agencies have been taxed to their limit in the wake of Hurricane Katrina. The USGS anticipates that the funding requested for FY 2007 will help to ease the impact of funding pressures among the network's 800 partner agencies nationwide. In addition, the funds would provide resources for technological investments that will make the entire network more cost-efficient in the long term. These include procurement or development of improved software for data collection and data processing, and new instruments that are more reliable or make the data collection process more efficient.

Biological Research
Biological Research and Monitoring Subactivity

NatureServe +$1,000,000

Funding is provided for NatureServe as part of a broader strategy to improve delivery and access of information needed to support Department of the Interior bureaus in the fulfillment of their missions. The funding will support maintenance of the Natural Heritage database, an available database of nationally consistent species and ecosystem information needed for many forms of decisionmaking.

More broadly, program components of the Biological Resources discipline (such as the National Biological Information Infrastructure (NBII), Gap Analysis (GAP), and Status and Trends) will work with NatureServe and other partners to make information on the distribution of rare and endangered species and threatened ecosystems accessible by all Department of the Interior employees in versions that allow field offices to input their own data points and to analyze scenarios on the impacts of alternative management plans. This includes supporting analyses that can be applied to research and monitoring as well as natural resource management needs so that they can incorporate information from a variety of sources to understand the linkages between rare and endangered species and threatened ecosystems and the impacts and (or) effects of invasive species, diseases, climate change and natural hazards.

Enterprise Information

Departmental Working Capital Fund +$1,458,000

Additional increases are requested for the centrally billed portion of the Working Capital Fund as follows:

- **Enterprise Information Security and Technology (+$1,297,000) —** Enterprise Services Network and Electronic Messaging System.
- **Enterprise Information Resources (+$11,000) —** FOIA appeals.
- **Enterprise Information National Geospatial Program (+$150,000) —** Department Geographic Information Management.

Other Increases

Integrated Multi-Hazard Demonstration Project +$2,180,000

Geographic Analysis and Monitoring (+$300,000) — The Integrated Multi-Hazards Demonstration Project in Southern California, part of a multi-year initiative, focuses on (1) research and assessments on the cause and consequences of natural hazards, (2) response to the hazard events that merges information about disparate hazards into integrated products to support land-use planning, hazards mitigation, emergency response, and business recovery, and (3) information-sharing with the community to help society prepare for and recover from natural disasters. One goal of this work is to reduce losses of life and property

from natural disasters, which supports the end outcome goal of "Protect lives, resources, and property" under the mission goal of Serving Communities.

The Geographic Analysis and Monitoring part of the project will leverage $300,000 of new funds with $700,000 from cost savings or from the redirection of lower priority work to provide interactive GIS databases and decision support tools that incorporate new and existing information from seismic, flood, and geodetic monitoring systems for six natural hazards (earthquakes, tsunamis, fires, landslides, extreme coastal storms and floods) and land use/land cover characteristics. Web-based techniques that incorporate spatial and temporal hazards data will be developed to improve risk communication processes. These databases and decision support tools will assist in developing integrated hazard products for use in hazard mitigation planning, emergency management operations, and protection of business, industry, and government facilities in Southern California. The USGS will form 1 partnership in 2007 to link scientific information to societal decisions and 3 more in 2008 and beyond.

Earthquake Hazards (+$300,000) — The Integrated Multi-Hazards Demonstration Project in Southern California, part of a multi-year initiative, will focus on integrating information and products about multiple hazards to improve the usefulness of this information in reducing loss of life and property from natural hazards, which supports the end outcome goal of "Protect lives, resources, and property" under the mission goal of Serving Communities. The development of integrated databases and the enhancement of IT systems to track multiple hazards will facilitate more rapid communication and response to the user community, regardless of the timeframe of a natural disaster.

The requested increase for the Earthquake Hazards Program (EHP) component of this demonstration project is $300,000, to be enhanced by $700,000 from the redirection or postponement of lower priority work. The EHP role will be to conduct a systematic study of the earthquake history of the southernmost 550 kilometers of the San Andreas Fault. Another component is analysis of the geodetic information about land-surface movements collected by the NSF-funded Plate Boundary Observatory, which is deploying a network of GPS sensors along key portions of the plate boundary in the region. This work will benefit from leveraging the activities of the Southern California Earthquake Center (SCEC) which has identified the southern San Andreas Fault as a concentrated research topic for the next several years. The results from this assessment will be incorporated into a multi-hazard GIS framework developed in partnership with State and local emergency managers tasked with responding to earthquake events. Redirected funds will be used to initiate development of a first-ever time-dependent seismic hazard assessment for California. This effort will expand upon the time-independent assessment being conducted in FY 2006 in concert with the California Geological Survey and SCEC, and will be leveraged with support from the California Earthquake Authority (CEA). Redirected funds will also be used to seismically instrument structures in high-hazard areas of Southern California in order to collect data on building fragility, a key factor in understanding the region's earthquake risk.

Landslide Hazards (+$200,000) — The Integrated Multi-Hazards Demonstration Project in Southern California, part of a multi-year initiative, will focus on integrating information and products about multiple hazards to improve the usefulness of this information in reducing loss of life and property from natural hazards, which supports the end outcome goal of "Protect lives, resources, and property" under the mission goal of Serving Communities. The development of integrated databases and the enhancement of IT systems to track multiple hazards will facilitate more rapid communication and response to the user community, regardless of the timeframe of a natural disaster.

The LHP role in the Multi-Hazards Demonstration Project will be to implement a system for issuing watches and warnings of flash floods and debris flows in previously burned areas in Southern California in a joint effort with the NOAA. This information will be entered into interactive GIS databases with other hazards information to provide immediate and comprehensive response to decisionmakers and the public. The requested funds of $200,000 will be enhanced by $100,000 redirected from lower priority work. The increased funding to LHP will enhance several important performance measures already in place. Training and technical assistance will be given to National Weather Service meteorologists in Southern California, so they may understand how to incorporate debris flow advisories into flash flood warnings. Additional landslide hazard assessments for newly burned areas will be carried out, and the rain gauge network required for the successful implementation of the debris flow warning system in Southern California will become more robust.

The LHP role in the Multi-Hazards Demonstration Project will be to implement a system for issuing watches and warnings of flash floods and debris flows in previously burned areas in Southern California in a joint effort with NOAA. The NOAA/USGS Debris-Flow Warning System was initiated as a pilot project in FY 2006 through a Memorandum of Agreement.

Coastal and Marine Geology (+$200,000) — The Integrated Multi-Hazards Demonstration Project in Southern California, part of a multi-year initiative, will focus on integrating information and products about multiple hazards to improve the usefulness of this information in reducing loss of life and property from natural hazards, which supports the end outcome goal of "Protect lives, resources, and property" under the mission goal of Serving Communities. The development of integrated databases and the enhancement of IT systems to track multiple hazards will facilitate more rapid communication and response to the user community, regardless of the timeframe of a natural disaster.

With $200,000 of requested funds and $200,000 from cost savings, CMG will develop models and tools to assess coastal vulnerability to extreme storm events, in partnership with the State of California and the U.S. Army Corps of Engineers. CMG will continue collaborative activities with the National Tsunami Hazard Mitigation Program and the University of Southern California to advance tsunami modeling and inundation mapping.

National Streamflow Information Program (+$200,000) — To improve efficiencies and effectiveness of current research and response to natural hazards, the USGS is proposing a demonstration project that holistically links natural hazards mitigation efforts in specific geographic areas. The NSIP part of the demonstration project includes flood inundation analysis and improved streamgaging networks to fill critical gaps in the areal coverage within the project area. About 18 streamgages and raingages will be added to the existing network in the Southern California study area. Sites will be upgraded to allow real-time transmission of soils and environmental monitoring data. These data are used in flood, landslide, and debris-flow forecasting and warning. The work described above would be accomplished with a combination of the $200,000 increase requested in this budget and the redirection of $900,000 from lower priority NSIP activities in other areas of the country.

Biological Research and Monitoring (+$300,000) — The Integrated Multi-Hazards Demonstration Project in Southern California, part of a multi-year initiative, will focus on integrating information and products about multiple hazards to improve the usefulness of this information in reducing loss of life and property from natural hazards, which supports the end outcome goal of "Protect lives, resources, and property" under the mission goal of Serving

Communities. The development of integrated databases and the enhancement of information technology systems to track multiple hazards will facilitate more rapid communication and response to the user community, regardless of the timeframe of a natural disaster.

One element of this integrated project would focus on wildfire research. New work on investigations on the role of fire suppression and fuels accumulation in chaparral ecosystems, specifically on the relation of wildfire intensity and severity to fuels accumulations affected by historical fire suppression, human fire ignitions during extreme weather conditions, and the interspersion of urban and wildland areas will build on current activities. An additional $100,000 would be redirected from lower priority fire activities to this initiative. The USGS would provide one workshop for customers in FY 2007.

National Geospatial Program (+$680,000) — The budget includes an increase of $680,000 to continue development and implementation of the EI activities related to the Integrated Multi-Hazards Demonstration Project. The USGS will redirect $1,000,000 from lower priority activities to make enhancements to key IT infrastructure components to support the Integrated Multi-Hazards Demonstration Project. Enhancements will include providing more intensive network monitoring and technical support service for selected critical network components to detect and restore outages as quickly as possible, as well as acquisition of network hardware and software (switches, routers, etc.) and additional leased circuits to strengthen network redundancy and failover.

FY 2007 Priority Goals and Resources by DOI Goal ($000)

Resource Protection

End Outcome Goal: PEO.1. – Improve health of watersheds, landscapes, and marine resources that are DOI managed or influenced in a manner consistent with the obligations regarding the allocation and use of water.			
Biological Research, Biological Research and Monitoring	Hazards Initiative	$300	+1 workshop or training provided to customers

End Outcome Goal: PEO.2. – Sustain biological communities on DOI managed or influenced lands and waters in a manner consistent with the obligations regarding the allocation and use of water.			
Biological Research, Biological Research and Monitoring	NatureServe	$1,000	Though the program contributes to the strategic goal of sustaining biological communities, there are no performance measures specifically linked to this program change.

Resource Use

End Outcome Goal: UEO.1. – Manage or influence resource use to enhance public benefit, promote responsible use, and ensure optimal value - Energy			
Geologic Resource Assessment, Energy Resources	Energy Program	$500	Impact in Outyears
Geologic Resource Assessment, Energy Resources	Green River Oil Shale Assessment	$500	Impact in Outyears
Geologic Resource Assessment, Energy Resources	Preservation of Geological and Geophysical Data	$1,000	Impact in Outyears

Serving Communities

End Outcome Goal: SEO.1. – Protect lives, resources, and property			
Geologic Hazard Assessments, Earthquake Hazards	Hazards initiative	$300	+1 systematic analyses & investigations delivered to customers (risk/hazard assessments) +1 formal workshops or training provided to customers (instances/issues/ events)
Geologic Hazard Assessments, Landslide Hazards	Hazards Initiative	$200	Though the program contributes to the strategic goal of protecting lives, resources, and property, there are no performance measures specifically linked to this program change.

End Outcome Goal: SEO.2. – Advance knowledge through scientific leadership and inform decisions through the application of science.			
Geographic Research, Investigations, and Remote Sensing, Land Remote Sensing	Landsat Data Continuity Mission	$15,950	+16% of ground system designed, built and tested in FY 2007
Geographic Research, Investigations, and Remote Sensing, Geographic Analysis and Monitoring	Hazards Initiative	$300	+1 partnership formed to link scientific information and societal decisions
Geologic Hazard Assessments, Coastal and Marine Geology	Hazards initiative	$200	+1 systematic analyses & investigations delivered to customers (risk/hazard assessments)
Water Resources Investigations, Hydrologic Monitoring, Assessments, and Research, National Streamflow Information Program	Network Operations	$2,325	+1% content and expanse of knowledge base (% of proposed streamflow sites currently in operation that meet one or more Federal needs) +144 real-time streamgages reporting in NWISWeb +1% river basins that have streamflow stations +1% WRD streamflow stations with 30 or more years of record
Water Resources Investigations, Hydrologic Monitoring, Assessments, and Research, National Streamflow Information Program	Hazards Initiative	$200	Though the program contributes to the strategic goals of advancing knowledge through scientific leadership and informing decisions through the applications of science, there are no performance measures specifically linked to this program change.
Enterprise Information, Enterprise Information Security and Technology	Enterprise Services Network and Electronic Messaging System	$1,297	Though the program contributes to the strategic goals of advancing knowledge through scientific leadership and informing decisions through the applications of science, there are no performance measures specifically linked to this program change.
Enterprise Information, Enterprise Information Resources	FOIA Appeals	$11	Though the program contributes to the strategic goals of advancing knowledge through scientific leadership and informing decisions through the applications of science, there are no performance measures specifically linked to this program change.
Enterprise Information, National Geospatial Program	Geographic Information Management	$150	Though the program contributes to the strategic goals of advancing knowledge through scientific leadership and informing decisions through the applications of science, there are no performance measures specifically linked to this program change.
Enterprise Information, National Geospatial Program	Hazards Initiative	$680	Though the program contributes to the strategic goals of advancing knowledge through scientific leadership and informing decisions through the applications of science, there are no performance measures specifically linked to this program change.

This page intentionally left blank.

Program Decreases

(Dollars in thousands)

Component	FY 2007 Program Change ($000)	Page Reference
AmericaView	-$2,970	G - 5
Geographic Research	-$2,300	G - 22
Earth Surface Dynamics — Global Dust Study	-$247	H - 53
Coastal and Marine Geology — Florida Shelf Research	-$591	H - 72
Mineral Resources	-$22,943	H - 91
Memphis Aquifer Study	-$493	I - 5
Ozark Aquifer Study	-$227	I - 5
National Water-Quality Assessment (NAWQA)	-$940	I – 15
Roubidoux Aquifer	-$1,231	I – 25
Skiatook Lake Study of Petroleum-Related Contamination	-$227	I – 25
Hood Canal	-$99	I – 37
San Pedro Partnership	-$296	I – 37
Participation in the Long-Term Estuary Assessment Group (LEAG) Consortium	-$846	I – 38
Lake Champlain Monitoring	-$291	I – 55
Monitoring Water in Hawaii	-$444	I – 55
Tongue River Coalbed Methane Study	-$887	I – 55
Cooperative Water Program Investigations	-$2,000	I – 67
Grants to State Water Resources Research Institutes	-$6,404	I – 79
Pacific Northwest Forest Program	-$1,000	J - 8
Biological Assistance to NAWQA	-$594	J - 9
Wildlife, Terrestrial, and Endangered Resources	-$509	J - 9
Molecular Biology at Leetown Science Center	-$788	J - 9
Mark Twain National Forest Lead Mining Study	-$345	J - 9
Diamondback Terrapin Study	-$197	J - 9
Pallid Sturgeon Research	-$345	J - 9
Bear DNA Sampling in Montana	-$394	J -9
Multidisciplinary Water Study at Leetown	-$197	J - 9
Great Lakes Science Center Boat Dock	-$1,409	J - 9
Equipment at Anadromous Fish Lab	-$148	J - 9
Tunison Lab Atlantic Salmon Research	-$247	J - 9
Potomac Snakehead Program	-$172	J - 9
Upper Midwest Environmental Sciences Center	-$197	J - 10
Science Excellence with the FWS	-$197	J - 10
Ivory-billed Woodpecker	-$394	J - 10

Component	FY 2007 Program Change ($000)	Page Reference
Wetland Ecology Center with the University of Missouri	-$197	J - 10
One-time FY 2006 Supplemental Costs (Avian Influenza)	-$400	J - 10
National Biological Information Infrastructure	-$2,000	J - 33
Enterprise Information Security and Technology, Operational Efficiencies	-$500	K - 5
Enterprise Information Resources, Operational Efficiencies	-$500	K - 15
Geospatial Data Integration	-$2,000	K - 24
Landsat Pay-back	-$3,941	L - 1
Director's and Bureau Support Staffs	-$69	L - 1
Space Management	-$540	M - 5
Total	**-$60,716**	

Mapping, Remote Sensing, and Geographic Investigations
Land Remote Sensing Subactivity

AmericaView **-$2,970,000**

This decrease will end Federal funding for a State-level network that provides access to information and imagery archives for university participants and other users at all levels of public service. Federal outreach activities begun under the program will be eliminated, as will limited support for research and applications development, curriculum development and student support.

Geographic Analysis and Monitoring Subactivity

Geographic Research **-$2,300,000**

The FY 2007 budget request proposes a decrease to lower priority resources within Geographic Analysis and Monitoring program to assist in funding the costs of the LDCM. The following lower priority programs will be affected:

- Urban studies — Monitor the environmental conditions of urban areas across the United States and model the impacts of increasing urbanization on environmental quality. This reduction to the GAM program will terminate these urban studies and reduce staff.
- Interior Lands Studies — Conducts research to analyze environmental impacts on Department of Interior lands and areas of interest. The proposed reduction eliminates funding for these projects, resulting in the reduction of staff and ending current agreements with Interior bureaus.
- Human Health — Participates in human health studies related to assessments of water quality and the spread of the West-Nile virus across the country. Geographic research on all health-related research will be stopped and staff reduced.

Geologic Hazards, Resources, and Processes
Geologic Landscape & Coastal Assessments Subactivity

Earth Surface Dynamics -$247,000

Global Dust Study — The proposed funding decrease in the Global Dust Study would reduce the current scope of the project and discontinue additional analyses of dust composition and its impacts. Additional planned studies which include microbiological, mineralogical and geochemical studies of major dust source areas in Africa and Asia and investigations of pathways of dust and included organic contaminants to organisms in impacted ecosystems (e.g., coral reefs) would be eliminated or reduced.

Coastal and Marine Geology -$591,000

Florida Shelf Research — The requested decrease will eliminate efforts funded in FY 2006 by Congressional earmark to support geological and environmental characterization of the inner shelf region of Florida. Efforts will be ended with the State of Florida and the University of South Florida to provide environmental characterization for the management of submerged resources; to develop collaborative mapping programs, including inventory, synthesis, and management of existing data and new data collection. The USGS will also not continue participation in the Gulf of Mexico Alliance action plan.

Geologic Resource Assessments Subactivity

Mineral Resources -$22,943,000

The Mineral Resources Program (MRP) conducts basic research in ore deposits, geochemistry, and geophysics and applied research in national and international mineral assessments that benefit States, local governments, industry, and academia, in addition to many Federal programs. With current budget constraints, the Administration is focusing its efforts in mineral resource assessments and research to those efforts that support the needs of Federal land management programs and expects that universities or other entities will undertake assessments and research that support non-Federal needs. This funding level will keep the core Federal program intact, providing the information and analyses that address the Department's strategic plan goals concerning Resource Use.

The proposed reductions to the budget for MRP will result in a significantly scaled-back program that will conduct three site-specific mineral resource projects and mineral resource assessments for Federal land management agencies in the lower 48 States, provide regional-scale geologic data and mineral resource assessments in three areas of Alaska, complete collection of national-scale data characterizing earth materials, collect data only on domestic production and utilization of 100 mineral commodities, and manage four national-scale long term databases. The proposed reductions will be addressed with the following specific actions:

- Termination of an international collaboration to provide a global assessment of potential for undiscovered mineral resources;
- Discontinuation of research on improving methods of mineral resource assessment and on enhancing applications of GIS to mineral resource assessments;

- Discontinuation of most research and data collection projects, including:
  - Research in the lower 48 States and Alaska on processes that form ore deposits,
  - Geo-environmental research aimed at understanding processes through which metals are dispersed through the environment (the basis for partnerships in watersheds challenged with abandoned mine sites),
  - Industrial minerals research,
  - Application of remotely sensed data to meet the needs of Interior bureaus, including remote characterization of mineral products released at abandoned mine sites and prioritization of specific remediation targets,
  - Research on the human health consequences of mineral materials, including dusts and toxins such as mercury and arsenic, and
  - A comprehensive soil geochemical survey of the United States,
- Elimination of support for at least 8 USGS geochemical and geophysical labs,
- Elimination of the collection of data on international production and utilization of 100 mineral commodities,
- Termination of research and analysis of minerals and materials life cycles, materials flows, and future uses of minerals and materials, and
- Elimination of the Mineral Resources External Research Program (MRERP), which makes grants to non-Federal entities to conduct research addressing MRP goals.

The proposed decrease would require that USGS eliminate at least 180 jobs held by employees at nine locations across the United States (Denver, CO; Flagstaff, AZ; Menlo Park, CA; Mounds View, MN; Reno, NV; Reston, VA; Spokane, WA; Seattle, WA; and Tucson, AZ).

Water Resources Investigations

Hydrologic Monitoring, Assessments and Research Subactivity

Ground-Water Resources Program **-$720,000**

The reduction will end two unrequested earmarked projects. These projects are not Administration or USGS priorities and do not address the highest priority science needs in ground-water research and monitoring. This will keep the core program intact while allowing the USGS to make the best use of resources.

- **Memphis Aquifer Study (-$493,000) —** This reduction would end a project begun in FY 2006 that supports hydrologic monitoring, geologic mapping, and modeling provided by three USGS Water Science Centers in support of the Mississippi, Arkansas, and Tennessee Regional Aquifer Study.
- **Ozark Aquifer Study (-$227,000) —** This reduction would end a project begun in FY 2006 to develop a ground-water flow model of the Ozark and Springfield Plateau aquifers in the tri-State (KS, MO, and OK) area.

Performance impacts of these reductions will not occur until FY 2008 or later.

National Water-Quality Assessment -$940,000

These activities do not address the highest priority science needs in water-quality research and monitoring. This funding level will keep the core program intact while allowing the USGS to make the best use of resources. This reduction would focus on a portion of the funding used for national technical support and training activities for the geographically distributed USGS water-quality studies. This support provides quality control to assure the technical excellence of water-quality field programs and provides a structured way of transferring new technology to USGS investigative and data activities that are primarily conducted at the USGS Water Science Centers located in each State. Technical support also includes a formal way of establishing priorities for water-quality research by the USGS and provides a mechanism to make water-quality information available to other agencies, the scientific community, and the public. The results of the reduction would:

- Be somewhat offset by savings resulting from the 2005–06 space consolidation at the National Water Quality Laboratory and the Branch of Quality Systems at the Denver Federal Center;
- Slow research and development of field instrumentation and electronic entry of field data using handheld computers for water quality activities; and
- Slow technical support to USGS State Water Science Centers for technology transfer and for training in new water-quality techniques.

Toxic Substances Hydrology -$1,458,000

The reduction will end one unrequested earmarked project and one project from the base program. The earmarked project does not address the highest priority science needs for toxic substances hydrology research. This will keep the core program intact while allowing the USGS to make the best use of resources.

- **Roubidoux Aquifer (-$1,231,000) —** This is a reduction of an unrequested earmark that will bring to a close a study with the University of Oklahoma to characterize the Tar Creek Superfund site in Oklahoma, including characterization of mine drainage discharges, characterization of waste pile and pond drainage runoff, assessment of in-stream contaminant loading, characterization of asphalt road runoff, assessment of surface water impacts, and air quality and meteorological monitoring. In FY 2005 and 2006, most of the funding went to the University in the form of a pass-through grant.
- **Skiatook Lake Study of Petroleum-Related Contamination (-$227,000) —** The USGS will end a study of petroleum-related contamination at Skiatook Lake in the southeastern part of the Osage Indian Reservation in northeastern Oklahoma.

Under the Department's Serving Communities—Advance Knowledge mission goal, the decrease of -$227,000 for the Skiatook Lake study will result in the loss of -1 systematic analysis and investigation in FY 2007, compared to the FY 2006 level. There is no change in FTE or other resources associated with either of the decreases described above.

Hydrologic Research and Development -$1,241,000

The 2007 request eliminates unrequested earmarked projects, as they do not address the highest priority science needs for hydrologic research and development. This will keep the core program intact while allowing the Survey to make the best use of resources.

- **Hood Canal (-$99,000) —** Research to help determine the causes of low dissolved oxygen levels and fish mortality in Hood Canal, WA, is in its final year. FY 2006 funding is being used to complete and publish a study of freshwater and nitrogen inputs into the canal from the surrounding ground water. Under the Department's Serving Communities—Advance Knowledge mission goal, the completion of this study will decrease the "systematic analyses and investigations" performance target by -1.
- **San Pedro Partnership (-$296,000) —** USGS participation in the interagency Upper San Pedro Partnership and the reporting requirements of Public Law 108–136, Section 321, will not be funded. Under the Department's Serving Communities—Advance Knowledge mission goal, the discontinuation of these activities in FY 2007 will affect the "systematic analyses and investigations" performance target by -1.
- **Participation in the Long-Term Estuary Assessment Group (LEAG) Consortium (-$846,000) —** Pass-through grants to Tulane and the other LEAG universities will end, and the USGS will end in-house efforts related to LEAG activities. The USGS will ensure that this shift in priorities does not cause the closure of streamgages or water-quality monitors on the lower Mississippi and tributaries.

Hydrologic Networks and Analysis -$1,622,000

The FY 2007 request will end three unrequested earmarked projects. These projects do not address the highest priority science needs for hydrologic data collection, research, and analysis. This will keep the core program intact while allowing the Survey to make the best use of resources.

- **Lake Champlain Monitoring (-$291,000) —** The USGS would end expanded water-quality monitoring for mercury and other toxic substances in Lake Champlain. At the level proposed for FY 2007, $157,000 would remain in the program for basic data collection in the Lake.
- **Monitoring Water in Hawaii (-$444,000) —** The USGS would end expanded monitoring of water resources in Hawaii, in cooperation with the State Department of Natural Resources.
- **Tongue River Coalbed Methane Study (-$887,000) —** The USGS would stop the collection of hydrologic data that was begun in FY 2004 to document and establish a baseline for current conditions in the streams in the Tongue River watershed. All data collected in prior years of this effort would continue to be available to the public, though no new data would be available.

Under the Department's Serving Communities—Advance Knowledge mission goal, the discontinuation of these activities in FY 2007 will affect performance targets by decreasing the number of real-time data collection sites. The number of sites to be discontinued will depend upon the willingness of non-Federal partners to fund continued operation of those sites.

No performance change is shown for these reductions in FY 2007 because performance will not be affected until FY 2008. The -2 systematic analyses and investigations delivered to customers reflects reports that will not be delivered due to elimination of the coalbed methane study and elimination of the expanded water-quality work at Lake Champlain.

Cooperative Water Program Subactivity

Cooperative Investigations **-$2,000,000**

The interpretive studies portion of the Coop Program includes some turn-over each year as current projects end and new projects begin, according to the needs of the USGS and its non-Federal cooperators. The USGS will take this reduction from areas where projects are scheduled to end during FY 2006, so that projects do not have to be stopped before completion. Since the cooperators provide about two-thirds of the funding for the program, the content of projects is determined in consultation with those cooperators, and specific focus areas are often not known until workplans and joint funding agreements are established during the fiscal year. At the proposed funding level, the Coop Program will still be able to start $5–6 million in new projects in FY 2007.

Under the Department's Serving Communities—Advance Knowledge mission goal, this reduction will decrease the number of systematic analyses and investigations delivered to customers by -10. Since more than half the funds for the Coop Program are provided by the 1,400 State and local partner agencies, and since the program is highly customer driven, the reduction could also affect two end outcome measures under End Outcome Goal SEO.2:

- "Inform decisions through the application of science: Improved access to needed science information," and
- "Inform decisions through the application of science: Stakeholders reporting that information helped achieve goal."

Because of the cost-sharing requirements in the program's authorizing legislation, it is likely that State and local partners will withdraw funding of about $2 million, resulting in a real decrease to the program of $4 million. This loss of State and local partner funding will also result in an additional loss of -18 FTE, making the total FTE decrease for this program -36.

Water Resources Research Act Program Subactivity

Grants to the State Water Resources Research Institutes **-$6,404,000**

The proposed reduction eliminates USGS funding for each of the 54 State Water Resources Research Institutes. The reduction also eliminates USGS support for research projects under the national competitive grant program authorized by section 104(g) of the Water Resources Research Act. This USGS support amounts to less than 6 percent of their total funding. Most of the Institutes have been very successful in generating funding from non-USGS sources and no longer need USGS funding to continue operating. Though the program contributes to the strategic goals of advancing knowledge in the hydrologic sciences, there are no performance measures specifically linked to this program change.

Biological Research
Biological Research and Monitoring Subactivity

Pacific Northwest Forest Program -$1,000,000

Eliminate or reduce the scope of ongoing studies of habitat requirements of select species in old-growth forest and riparian ecosystems, and reduce research support for long-term effectiveness monitoring of select management options designed to sustain biodiversity and ecosystem function. The proposed decrease would also reduce ongoing research focused on improving understanding of the consequences of forest management for ecosystem functions, with particular emphasis on biogeochemical cycling.

Biological Assistance to NAWQA -$594,000

Lower priority studies that provide information on the impacts of chemical concentrations of substances such as mercury, pesticides, and nutrients found by the NAWQA program on fish, wildlife, and other Interior Trust resources.

Wildlife, Terrestrial, and Endangered Resources -$509,000

Reduce funding for lower priority research activities such as those related to migratory birds, marine mammals, and imperiled wildlife species.

Molecular Biology at Leetown Science Center -$788,000

Eliminate research on molecular biology at Leetown, WV, terminating fishery genetics research projects along the Northeast and Mid-Atlantic coast, in the Great Lakes and Finger Lakes, and in northern Appalachia.

Mark Twain National Forest Lead Mining Study -$345,000

Eliminate a study to determine potential impacts of lead mining in the Mark Twain National Forest in Missouri in cooperation with the U.S. Forest Service.

Diamondback Terrapin Study -$197,000

Discontinue a study of the decline of diamondback terrapins in the Chesapeake Bay that is coordinated with the Maryland Department of Natural Resources and the University of Maryland Cooperative Research Unit.

Pallid Sturgeon Research -$345,000

Eliminate funds for pallid sturgeon research and discontinue scientific investigations to locate and monitor pallid sturgeon in the Missouri River Basin and document their habitat relationships and requirements for all life stages for population growth.

Bear DNA Sampling in Montana **-$394,000**

A study related to grizzly bear DNA sampling will be completed in FY 2006.

Multidisciplinary Water Study at Leetown **-$197,000**

Eliminate funds for a study of the quantity and quality of the Leetown Science Center's ground water supply.

Great Lakes Science Center Boat Dock **-$1,409,000**

Eliminate funding for a one-time earmark in FY 2006 for construction of a permanent docking facility for the USGS-owned research vessel *Kiyi*, of the Great Lakes Deepwater Fisheries Program.

Equipment at Anadromous Fish Lab **-$148,000**

Eliminate funds for a one-time earmark in FY 2006 to support the purchase of new equipment at the Anadromous Fish Lab to undertake state-of-the-art research in fish passage, fish migration, and related watershed science.

Tunison Lab Atlantic Salmon Research **-$247,000**

End efforts to evaluate salmon strains in key Lake Ontario tributaries that are targeted for restoration and investigations of competition between Atlantic salmon and Pacific salmon in the tributaries, along with subsequent effects of competition on survival of reintroduced Atlantic salmon.

Potomac Snakehead Program **-$172,000**

Eliminate funds earmarked in FY 2006 for Potomac snakehead studies.

Upper Midwest Environmental Sciences Center **-$197,000**

End efforts begun in FY 2006 to develop an analytical method for piscicidal concentrations of antimycin A at the Upper Midwest Environmental Sciences Center.

Science Excellence with the U.S. Fish and Wildlife Service **-$197,000**

Eliminate funds earmarked in FY 2006 that support close coordination and joint funding between the USGS and the FWS for the FWS science excellence initiative.

Ivory-billed Woodpecker **-$394,000**

Reduce funds for the ivory-billed woodpecker, limiting USGS support to FWS recovery plans and limiting operational funds that are required to monitor and determine the distribution and status of this species.

Wetland Ecology Center with the University of Missouri -$197,000

Reduce funding for a one-time earmark in FY 2006 to establish a Wetlands Ecology Center of Excellence, a partnership linking University of Missouri, Missouri Department of Conservation, the USGS, and other Federal, State, and private organizations interested.

One-time FY 2006 Supplemental Costs (Avian Influenza) -$400,000

Reduce funding for a one-time FY 2006 purchase of a robotic micro sample extractor and molecular biology workstation to process the large number of samples resulting from Highly Pathogenic Avian Influenza surveillance activities in Alaska and elsewhere.

Biological Information Management and Delivery Subactivity

National Biological Information Infrastructure -$2,000,000

The USGS proposes to reduce funding for 7 of 14 nodes. The USGS would preserve access to data currently served through these nodes by transferring some of the data to the USGS Center for Biological Informatics. However, the USGS would be unable to increase the amount of data associated with some issue areas. The USGS would ensure that there is no impact to data and information critical to hurricane restoration efforts. The impact of the proposed reductions on the individual nodes is shown in the table below.

(Dollars in Thousands)

NBII Node	Current Funding	Proposed Reduction
Northeast Information Node	450	-350
Mid-Atlantic Information Node	450	-230
Southern Appalachian Information Node	1,900	-1,000
Central Southwest/Gulf Coast Information Node	910	-200
Mountain-Prairie Information Node	140	-40
California Information Node	190	-90
Pacific Northwest Information Node	190	-90
Total Proposed Reduction		-2,000

Results of this proposal would include 6 fewer training/workshop events in FY 2007. The reductions would also result in a decrease of 7 FTE.

Enterprise Information

Enterprise Information Security and Technology Subactivity

Operational Efficiencies -$500,000

The proposed decrease achieves savings through economies of further IT centralization, consolidated software and hardware purchases, and workforce planning.

Enterprise Information Resources Subactivity

Operational Efficiencies **-$500,000**

The proposed decrease achieves savings through further consolidation and integration of bureau-level science information delivery services and associated workforce planning.

National Geospatial Program Subactivity

Geospatial Data Integration **-$2,000,000**

The proposed reduction would result in a slowing of the development of hydrography, elevation, and imagery data. For hydrography, development of the National Hydrography Dataset would be delayed for remaining areas of interest to Interior bureaus in Montana, Washington, Oregon, Nevada, Arizona, and the Dakotas. For orthoimagery, the ability to maintain the currentness of high-resolution imagery over urban and natural hazard areas would be diminished.

Other Decreases

Landsat Pay-back **-$3,941,000**

Reduces Science Support for the one-time appropriation of $3,941,000 received in FY 2006. The funding had been provided in 2006 to cover information technology and critical infrastructure investments that were deferred from 2005 to provide resources to cover the funding shortfall in the Landsat program.

Director's and Bureau Support Staffs **-$69,000**

Reduction will be absorbed equally by the Director’s Office, Administrative Policy and Services, Human Capital and Regional Offices through operating expenses and attrition.

Space Management **-$540,000**

The proposed decrease supports the bureau’s efforts to reduce space costs through consolidations and co-locations. In addition to the reduction in rental payments described above, the USGS is also undertaking facilities management actions intended to result in space cost savings over the long term. The USGS is reducing space utilization in several locations through consolidations of existing facilities and closure of unneeded space. The USGS Strategic Facilities Master Plan and the assignment to the Investment Review Board will generate additional opportunities for reducing USGS space requirements over time.

FY 2007 Program Decreases by DOI Goal
($000)

Resource Protection

End Outcome Goal: PEO.1. – Improve health of watersheds, landscapes, and marine resources that are DOI managed or influenced in a manner consistent with the obligations regarding the allocation and use of water.			
Biological Research, Biological Research and Monitoring	Pacific Northwest Forest Program	-$1,000	-5 systematic analyses and investigations delivered to customers in FY 2009
Biological Research, Biological Research and Monitoring	Biological Assistance to NAWQA	-$594	-3 systematic analyses and investigations delivered to customers in FY 2009
Biological Research, Biological Research and Monitoring	Mark Twain National Forest Study	-$345	-4 systematic analyses and investigations delivered to customers in FY 2009
Biological Research, Biological Research and Monitoring	Wetland Ecology Center with the University of Missouri	-$197	Though the program contributes to the strategic goal of improving the health of watersheds, landscapes, and marine resources, there are no performance measures specifically linked to this program change.

End Outcome Goal: PEO.2. – Sustain biological communities on DOI managed or influenced lands and waters in a manner consistent with the obligations regarding the allocation and use of water.			
Biological Research, Biological Research and Monitoring	Wildlife, Terrestrial, and Endangered Resources	-$509	-2 systematic analyses and investigations delivered to customers in FY 2009
Biological Research, Biological Research and Monitoring	Molecular Biology at Leetown Science Center	-$788	-4 systematic analyses and investigations delivered to customers in FY 2009
Biological Research, Biological Research and Monitoring	Diamondback Terrapin Study	-$197	-1 systematic analyses and investigations delivered to customers in FY 2009
Biological Research, Biological Research and Monitoring	Pallid Sturgeon Research	-$345	-2 systematic analyses and investigations delivered to customers in FY 2009
Biological Research, Biological Research and Monitoring	Bear DNA Sampling in Montana	-$394	-2 systematic analyses and investigations delivered to customers in FY 2009
Biological Research, Biological Research and Monitoring	Multidisciplinary Water Study at Leetown	-$197	-1 systematic analysis or investigation delivered to customers in FY 2009
Biological Research, Biological Research and Monitoring	Great Lakes Science Center Boat Dock	-$1,409	Though the program contributes to the strategic goal of sustaining biological communities, there are no performance measures specifically linked to this program change.
Biological Research, Biological Research and Monitoring	Equipment at Anadromous Fish Lab	-$148	Though the program contributes to the strategic goal of sustaining biological communities, there are no performance measures specifically linked to this program change.
Biological Research, Biological Research and Monitoring	Tunison Lab Atlantic Salmon Research	-247	-1 systematic analysis or investigation delivered to customers in FY 2009
Biological Research, Biological Research and Monitoring	Potomac Snakehead Program	-$172	-1 systematic analysis or investigation delivered to customers in FY 2009
Biological Research, Biological Research and Monitoring	Upper Midwest Environmental Sciences Center	-$197	-1 systematic analysis or investigation delivered to customers in FY 2009

End Outcome Goal: PEO.2. – Sustain biological communities on DOI managed or influenced lands and waters in a manner consistent with the obligations regarding the allocation and use of water.			
Biological Research, Biological Research and Monitoring	Science Excellence with the FWS	-$197	-1 systematic analysis or investigation delivered to customers in FY 2009
Biological Research, Biological Research and Monitoring	Ivory-billed Woodpecker	-$394	-1 systematic analysis or investigation delivered to customers in FY 2009

Other Biological Research and Monitoring performance impacts:

- -3 workshops or training provided to customers in FY 2007.

Resource Use

End Outcome Goal: UEO.2. – Manage or influence resource use to enhance public benefit, promote responsible use, and ensure optimal value – Non-Energy Minerals			
Geologic Resource Assessments, Mineral Resources	Minerals Research & Assessment Activities	-$22,943	-5 systematic analyses and investigations delivered to customers in FY 2007, and -14 more through FY 2011. 3 systematic analyses scheduled for delivery in FY 2007 will be delayed until at least FY 2008, 1 scheduled for 2008 will be delayed to 2010, and 1 scheduled for 2009 will also be delayed to 2010. Starting in 2007, MRP will be able to produce about 1 systematic analysis per year. -5 workshops or training for customers in FY 2007 and beyond. -20 mineral commodity and related reports (including materials flow studies) produced annually in FY 2007 and beyond; the remaining reports will include no international production and consumption data. Average cost of a systematic analysis or investigation will increase $9.4M (includes sunk costs of projects terminated early as a result of funding change)

Serving Communities

End Outcome Goal: SEO.1. – Protect lives, resources and property.			
Biological Research, Biological Research and Monitoring	One-time FY 2006 Supplemental Costs (Avian Influenza)	-$400	This reduction reflects elimination of emergency supplemental funds used for a one-time purchase of equipment; as a result, there are no performance measures specifically linked to this program change.

End Outcome Goal: SEO.2. – Advance knowledge through scientific leadership and inform decisions through the application of science.			
Geographic Research, Investigations, and Remote Sensing, Land Remote Sensing	AmericaView	-$2,970	Though the program contributes to the strategic goals of advancing knowledge through scientific leadership and informing decisions through the applications of science, there are no performance measures specifically linked to this program change.
Geographic Research, Investigations, and Remote Sensing, Geographic Analysis and Monitoring	Geographic Research	-$2,300	-28 systematic analyses and investigations delivered to customers in FY 2007, and -4 additional in the outyears. -3 formal workshops or training provided to customers in FY 2007 and -2 additional in the outyears.
Geologic Landscape & Coastal Assessments, Earth Surface Dynamics	Global Dust Study	-$247	Though the program contributes to the strategic goals of advancing knowledge through scientific leadership and informing decisions through the applications of science, there are no performance measures specifically linked to this program change.
Geologic Landscape & Coastal Assessments, Coastal and Marine Geology	Florida Shelf Research	-$591	Though the program contributes to the strategic goals of advancing knowledge through scientific leadership and informing decisions through the applications of science, there are no performance measures specifically linked to this program change.
Water Resources Investigations, Ground-Water Resources Program	Memphis Aquifer Study	-$493	-1 systematic analysis or investigation delivered to customers in FY 2008
Water Resources Investigations, Ground-Water Resources Program	Ozark Aquifer Study	-$227	-1 systematic analysis or investigation delivered to customers in FY 2008
Water Resources Investigations, National Water-Quality Assessment	Technical Support Activities	-$940	Though the program contributes to the strategic goals of advancing knowledge in the hydrologic sciences, there are no performance measures specifically linked to this program change.
Water Resources Investigations, Toxic Substance Hydrology	Roubidoux Aquifer	-$1,231	Though the program contributes to the strategic goals of advancing knowledge in the hydrologic sciences, there are no performance measures specifically linked to this program change.
Water Resources Investigations, Toxic Substance Hydrology	Study of Petroleum-Related Contamination	-$227	-1 systematic analysis or investigation delivered to customers
Water Resources Investigations, Hydrologic Research & Development	Hood Canal Fish Mortality	-$99	-1 systematic analysis or investigation delivered to customers
Water Resources Investigations, Hydrologic Research & Development	San Pedro Partnership	-$296	-1 systematic analysis or investigation delivered to customers

End Outcome Goal: SEO.2. – Advance knowledge through scientific leadership and inform decisions through the application of science.			
Water Resources Investigations, Hydrologic Research & Development	Long-Term Estuary Assessment Group	-$846	Though the program contributes to the strategic goals of advancing knowledge in the hydrologic sciences, there are no performance measures specifically linked to this program change.
Water Resources Investigations, Hydrologic Networks and Analysis	Lake Champlain Monitoring	-$291	-1 systematic analysis or investigation delivered to customers in FY 2008
Water Resources Investigations, Hydrologic Networks and Analysis	Monitoring Water in Hawaii	-$444	Though the program contributes to the strategic goals of advancing knowledge in the hydrologic sciences, there are no performance measures specifically linked to this program change.
Water Resources Investigations, Hydrologic Networks and Analysis	Tongue River Coalbed Methane	-$887	-1 systematic analysis or investigation delivered to customers in FY 2008
Water Resources Investigations, Cooperative Water Program	Cooperative Investigations	-$2,000	-10 systematic analyses and investigations delivered to customers
Water Resources Investigations, Water Resources Research Act Program	Water Resources Research Institutes Grants	-$6,404	Though the program contributes to the strategic goals of advancing knowledge in the hydrologic sciences, there are no performance measures specifically linked to this program change.
Biological Research, Biological Information Management and Delivery	National Biological Information Infrastructure	-$2,000	-6 workshops or training delivered to customers
Enterprise Information, Enterprise Information Security and Technology	Operational Efficiencies	-$500	Though the program contributes to the strategic goal of advancing knowledge through scientific information, there are no performance measures specifically linked to this program change.
Enterprise Information, Enterprise Information Resources	Operational Efficiencies	-$500	Though the program contributes to the strategic goal of advancing knowledge through scientific information, there are no performance measures specifically linked to this program change.
Enterprise Information, National Geospatial Program	Geospatial Data Integration	-$2,000	-4% of total cost FSA and USGS saved through partnering with other entities for imagery acquisition of 1-meter NAIP orthoimagery -6 formal workshops or training provided to customers
Science Support	Landsat Pay-back	-$3,941	Though the program contributes to the strategic goals of advancing knowledge through scientific leadership and informing decisions through the applications of science, there are no performance measures specifically linked to this program change.
Science Support	Director's and Bureau Support Staffs	-$69	Though the program contributes to the strategic goals of advancing knowledge through scientific leadership and informing decisions through the applications of science, there are no performance measures specifically linked to this program change.
Facilities, Rental Payments	Space Management	-$540	Though the program contributes to the strategic goals of advancing knowledge through scientific leadership and informing decisions through the applications of science, there are no performance measures specifically linked to this program change.

This page intentionally left blank.

Analysis by Activity

(Dollar Amounts in Thousands)

Activity	2006 Enacted FTE a/	2006 Enacted Amount	Fixed Costs and Related Changes b/ FTE	Fixed Costs and Related Changes b/ Amount	Program Changes FTE	Program Changes Amount	2007 Budget Request FTE a/	2007 Budget Request Amount	Inc.(+) Dec.(-) from 2006 FTE	Inc.(+) Dec.(-) from 2006 Amount
Geographic Research, Investigations, & Remote Sensing	556	129,273	-335	-63,639	-18	10,980	203	76,614	-353	-52,659
Geologic Hazards., Resources, and Processes	1,447	235,286	-40	3,213	-179	-21,081	1,228	217,418	-219	-17,868
Water Resources Investigations	1,955	211,764	0	4,143	-29	-11,860	1,926	204,047	-29	-7,717
Biological Research	1,257	178,544	0	2,483	-19	-8,430	1,238	172,597	-19	-5,947
Enterprise Information	176	46,394	303	65,698	-26	-862	453	111,230	277	64,836
Science Support	459	69,302	0	2,090	0	-4,010	459	67,382	0	-1,920
Facilities	58	94,782	0	1,230	0	-540	58	95,472	0	690
SIR Appropriation, Total	5,908	965,345	-72	15,218	-271	-35,803	5,565	944,760	-343	-20,585
Emergency Approp. (P.L. 109-148) [Katrina]		5,300								-5,300
Spectrum Relocation Costs Transfer				6,159				6,159		6,159
SIR Appropriation, Total	5,908	970,645	-72	21,377	-271	-35,803	5,565	950,919	-343	-19,726

a/ The FTE's depicted in the FY 2005, 2006, and 2007 columns are only the staff-years associated with appropriated funding. Reimbursable FTE's are 2,670, 2,670 and 2,652 and Working Capital Fund FTE's are 206, 179 and 179 for FY 2005, 2006 and 2007 respectively. USGS total FTE's for FY 2005, 2006, and 2007 are 8,920, 8,757 and 8,396 respectively. FTE may not add to totals and subtotals, due to rounding.

b/ Fixed cost funding for this account totals $20,724, of which $15,218 will be budgeted and $5,506 will be absorbed. Included in this account's funding is a one-time technical adjustment that, through a budget restructure, moves $64,301 to the Enterprise Information Activity from the Geographic Research, Investigations, and Remote Sensing Activity related to the need to unify management and control of geospatial programs.

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, nvestigations, 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; **[**$976,035,000**]**$944,760,000, of which **[**$63,770,000**]**$62,171,000 shall be available only for cooperation with States or municipalities for water resources investigations; of which **[**$8,000,000**]**$7,882,000 shall remain available until expended for satellite operations; of which **[**$21,720,000**]**$21,084,000 shall be available until September 30, **[**2007**]**2008, for the operation and maintenance of facilities and deferred maintenance; of which **[**$1,600,000**]**$2,000,000 shall be available until expended for deferred maintenance and capital improvement projects that exceed $100,000 in cost; and of which **[**$177,485,000**]**$172,597,000 shall be available until September 30, **[**2007**]**2008, for the biological research activity and the operation of the Cooperative Research Units: Provided, That none of the funds provided for the biological 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. (Department of the Interior, Environment, and Related Agencies Appropriations Act, 2006.)

[For an additional amount for “Surveys, Investigations, and Research”, for necessary expenses related to the consequences of hurricanes in the Gulf of Mexico in calendar year 2005 and for repayment of advances to other appropriation accounts from which funds were transferred for such purposes, $5,300,000, to remain available until expended: *Provided*, That the amount provided under this heading is designated as an emergency requirement pursuant to section 402 of H. Con. Res. 95 (109th Congress), the concurrent resolution on the budget for fiscal year 2006.

For an additional amount for “Surveys, Investigations, and Research”, for the detection of highly pathogenic avian influenza in wild birds, including the investigation of morbidity and mortality events, targeted surveillance in live wild birds, and targeted surveillance in hunter-taken birds, $3,670,000 to remain

available until September 30, 2007: *Provided*, That the amount provided under this heading is designated as an emergency requirement pursuant to section 402 of H. Con. Res. 95 (109th Congress), the concurrent resolution on the budget for fiscal year 2006.**]** (*Emergency Supplemental Appropriations Act to Address Hurricanes in the Gulf of Mexico and Pandemic Influenza, 2006*.)

Justification of Proposed Language Change

1. Change: of which **[**$1,600,000**]**$2,000,000 shall be available until expended for deferred maintenance and capital improvement projects that exceed $100,000 in cost

   This change increases the no-year funding amount available for deferred maintenance and capital improvement projects by $400,000. This change helps to address the rising costs associated with deferred maintenance needs due to inflation and allows more funding to have a greater length of time to carry out these projects.

2. Deletion of the following wording:

   [For an additional amount for "Surveys, Investigations, and Research", for necessary expenses related to the consequences of hurricanes in the Gulf of Mexico in calendar year 2005 and for repayment of advances to other appropriation accounts from which funds were transferred for such purposes, $5,300,000, to remain available until expended: *Provided*, That the amount provided under this heading is designated as an emergency requirement pursuant to section 402 of H. Con. Res. 95 (109th Congress), the concurrent resolution on the budget for fiscal year 2006.

   For an additional amount for "Surveys, Investigations, and Research", for the detection of highly pathogenic avian influenza in wild birds, including the investigation of morbidity and mortality events, targeted surveillance in live wild birds, and targeted surveillance in hunter-taken birds, $3,670,000 to remain available until September 30, 2007: *Provided*, That the amount provided under this heading is designated as an emergency requirement pursuant to section 402 of H. Con. Res. 95 (109th Congress), the concurrent resolution on the budget for fiscal year 2006.**]**

   This change removes language that had been provided as part of a supplemental funding bill in fiscal year 2006. The funding related to calendar year 2005 hurricanes is a one-time funding occurrence and the language is not being requested in the President's Budget. Most of the funding related to avian influenza is proposed to remain in the Surveys, Investigations, and Research budget in FY 2007, but current appropriation language is broad enough to cover this funding. Therefore, the avian influenza language is not being requested in the President's Budget.

Appropriation Language and Citations

1. 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.

2. its territories and possessions, and other areas as authorized by law.

    - **43 U.S.C 31(b)** provides that, "The authority of the Secretary of the Interior, exercised through the Geological Survey of the Department of the Interior, to examine the geological structure, mineral resources, and products of the national domain, is expanded to authorize such examinations outside the national domain where determined by the Secretary to be in the national interest."

    - **43 U.S.C. 1332(a)** provides that, "It is the declared policy of the United States, that the subsoil and seabed of the Outer Continental Shelf appertain to the United States and are subject to its jurisdiction, control, and power of disposition as provided in this subchapter."

    - **43 U.S.C. 1340** provides that, "Any agency of the United States and any person authorized by the Secretary may conduct geological and geophysical exploration in the Outer Continental Shelf. ..."

3. classify lands as to their mineral and water resources;

    - **43 U.S.C. 31(a)** provides that, "The Director of the Geological Survey, ... shall have the direction of the Geological Survey, and the classification of public lands and examination of the geological structure, mineral resources, and products in the National domain. ..."

4. give engineering supervision to power permittees

    - **43 U.S.C. 959** provides that, "The Secretary of the Interior is authorized and empowered, ... to permit the use of right of way through the public lands, forest, and other reservations of the United States ... for electrical plants, poles, and lines for the generation and distribution of electrical power, ...**Provided**, that such permits shall be allowed within or through any of said parks or any forest, military, Indian, or other reservation only upon approval of the Chief Officer of the Department under whose supervision such park or reservation falls and upon a finding by him that the same is not incompatible with the public interest ..."

    - **43 U.S.C. 961** provides that, "The head of the department having jurisdiction over the lands be, and he is, authorized and empowered, ... to grant an easement for right of way, ... over, across and upon the public lands and reservations of the United States for

electrical poles and lines for the transmission and distribution of electrical power ... upon a finding by him that the same is not incompatible with the public interest ..."

5. and Federal Energy Regulatory Commission licensees;

   - **16 U.S.C. 797(c)** states that, "To cooperate with the executive departments and other agencies of States or National Governments in such investigations; and for such purposes the several departments and agencies of the National Government are authorized and directed upon the request of the commission, to furnish such records, papers and information in their possession as may be requested by the commission, and temporarily to detail to the commission such officers or experts as may be necessary in such investigations."

6. administer the minerals exploration program;

   - **30 U.S.C. 641** provides that, "The Secretary of the Interior is hereby authorized and directed, in order to provide for discovery of additional domestic mineral reserves, to establish and maintain a program for exploration by private industry within the United States, its territories and possessions for such minerals, excluding organic fuels, as he shall from time to time designate, and to provide Federal financial assistance on a participating basis for that purpose."

7. publish and disseminate data relative to the foregoing activities;

   - **43 U.S.C. 41** provides for the publication of geological and economic maps, illustrating the resources and classification of the lands, and reports upon general and economic geology and paleontology. This section also provides for the scientific exchange and sale of such published material.

   - **44 U.S.C. 1318** provides for publication, by the Geological Survey, of various reports, including a report of mineral resources of the United States, bulletins and professional papers, and monographs. This section also specifies, in some instances, numbers of copies to be printed and the distribution thereof.

   - **44 U.S.C. 1320** provides for the distribution by the Director of the Geological Survey of copies of sale publications to public libraries.

8. and to conduct inquiries into the economic conditions affecting mining and materials processing industries...and related purposes as authorized by law and to publish and disseminate data;

   - **30 U.S.C. 3** provides for inquiry into the economic conditions affecting the mining, quarrying, metallurgical, and other minerals industries. This section also provides for the dissemination of information concerning these industries.

   - **30 U.S.C. 21(a)** provides for an annual report on the state of the domestic mining minerals, and mineral reclamation industries, including a statement of the trend in utilization and depletion of resources.

- **30 U.S.C. 1603** provides for ...improved collection, analysis, and dissemination of scientific, technical and economic materials information and data from Federal, state, and local governments, and other sources as appropriate.

- **50 U.S.C. 98g(1)** provides for scientific, technologic, and economic investigations concerning the development, mining, preparation, treatment, and utilization of ore and other mineral substances.

9. of which ( ) shall be available only for cooperation with States or municipalities for water resources investigations;

- **43 U.S.C. 48** provides that, "...amounts received by the Geological Survey from any State, Territory or political subdivision thereof in carrying on work involving cooperation to be used in reimbursing the appropriation from which the expense of such work was paid, was from the act making appropriations for the Department of the Interior for the fiscal year ending June 30, 1928, and for other purposes, act January 12, 1927, ch. 277, 1, 44 Stat. 963, and has not been repeated in subsequent appropriation acts."

- Similar provisions were contained in the following act: 1926 - May 10, 1926, ch. 277, 1, 44 Stat. 487.

10. of which ( ) shall remain available until expended for satellite operations;

- **P.L. 107–43, Department of the Interior and Related Agencies Appropriation Act, 2002**

11. of which ( ) shall be available until September 30, ( ), for the operation and maintenance of facilities and deferred maintenance;

- **P.L. 106–291, Department of the Interior and Related Agencies Appropriations Act, 2001**

12. of which $1,600,000 shall be available until expended for deferred maintenance and capital improvement projects that exceed $100,000 in cost;

- **P.L. 108–447, Consolidated Appropriations Act, 2005 (Interior and Related Agencies portion)**

13. and of which ( ) shall be available until September 30, ( ), for the biological research activity and the operation of the Cooperative Research Units;

- **P.L. 104–208, Omnibus Appropriations Act, 1997 (Interior and Related Agencies portion)**

14. *Provided*, That none of these funds provided for the biological research activity shall be used to conduct new surveys on private property, unless specifically authorized in writing by the property owner:

- **P.L. 104–208, Omnibus Appropriations Act. 1997 (Interior and Related Agencies portion)**

15. 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 collections and investigations carried on in cooperation with States and municipalities.

    - **43 U.S.C. 50** provides that, "The share of the Geological Survey in any topographic mapping or water resources investigations carried on in cooperation with any State or municipality shall not exceed 50 per centum of the cost thereof. ..."

Permanent authority:

16. Provided further, that in fiscal year 1984 and thereafter, all receipts from the sale of maps sold or stored by the Geological Survey shall be available for map printing and distribution to supplement funds otherwise available, to remain available until expended.

    - **43 U.S.C. 42a** 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** with the establishment of the Working Capital Fund (WCF) in FY 1991, the Telecommunications Amortization Fund account and its end of year FY 1990 balances were included in the WCF.

17. Provided further, that, heretofore and hereafter, in carrying out work involving cooperation with any State, Territory, possession, or political subdivision thereof, the Geological Survey may, notwithstanding any other provisions of law, record obligations against accounts receivable from any such entities and shall credit amounts received from such entities to this appropriation.

    - **43 U.S.C. 50b**

18. Provided further, That in Fiscal Year 1987 and thereafter the Geological Survey is authorized to accept lands, buildings, equipment, and other contributions from public and private sources and to prosecute projects in cooperation with other agencies, Federal, State, or private.

    - **43 U.S.C. 36c** This authority for contributions was in the appropriation language annually from FY 1983 through FY 1986 and was made permanent in FY 1987.

19. Provided, That upon enactment of this Act and hereafter, final costs related to the National Petroleum Reserve in Alaska may be paid from available prior year balances in this account.

    - **P.L. 100–446, Department of the Interior and Related Agencies Appropriations Act, 1989**

20. Established a Working Capital Fund which is detailed in the Working Capital Fund section of this book.

    - **P.L. 101–512, Department of the Interior and Related Agencies Appropriations Act, 1991**

21. Provided further, That beginning October 1, 1990, and thereafter, funds received from any State, territory, possession, country, international organization, or political subdivision thereof, for topographic, geologic, or water resources mapping or investigations involving cooperation with such an entity shall be considered as intragovernmental funds as defined in the publication titled "A Glossary of Terms Used in the Federal Budget Process."

    - **P.L. 101–512, Department of the Interior and Related Agencies Appropriations Act, 1991**

    This authority exempts non-Federal cooperative funds from sequester as defined in 1985 amendments (P.L. 99–177) to the Budget Impoundment and Control Act of 1974.

22. Provided further, That beginning in fiscal year 1998 and once every five years thereafter, the National Academy of Sciences shall review and report on the biological research activity of the Survey:

    - **P.L. 104–208, Omnibus Appropriations Act, 1997 (Interior and Related Agencies portion)**

ADMINISTRATIVE PROVISIONS

The amount appropriated for the United States Geological Survey shall be available for the purchase and replacement of passenger motor vehicles; 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 31 U.S.C. 6302 et seq.: *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 temporary or intermittent services of students or recent graduates, who shall be considered employees for the purpose of chapters 57 and 81 of title 5, United States Code, relating to compensation for travel and work injuries, and chapter 171 of title 28, United States Code, relating to tort claims, but shall not be considered to be Federal employees for any other purposes. *(Department of the Interior and Related Agencies Appropriations Act, 2005.)*

Administrative Language and Citations

1. The amount appropriated for the Geological Survey shall be available for purchase and replacement of passenger motor vehicles;

    - **31 U.S.C. 638a(a)** provides that, "Unless specifically authorized by the appropriation concerned or other law, no appropriation shall be expended to purchase or hire passenger motor vehicles for any branch of the Government ...."

    - **31 U.S.C. 638a(b)** provides that, "Excepting appropriations for the military and Naval Establishments, no appropriation shall be available for the purchase, maintenance, or operation of any aircraft unless specific authority for the purchase, maintenance, or operation thereof has been or is provided in such appropriation."

2. 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;

    - **No specific authority**. These provisions are required by reason of rulings of the Comptroller General that specific authority is required for reimbursing the General Services Administration for guard services (B–87255); and for contracting with private persons for the performance of duties with which the agency is specifically charged (15 Comp. Gen. 951).

3. construction and maintenance of necessary buildings and appurtenant facilities;

    - **No specific authority.** The Organic Act of 1879, establishing the Geological Survey and providing for "... examination of the geological structure, mineral resources, and products of the national domain" (43 U.S.C. 31) is general authorization for construction of special-purpose laboratory buildings. Specific authorization by the Congressional committees on public works is not needed because of the highly specialized purposes of the building. 40 U.S.C. 612: "The term 'public building' means any building ... which is generally suitable for office or storage space ... but shall not include any such buildings and construction projects: ... (E) on or used in connection with ... or for nuclear production, research, or development projects." 41 U.S.C. 12: "No contract shall be entered into for the erection, repair, or furnishing of any public building ... which shall bind the government to pay a larger sum of money than the amount in the Treasury appropriated for the specific purpose."

4. acquisition of lands for gauging stations and observation wells;

    - **43 U.S.C. 36(b)** provides that, "The Secretary of the Interior may, on behalf of the United States and for the use by the Geological Survey in gaging streams and underground water resources, acquire lands by donation or when funds have been appropriated by Congress by purchase or condemnation ...."

5. expenses of the U.S. National Committee on Geology;

   - **43 U.S.C. 31** participation in and payment of expenses of the U.S. National Committee on Geology is a proper and necessary function of the Geological Survey, and so is authorized by the Survey's Organic Act of March 3, 1879, 43 U.S.C. 31. This Act provides that, "...The Director of the Geological Survey, which office is established, under the Interior Department, shall be appointed by the President by and with the advice and consent of the Senate. This officer shall have the 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 ...."

6. 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:

   - **66 Stat. 453.** The above language first appeared in the Appropriation Act for FY 1953, P.L. 82–470 (66 Stat. 453), and has been repeated in each Act since that date. Article I, Section 10, paragraph 3, of the United States Constitution provides that, No State shall, without the consent of Congress, lay any duty on tonnage, keep troops, or ships of war in time of peace, enter into any agreement or compact with another State, or with a foreign power, or engage in war, unless actually invaded, or in such imminent danger as will not admit or delay." (emphasis supplied)

   Thus each interstate compact must be approved by the Congress and signed by the President. The Public Law approving each interstate compact represents the authorizing legislation.

7. *Provided*, That activities funded by appropriations herein may be accomplished through the use of contracts, grants, or cooperative agreements as defined in 31 U.S.C. 6302, et seq.

   - The above language appears in the Department of the Interior and Related Agencies Appropriations Act, 1988, as included in Public Law 100–202.

8. *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 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.

   - The above language appears in the Consolidated Appropriations Act, 2005 (Interior and Related Agencies portion), as included in Public Law 108–447.

Permanent Authority:

1. *Provided*, That appropriations herein and hereafter made shall be available for paying costs incidental to the utilization of services contributed by individuals who serve without compensation as volunteers in aid of work of the Geological Survey, and that within appropriations herein and hereafter provided, Geological Survey officials may authorize either direct procurement of or reimbursement for expenses incidental to the effective use of volunteers such as, but not limited to, training, transportation, lodging, subsistence, equipment, and supplies.

    - **43 U.S.C. 50c**

2. *Provided further*, That provision for such expenses or services is in accord with volunteer or cooperative agreements made with such individuals, private organizations, educational institutions, or State or local government.

    - **43 U.S.C 31(a)**

3. *Provided further*, That the Geological Survey (43 U.S.C. 31(a)) shall hereafter be designated the United States Geological Survey.

    - **Department of the Interior and Related Agencies Appropriations Act, 1992, as included in Public Law 102–154.**

4. *Provided further*, That the United States Geological Survey may hereafter contract 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 purposes 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 a Federal employees for any other purposes.

    - **Department of the Interior and Related Agencies Appropriations Act, 2000, as included in Public Law 106–113.**

5. *Provided further,* That notwithstanding the provisions of the Federal Grant and Cooperative. Agreement Act of 1977 (31 U.S.C. 6301–6308), the may be United States Geological Survey is authorized to continue existing, and hereafter, to enter into new cooperative agreements directed towards a particular cooperator, in support of joint research and data collection activities with Federal, State, and academic partners funded by appropriations herein, including those that provide for space in cooperator facilities.

    - **Department of the Interior and Related Agencies Appropriations Act, 2004, as included in Public Law 108–108.**

Fixed Costs and Related Changes

(Dollar amounts shown in thousands)

Additional Operational Costs from 2006 and 2007 January Pay Raises

	2006 Budget Change	2006 Revised Change	2007 Change
2006 Pay Raise, 3 Quarters in 2006 Budget	+$10,004	+$9,858	NA
Amount of Pay Raise Absorbed	[0]	[$3,626]	NA
2006 Pay Raise, 1 Quarter			+$3,020
Amount of Pay Raise Absorbed			[$1,294]

	2007 Change
2007 Pay Raise	+$7,057
Amount of Pay raise Absorbed	[$3,024]

These adjustments are for an additional amount needed in 2007 to fund the remaining 3-month portion of the estimated cost of the, on average, 3.1 percent pay increases effective in January 2006 and the additional costs of funding an estimated 2.2 percent January 2007 pay increase for GS-series employees and the associated pay rate changes made in other pay series.

Other Fixed Cost Changes

	2006 Budget	2006 Revised	2007 Change
Worker's Compensation Payments	$3,425	$3,375	-$381
Amount Absorbed		[$50]	

The adjustment is for actual charges through June 2005, in the costs of compensating injured employees and dependents of employees who suffered accidental deaths while on duty. Costs for 2006 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.

	2006 Budget	2006 Revised	2007 Change
Unemployment Compensation Payments	$592	$583	+$141
Amount Absorbed		[$9]	

The adjustment is for estimated 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

	2006 Budget	2006 Revised	2007 Change
Rental Payments to GSA and Others	$65,004	$64,048	+$1,123
Amount Absorbed		[$956]	

The adjustment is for changes in the costs payable to General Service 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. 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.

Other Fixed Cost Changes (continued)

	2006 Budget	2006 Revised	2007 Change
Department Working Capital Fund Changes	$14,617	$14,504 [$145]	+$1,485

The change reflects expected changes in the charges for services funded through the working capital fund (WCF). These charges are displayed in the Budget Justification for Department Management.

	2006 Budget Change	2006 Revised Change	2007 Change
Employer Share of Federal Health Benefit Plans	$36,374	$35,839	+$2,773
Amount Absorbed	[$0]	[$535]	[$1,188]

The adjustment is for changes in the Federal government's share of the cost of health insurance coverage for Federal employees. The increase is estimated at 11 percent, the average increase for the past few years.

Technical Adjustments

Geographic Research and Geospatial Information Restructure

Geographic Research and Geospatial Information Restructure	2007 Change
Geographic Research, Investigations, & Remote Sensing	
Cooperative Topographic Mapping	-$68,855
Land Remote Sensing	+$2,768
Geographic Analysis and Monitoring	+$1,786
Subtotal	-$64,301
Enterprise Information	
National Geospatial Program	+$64,301
Net Change	$0

With the establishment of the Enterprise Information Activity in FY 2005, the USGS instituted a new management model for geographic research and geospatial information programs to enhance the integration, synthesis, and delivery of USGS geospatial data and to consolidate funding for bureau information infrastructure.

The restructure is necessary to enable the USGS to focus efforts on developing geographic research and applications activities with the Geographic Analysis and Monitoring, Land Remote Sensing, and Science Impact programs, which are the centerpieces of USGS geography research and applications.

The restructure is also necessary to bring together geospatial data coordination, standards, partnership, and policy development efforts for the Federal Geographic Data Committee,

Geospatial One-Stop, and *The National Map*.

The FY 2006 Budget Justification introduced the need to unify management and control of geospatial programs; hence, a budget restructure is proposed in FY 2007 to fulfill that need.

Benefits of the transfer include:

- Aligning management and performance responsibility for geospatial activities with program responsibility,
- Implementing OMB guidelines through an enterprise approach to managing the USGS portfolio of geospatial assets by integrating the essential geospatial components and enabling them to be managed as a unified portfolio that benefits the entire geospatial community,
- Shifting emphasis from producing maps to providing oversight and access to the creation of map products and geographic knowledge,
- Developing an enhanced suite of USGS geospatial products and services, and
- Furthering efforts to complete basic geospatial data layers on a national scale.

Science Support Restructure

The current budget structure for the Science Support activity contains a subactivity entitled "Payments to the NBC," which was originally intended to reflect payments to the Department for common services provided by the National Business Center and billed through the Department's Working Capital Fund. However, the subactivity has not kept pace with the increasing number and cost of services provided by the NBC and other Department offices. Additional funding has had to be provided from the Bureau Operations subactivity in particular, and from other components of the budget as well, to cover the full scope of Department services. Since the subactivity no longer reflects the purpose for which it was created, USGS proposes to consolidate the Payments to the NBC subactivity with the Bureau Operations subactivity and manage the Science Support activity at the activity level. This approach also mirrors the level at which this activity is overseen in the appropriation.

Summary of Requirements

(Dollar amounts in thousands)

Appropriation: Surveys, Investigations, and Research

	FTE	Amount	FTE	Amount
Budget estimate, 2006			5,908	965,345
Fixed and Related Cost Changes:				
Additional Cost in 2007 of January 2006 Pay Raise		+3,020		
Additional Cost in 2007 of January 2007 Pay Raise		+7,057		
Worker's Compensation Payments		-381		
Unemployment Compensation Payments		+141		
Rental Payments to GSA and Others		+1,123		
Department Working Capital Fund Charges		+1,485		
Employer Share of Federal Health Benefit Plans		+2,773		
Subtotal, Fixed Cost Adjustments				+15,218
Technical Adjustment			-72	0
Subtotal, Fixed Costs and Related Changes			-72	+15,218
Program Change			-271	-35,803
TOTAL REQUIREMENTS			5,565	944,760

Summary of Requirements (continued)

(Dollars in thousands)

Comparison by Activity/Subactivity/Prog Element	2005 Actual FTE a/	2005 Actual Amount	2006 Enacted FTE a/	2006 Enacted Amount	Fixed Costs & Related Changes (+/-) b/ FTE	Fixed Costs & Related Changes (+/-) b/ Amount	Program Changes (+/-) FTE	Program Changes (+/-) Amount	2007 Budget Request FTE a/	2007 Budget Request Amount	Inc.(+) Dec.(-) from 2006 FTE	Inc.(+) Dec.(-) from 2006 Amount
GEOGRAPHIC RESEARCH, INVESTIGATIONS, & REMOTE SENSING												
Cooperative Topographic Mapping	514	71,393	358	68,855	-358	-68,855		0	0	0	-358	-68,855
Land Remote Sensing	83	32,730	85	45,713	20	3,061	2	12,980	107	61,754	22	16,041
Geographic Analysis and Monitoring	113	14,628	113	14,705	3	2,155	-20	-2,000	96	14,860	-17	155
TOTAL	710	118,751	556	129,273	-335	-63,639	-18	10,980	203	76,614	-353	-52,659
GEOLOGIC HAZ., RESOURCES, & PROC.												
Geologic Hazard Assessments												
Earthquake Hazards	227	50,864	227	50,583	-6	578		300	221	51,461	-6	878
Volcano Hazards	135	20,714	135	21,466	-4	206		0	131	21,672	-4	206
Landslide Hazards	20	3,043	20	3,042	-1	42	1	200	20	3,284	0	242
Global Seismographic Network	5	7,469	5	3,914		35		0	5	3,949	0	35
Geomagnetism	14	1,989	14	1,995		35		0	14	2,030	0	35
Subtotal	401	84,079	401	81,000	-11	896	1	500	391	82,396	-10	1,396
Geologic Landscape & Coastal Assessments												
Earth Surface Dynamics	82	13,634	82	13,354	-2	159		-247	80	13,266	-2	-88
National Cooperative Geologic Mapping	144	25,162	144	25,113	-4	334		0	140	25,447	-4	334
Coastal and Marine Geology	236	37,457	239	39,285	-7	499		-391	232	39,393	-7	108
Subtotal	462	76,253	465	77,752	-13	992	0	-638	452	78,106	-13	354
Geologic Resource Assessments												
Mineral Resources	426	53,764	424	52,774	-12	954	-180	-22,943	232	30,785	-192	-21,989
Energy Resources	157	23,250	157	23,760	-4	371		2,000	153	26,131	-4	2,371
Subtotal	583	77,014	581	76,534	-16	1,325	-180	-20,943	385	56,916	-196	-19,618
TOTAL	1,446	237,346	1,447	235,286	-40	3,213	-179	-21,081	1,228	217,418	-219	-17,868
WATER RESOURCES INVESTIGATIONS												
Hydrologic Monitoring, Assessments & Research												
Ground-Water Resources Program	60	6,998	60	8,027		115		-720	60	7,422	0	-605
National Water-Quality Assessment	430	61,645	451	62,203		1,308	-9	-940	442	62,571	-9	368
Toxic Substances Hydrology	64	14,476	64	14,386		287		-1,458	64	13,215	0	-1,171
Hydrologic Research & Development	294	15,997	294	14,609		285		-1,241	294	13,653	0	-956
National Streamflow Information Program	43	13,814	43	13,944		295		2,525	43	16,764	0	2,820
Hydrologic Networks and Analysis	261	29,524	261	29,358		515		-1,622	261	28,251	0	-1,107
Subtotal	1,152	142,454	1,173	142,527	0	2,805	-9	-3,456	1,164	141,876	-9	-651
Cooperative Water Program	789	62,337	780	62,833		1,338	-18	-2,000	762	62,171	-18	-662
Water Resources Research Act Program	2	6,409	2	6,404		0	-2	-6,404	0	0	-2	-6,404
TOTAL	1,943	211,200	1,955	211,764	0	4,143	-29	-11,860	1,926	204,047	-29	-7,717

Summary of Requirements (continued)

(Dollars in thousands)

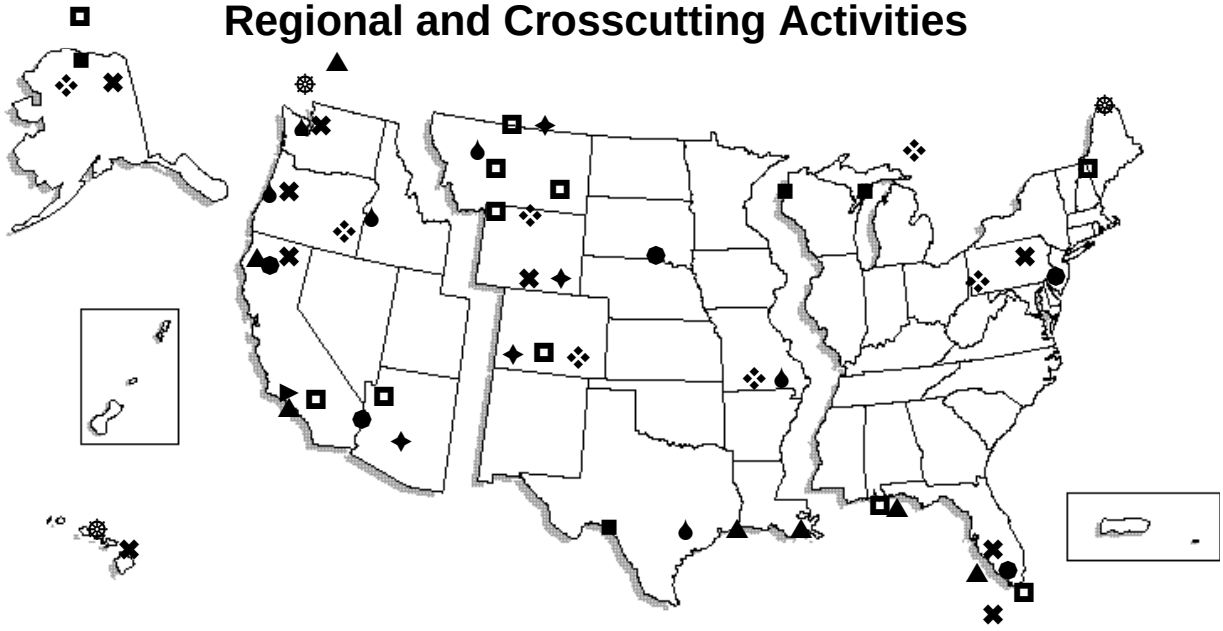
Comparison by Activity/Subactivity/Prog Element	2005 Actual FTE a/	2005 Actual Amount	2006 Enacted FTE a/	2006 Enacted Amount	Fixed Costs & Related Changes (+/-) b/ FTE	Fixed Costs & Related Changes (+/-) b/ Amount	Program Changes (+/-) FTE	Program Changes (+/-) Amount	2007 Budget Request FTE a/	2007 Budget Request Amount	Inc.(+) Dec.(-) from 2006 FTE	Inc.(+) Dec.(-) from 2006 Amount
BIOLOGICAL RESEARCH												
Biological Research and Monitoring	1,042	133,130	1,051	140,086		2,036	-12	-6,430	1,039	135,692	-12	-4,394
Biological Information Management & Delivery	80	23,999	80	23,794		173	-7	-2,000	73	21,967	-7	-1,827
Cooperative Research Units	126	14,570	126	14,664		274		0	126	14,938	0	274
TOTAL	1,248	171,699	1,257	178,544	0	2,483	-19	-8,430	1,238	172,597	-19	-5,947
ENTERPRISE INFORMATION												
Enterprise Information Security and Technology	73	22,714	73	24,866		309	-3	797	70	25,972	-3	1,106
Enterprise Information Resources	92	16,989	91	16,900		225	-3	-489	88	16,636	-3	-264
National Geospatial Program	12	4,670	12	4,628	303	65,164	-20	-1,170	295	68,622	283	63,994
TOTAL	177	44,373	176	46,394	303	65,698	-26	-862	453	111,230	277	64,836
SCIENCE SUPPORT	462	65,584	459	69,302		2,090		-4,010	459	67,382	0	-1,920
FACILITIES												
Rental Payments	0	71,367	0	71,805		1,123		-540	0	72,388	0	583
Operations & Maintenance	58	19,820	58	19,604		107		0	58	19,711	0	107
Deferred Maintenance & Capital Improvement	0	3,424	0	3,373		0		0	0	3,373	0	0
TOTAL	58	94,611	58	94,782	0	1,230	0	-540	58	95,472	0	690
SIR Appropriation, TOTAL	6,044	943,564	5,908	965,345	-72	15,218	-271	-35,803	5,565	944,760	-343	-20,585
Emergency Approp. (P.L. 108-324) [2004 Hurricanes]		1,000										
DOI 101/102 Transfer [Katrina]		4,000										
Emergency Approp. (P.L. 109-148) [Katrina]				5,300								-5,300
Spectrum Relocation Costs Transfer						6,159				6,159		6,159
SIR Appropriation, TOTAL	6,044	948,564	5,908	970,645	-72	21,377	-271	-35,803	5,565	950,919	-343	-19,726

a/ The FTE's depicted in the FY 2005, 2006, and 2007 columns are only the staff-years associated with appropriated funding. Reimbursable FTE's are 2,670, 2,670 and 2,652 and Working Capital Fund FTE's are 206, 179 and 179 for FY 2005, 2006 and 2007 respectively. USGS total FTE's for FY 2005, 2006, and 2007 are 8,920, 8,757 and 8,396 respectively. FTE may not add to totals and subtotals, due to rounding.

b/ Fixed cost funding for this account totals $20,724, of which $15,218 will be budgeted and $5,506 will be absorbed. Included in this account's funding is a one-time technical adjustment that, through a budget restructure, moves $64,301 to the Enterprise Information Activity from the Geographic Research, Investigations, and Remote Sensing Activity related to the need to unify management and control of geospatial programs.

This page intentionally left blank.

Science on the Landscape — Regional and Crosscutting Activities



Science on the Landscape — Regional and Crosscutting Activities focuses on multidisciplinary studies that showcase USGS science within and across disciplines, address issues important to regional partners and customers, and enhance partnerships both internally and externally. The programmatic contributions to the multidisciplinary studies are described in the relevant program sections. Some examples of the multidisciplinary work conducted across the Nation are indicated on the map shown above with symbols representing the projects and issues described below.

Included in this section is a new initiative, the FY 2007 Integrated Multi-Hazards Demonstration Project in Southern California, which integrates research, information, and products from several hazards into common data sets to improve the utility of information in reducing loss of life and property. Other regionally focused efforts reported here include Science on the DOI Landscape, a regionally funded program, which continues to focus on the partner needs of Interior bureaus; Departmental crosscuts, many of which are multi-disciplinary; and other significant multidisciplinary accomplishments, including Priority Ecosystems Science, which addresses five priority ecosystems of Everglades, Chesapeake Bay, Platte River, Mojave Desert, and San Francisco Bay/Delta.

The Science on the Landscape section describes:

- ► Multi-Hazards Initiative – Southern California
- ◘ Science on the DOI Landscape
- ✖ Crosscuts
- ▲ Hazards
- ♦ Water Use and Availability
- ✦ Fire
- ❖ Landscape Change
- ☸ Coastal and River Processes
- ■ Human Health
- ● Priority Ecosystems Science

Integrated Multi-Hazards Demonstration Project in Southern California

Program Component	FY 2005 Actual	FY 2006 Enacted	2007 Fixed Costs & Related Changes	2007 Program Changes	2007 Budget Request	Change From 2006
Geographic Resources, Investigations, & Remote Sensing						
Geographic Analysis & Monitoring	14,628	14,705	+2,155	-2,000	14,860	+155
Multi-Hazards Project	***0***	***0***	***0***	***+300***	***300***	***+300***
FTE	*0*	*0*		*+1*	*1*	*+1*
Geologic Hazards, Resources, and Processes						
Geologic Hazard Assessments						
Earthquake Hazards	50,864	50,583	+578	+300	51,461	+878
Multi-Hazards Project	***0***	***0***	***0***	***+300***	***300***	***+300***
Landslide Hazards	3,043	3,042	+42	+200	3,284	+242
Multi-Hazards Project	***0***	***0***	***0***	***+200***	***200***	***+200***
FTE	*0*	*0*		*+1*	*1*	*+1*
Geologic Landscape & Coastal Assessments						
Coastal & Marine Geology	37,457	39,285	+499	-391	39,393	+108
Multi-Hazards Project	***0***	***0***	***0***	***+200***	***200***	***+200***
Water Resources Investigations						
Hydrologic Monitoring, Assessments, & Research						
National Streamflow Information Program	13,814	13,944	+295	+2,525	16,764	+2,820
Multi-Hazards Project	***0***	***0***	***0***	***+200***	***200***	***+200***
Biological Research						
Biological Research & Monitoring	133,130	140,086	2,036	-6,430	135,692	-4,394
Multi-Hazards Project	***0***	***0***	***0***	***+300***	***300***	***+300***
FTE	*0*	*0*		*+1*	*1*	*+1*
Enterprise Information						
National Geospatial Program	4,670	4,628	+65,164	-1,170	68,622	+63,994
Multi-Hazards Project	***0***	***0***	***0***	***+680***	***680***	***+680***
Total Requirements $000	**0**	**0**	**0**	**+2,180**	**2,180**	**+2,180**
Total FTE	***0***	***0***	***0***	***+3***	***3***	***+3***

Justification of FY 2007 Program Changes

The 2007 request for the Integrated Multi-Hazards Demonstration Project in Southern California is $2,180,000 and 3 new FTE (GIS specialist, landslide geologist, and fire ecologist). In addition to the requested funds, the scientific and technological work described in this demonstration project will be supported by an additional $3.5 million and 4 FTE from cost savings associated with workforce restructuring in the Geologic Discipline and redirection of priorities within hazards-related and geospatial programs.

For FY 2007, the USGS proposes a new Integrated Multi-Hazards Demonstration Project to demonstrate how integrating information and products about multiple hazards improves the usefulness of this information in reducing loss of life and property from natural hazards. The Integrated Multi-Hazards Demonstration Project initiative brings the unique research and systems capabilities of the USGS to bear on the complex issues surrounding natural hazards events, especially those that are interrelated such as fire, floods, and debris flows, or earthquakes and tsunamis. Occurrences of natural hazards vary temporally, with some hazards (such as fires) recurring every year and others (such as earthquakes) occurring on a decadal or longer time period. The development of integrated databases and the enhancement of information technology (IT) systems to track multiple hazards will facilitate more rapid communication and response to the user community, regardless of the timeframe of a natural disaster. This proposed five-year demonstration project is part of a larger initiative, designed to transfer technologies, hazards systems, and integrated products to urban areas nationwide most at risk from multiple hazards. The next site(s) will be chosen based on a review of lessons learned, which will be conducted at the end of the third year of this project, as well as the potential for immediate catastrophic events.

Southern California, having one of the Nation's highest potentials for extreme, catastrophic losses from several natural hazards such as earthquakes, tsunamis, fires, landslides, and floods, will serve as the site for the demonstration project. Estimates of expected losses from these hazards in the eight counties of Southern California exceed $3 billion per year. These numbers are expected to increase as the present population of 20 million grows at more than 10 percent per year.

The multi-hazards initiative is funded through the Geographic Analysis and Monitoring subactivity, Earthquake Hazards program, Landslide Hazards program, Coastal and Marine Geology program, National Streamflow Information Program, Biological Research and Monitoring subactivity, and National Geospatial Program. These programs and subactivities support efforts to generate the specialized scientific data and research analyses necessary to produce scientific products that the public and private sectors can use to respond to and mitigate damages and reduce injuries and deaths as a result of natural disasters. The programs also provide the capability to develop layered maps using advanced satellite technologies to capture key landscape features, locations of essential operating facilities, and other features for the emergency management community's use.

Program Performance Change Table

Total Performance Change		*+3 formal workshops or training provided to customers* *+3 systematic analyses & investigations delivered to customers* *+2 county, or comparable jurisdiction, that has adopted improved building codes, land-use plans, emergency response plans, or other hazard mitigation measures based on USGS earthquake hazards information* *+4 partnership formed to link scientific information and societal decisions*			
	A	***B***	***C***	***D= B+C***	***E***
	Overall Performance Changes from 2006 to 2007				
Measure	**2006 Enacted Performance**	**2007 Base Performance Level**	**2007 Impact of Program Change on Performance**	**2007 Budget Request Performance**	**Out-year Impact of 2007 Program Change on Performance**
# of formal workshops or training provided to customers (instances/issues/events)	**0**	**0**	**+2**	**2**	**+1**
# of systematic analyses & investigations delivered to customers	**0**	**0**	**+2**	**2**	**+1**
# of counties, or comparable jurisdictions, that have adopted improved building codes, land-use plans, emergency response plans, or other hazard mitigation measures based on USGS earthquake hazards information **(PART)**	**0**	**0**	**+1**	**1**	**+1**
# of partnerships formed to link scientific information and societal decisions	**0**	**0**	**+1**	**1**	**+3**

Column B: The performance level you expect to achieve absent the program change (i.e., at the 2006 enacted level plus/minus funded fixed cost/related changes); this would reflect, for example, the impact of prior year funding changes, management efficiencies, absorption of fixed costs, and trend impacts.

Column E: The out-year impact is the change in performance level expected in 2008 and Beyond of ONLY the requested program budget change; it does <u>not</u> include the impact of receiving these funds again in a subsequent outyear.

Program Overview

The USGS proposes to demonstrate how the integration of information from modern earth observation hazard networks, targeted research on hazards processes, and effective risk communication can be used to save lives and reduce losses from natural hazards.

Modernizing Earth Observation Hazard Networks

Modern and stable ground-based monitoring networks provide the fundamental information for accurate predictions and characterizations of hazards, as well as information critical to response and recovery efforts. These networks, increasingly more utilized, act as the interface between

USGS scientists and Federal, State and local emergency managers, the private sector, the public, and the news media.

- Seismic networks — The proposed work will improve seismic networks in Southern California. Funds will permit the USGS and partners to install and maintain new ANSS strong-motion seismic sensors, robust real-time telemetry, and increased operational support. These improvements will allow the USGS to provide ShakeMaps to emergency responders in at-risk metropolitan areas.
- Streamgaging Networks — To fill critical gaps in the areal coverage within the project area, 18 streamgages and raingages will be added to the network. Raingages will be upgraded to allow real-time transmission of soils and environmental monitoring data. These data are used in flood, landslide, and debris-flow forecasting and warning.
- Early Warning System for Flash Floods and Debris Flows — In cooperation with the NOAA, the USGS will develop and operate a prototype flash-flood and debris-flow warning system for burned areas in Southern California. The prototype will initially utilize the NWS Flash Flood Monitoring and Prediction operational framework for meteorological data analyses, comparison with rainfall intensity-duration thresholds, and information and warning dissemination. The system will also provide map results on a publicly available risk-assessment and early-warning Web site, updated throughout significant storm events.

Targeted Research on Hazard Processes and Prediction

Accurate forecasts and prediction depend on a thorough understanding of the physical process controlling a hazard's occurrence, distribution, timing, and severity. Recent advances in science and technology have moved scientists closer to accurately predicting and forecasting hazard events, but additional targeted research is needed to make significant advances in these areas.

- Assessment of the Southern San Andreas Fault — The southern San Andreas Fault is recognized as Southern California's most likely source of future great earthquakes; 20 million people are likely to be affected by such an event. The project will include systematic study of the earthquake history of the southernmost 550 km of the fault. This work will benefit from leveraging the activities of the Southern California Earthquake Center (SCEC), a consortium of 40 academic research institutions supported by the USGS and NSF, with a mission to build predictive models for earthquake occurrence and effects in the region. The SCEC has identified the southern San Andreas Fault as a concentrated research topic for the next several years.
- Wildfires research will focus on the role of fire suppression and fuels accumulation in chaparral ecosystems, specifically on the relation of wildfire intensity and severity to fuels accumulations affected by historical fire suppression, human fire ignitions during extreme weather conditions, and the interspersion of urban and wildland areas (wildland-urban interface). Research is critical to understanding and mapping fire risk, planning effective fuel treatments if required, and developing emergency response plans.
- Tsunami Modeling and Inundation Mapping will continue USGS collaborative activities with the NOAA National Tsunami Hazard Mitigation Program (NTHMP) and the University of Southern California. Efforts will be made to identify, map, and date tsunami deposits onshore to further advance knowledge regarding large submarine landslide recurrence intervals, tsunami recurrence intervals, and the coastal impact of past events. These data and interpretations will lead to improved tsunami inundation maps for the

region. These products will support hazard assessment, response, and mitigation planning by Federal, State, and local emergency response managers.

- Landslide and Debris-flow Predictive Modeling — Application of predictive models before the occurrence of wildfires can help identify sensitive drainage basins and thus serve to direct both forest restoration efforts before fires and fire protection efforts during a fire. Rapid application of these models post-fire can guide and prioritize data collection and field mitigation efforts and aid in making effective and appropriate mitigation decisions by the USFS, the California Office of Emergency Services, and surrounding counties. Products will include decision support tools for assessing post-fire debris flow hazards, and assessments of hazards for extensive fire events within Southern California.

Risk Communication

USGS science information can reduce losses when communities at risk use it to make informed decisions. This program will expand the use of USGS science through improved communication and technology. The USGS will work with local planners, emergency managers, and first responders to develop products and tools that national and local decisionmakers and other stakeholders can use to evaluate the effectiveness and value of risk communication tools, methods, and processes. Web-based techniques that incorporate spatial and temporal hazards data will be developed to improve risk communication processes. These efforts will guide the development of improved multi-hazard risk communication techniques by both the USGS and local practitioners.

Products

Working with partners, the USGS will provide policymakers and the public with the tools needed to understand the significance of the hazards they face by better conveying the threat through risk-focused products. Among the products that the USGS will provide are:

- Integrated Hazard Maps and Products — The USGS will work with the emergency management community, including the Los Angeles and San Bernardino County Offices of Emergency Management, to use new integrated data systems, as well as existing seismic, flood, and geodetic monitoring systems for six natural hazards (earthquakes, tsunamis, extreme coastal storms, fires, landslides, and floods) to develop integrated hazard products (e.g., aftershock probability estimates, debris flow hazard maps, tsunami and floodplain inundation maps) for use in emergency management centers of business, industry, and government facilities in Southern California. Partnering with emergency managers in the development of products will ensure that they receive hazard information in formats that best serve their needs. The information will form the basis for landscape analysis and modeling for the project study area. This analysis will integrate the diverse and distributed natural hazards information from the USGS and will provide access to information from partners such as NOAA (weather data) and NIFC (wildfire information).
- Rainfall intensity-duration thresholds will be developed that identify the storm-rainfall conditions most likely to result in flash flood and debris-flow activity from burned basins. Primary users and partners include the NWS, which issues flash flood and debris flow warnings, and emergency response personnel, who need to be informed of the potential for flash floods and debris flows.

- Development of tools to assess coastal vulnerability to extreme storm events will build on partnerships with the California Department of Boating and Waterways and the USACE along the Santa Barbara and Ventura County shoreline. Beach morphology characteristics (beach height, dune/cliff location) will be combined with statistical models of wave run-up to develop an assessment of the susceptibility of the Santa Barbara coast to severe storms.
- Planning scenarios and decision tools for evaluating risk reduction strategies — The USGS will cooperate with local planners, emergency managers, and other decisionmakers to develop planning scenarios and decision analysis tools to evaluate tradeoffs associated with different risk reduction strategies. The scenarios and decision tools will be linked with participatory processes to assist communities in determining the impacts and consequences from alternative investment strategies, such as mitigation, zoning, and capital infrastructure decisions. These efforts will extend traditional physical models by integrating natural hazards and socioeconomic information in the development of risk reduction decision tools and products.

More information on this initiative can be found within each of the four discipline sections as well as in Enterprise Information (see pages G - 21, H -5, 29, and 71, I - 45, J - 8, K -24).

Regional Overview

The USGS regional construct was developed to focus on issue-based, multidisciplinary science; align USGS work more closely with partners at the local and regional level; and enhance partnerships with Department of the Interior bureaus and other Federal, State, and local agencies. Closer proximity of the three USGS regions to Interior bureaus and other partners allows USGS scientists and managers to understand and address land and resource management issues partners at the local and regional levels; increases the opportunity for partnerships and leveraging of resources; and brings the entire portfolio of USGS science expertise to bear on regional issues. Regional staff is successfully connecting the world-renowned capabilities of USGS with the high-priority, real-time land management, urban planning, and heightened security needs of local, Federal, State, Tribal, and community managers. Pressing regional science issues in FY 2007 include natural hazards, water use and availability, fire, landscape change, coastal and river processes, human health, and ecosystem processes.

Regional Planning, Performance, and Partnerships

Regional science planning is a collaborative effort between regional and programmatic managers to plan and implement the bureau's science goals, with an emphasis on work important to our many regional partners. Regional science outputs and outcomes directly address questions relating to the Department's strategic goals of Resource Protection, Resource Use, and Serving Communities and are reported in the programs' performance tables.

Activities for planning and assessment of performance are conducted at various management levels in the Regions. These activities include reviews on the full range of activities under their purview; scientific programs, products, management, and support services. Regional strategic reviews assess longer term strategic planning goals, their alignment with regional and bureau goals, and the impact of the scientific work on societal issues. Feedback is sought from partners who use and benefit from the products to identify their high priority science issues and specific science questions. Regional representatives meet with partners and USGS scientists to

propose science projects to address these issues. Following a description of each region are highlights of activities that illustrate how the USGS incorporates partnerships to conduct science and inform decisions for the future.

Eastern Region — The Eastern Region (ER) manages programs in 26 States, the District of Columbia, the Commonwealth of Puerto Rico, and the U.S. Virgin Islands. Approximately 2,800 employees are distributed across 123 duty stations east of the Mississippi River. The ER has the longest urbanized coastline extending from the Gulf Coast of Mississippi to the Atlantic coastline of Maine, and along the Great Lakes from New York to Wisconsin; coastal issues represent an important focus for USGS science in response to coastal storms, erosion, and other hazards. The ER includes 60 percent of the U.S. population, or 177 million people. Nearly 50 percent of the growth in U.S. population since 1990 has occurred in the East, which contributes to the longest record of human-induced change in the Nation. The Eastern Region is characterized by numerous, high-density, urban population centers located along or in close proximity to shorelines, hardwood forests, and the Appalachian Mountains. Continued expansion of coastal and riverine urban centers into rural areas of the region will impact the Nation's ability to use and enjoy natural resources while increasing the number and difficulty of the challenges to protect the welfare of citizens from natural disasters and other health risks.

In FY 2005, ER and the other regions conducted asset prioritization and implemented Regional Investment Review boards as part of the capital improvement planning process. Significant administrative and cost center management training was conducted and completed in the Eastern Region, including environmental management system training conducted at 15 major centers. Acquisition support was highly effective in response to the 2005 hurricanes in the Gulf of Mexico. The Eastern Region provided the contractual oversight for the bureau business strategy that includes competitive sourcing and entered into cooperative agreements with universities for conducting research as well as for sharing of facilities. ER renewed an MOU with the University of Puerto Rico to facilitate the exchange of faculty and students for research in the fields of management and interpretation of natural resources and hazards and continues the successful cooperation with Fort Valley State University on behalf of the bureau. Eighteen summer interns (minorities and women) were placed at 12 science centers in every USGS region.

Central Region — The USGS Central Region (CR) manages programs in 15 States between the Mississippi River and the western slope of the Rocky Mountains. Approximately 2,865 employees and 975 on-site contractors are distributed in 88 cities and 21 field offices across the region. Though largely rural, the region has some of the fastest growing population centers in the United States. Priority science issues of CR resource managers are agricultural practices, fire science, invasive species, water availability and use, and landscape change. Of note, response to natural disasters is in the forefront of CR scientific activities.

The USGS National Earthquake Information Center (NEIC), located in Golden, CO, plays a key role in providing near-real-time data to NOAA tsunami warning centers and supports tsunami monitoring in the Pacific Rim and disaster alerts in Alaska, Hawaii, Washington, California, and U.S. territories in the western Pacific. Seismic data from the Global Seismographic Network, supported jointly by the USGS and NSF, are used daily in the routine operations of the NEIC to determine the locations, depths, magnitudes, and other parameters of earthquakes worldwide. During the late 2005 Gulf Coast hurricanes, USGS employees across the country delivered invaluable information and technical support, such as evacuation, rescue, relocation, recovery, clean-up, maps, and environmental impact assessments.

GateWay Community College

Our partnership with the USGS has been instrumental in allowing us to recruit students and train them using the appropriate instrumentation and techniques and providing an opportunity for students to gain employment. Additionally, the input that USGS personnel have provided in the development and delivery of our curriculum has been invaluable.

We fully endorse the USGS and look forward to continuing our mutually beneficial relationship with them.

Lisa C. Young, M.Ed., Program Director
GateWay Community College
Phoenix, AZ
October 2005

In addition to a robust science program, Central Region reports accomplishments in the area of operations management that enhances services. Central Region staff worked to reduce growing rent and security costs by releasing nearly 68,000 square feet of rentable space. Recruiting from diverse populations, CR has taken major steps forward through the GateWay Community College (Phoenix, AZ) cooperative Hydrologic Technician training and internship programs in cooperation with the USGS. These programs are vehicles for converting interns to permanent positions. The strides made with GateWay are being replicated at colleges in Minnesota and South Dakota. USGS partnered with Southwestern Oklahoma State University on a 2-day course, "Introduction to Field Water-Quality Methods," for the Tribes of Oklahoma via the Distance Learning Program in August 2005. The timing of this training was critical for the Tribes in Oklahoma because many of them are applying for "Treatment as State" status from EPA, which will enable them to set their own water quality standards in their jurisdictional areas.

Western Region — The Western Region (WR) manages programs in nine western States, Guam, and the Pacific Trust Territories. There are approximately 2,400 employees distributed in 33 cities and 80 field offices across the region. With more than 75 percent of Interior lands in the Western Region, USGS responsibilities to serve as the science research arm of Interior to all of Interior's bureaus are enormous, as BLM, NPS, FWS, and BOR are largely vested in the West. WR has longstanding relationships with numerous Federal agencies such as USFS, USACE, EPA, DOE and DOD. USGS also has strong partnerships with the Tribes. WR partners with State and local governments and major private partners such as Bonneville Power on the Columbia River and those who manage hundreds of irrigation districts in the arid West.

The Western Region is home to over 50 million people, including 8 of the Nation's top 10 fastest growing urban metropolises. WR is rich in both renewable and non-renewable natural resources; minerals, hydroelectric energy, geothermal energy, wind energy, oil and gas, water and forests. Also, WR is home to 855 of the 1,263 federally listed threatened or endangered species. Ecosystems such as the San Francisco Bay/Delta, Klamath Basin, the Colorado River, and Puget Sound are the source of frequent collisions between clean water availability, endangered species protection, urban growth, and the Nation's increasing need for energy supply.

Natural hazards are a major driver for WR science projects and planning. WR has the longest coastline in the United States. Underlying the greater part of the coastline are huge and potentially catastrophic earthquake fault subduction zones. This is also the reason WR is home to numerous active volcanoes, one of the world's most volcanically active regions. Volcanoes form extensive belts along the coastal regions: running the length of the Aleutian Islands and the adjacent Alaska peninsula, also capping the Coast Range from Washington to California. Rangeland or forest wildfires have come with increasing frequency and severity bringing substantial impacts, particularly where urban areas encroach on to the rugged mountain terrain

and rural areas. Often these wildfires have associated post-event landslide and debris flows that wreak additional havoc. USGS researchers are working constantly to provide first responder and policy partners the scientific information and tools to keep the public informed, prepared, and safe.

To help increase the diversity of the USGS workforce, WR will attend job fairs at colleges and universities in California and Arizona in FY 2006. The goal is to recruit more women and minorities in under-represented occupations within the USGS workforce and in the student employee positions that serve as the career opportunities for women and minorities in the sciences.

Science on the DOI Landscape

FY 2007 Overview

One of the few completely regional projects, Science on the DOI Landscape has been successful with Interior bureau partners who appreciate the opportunity to work closely with the regions on science issues of mutual interest. In FY 2007, the USGS Regional Directors and staff will continue to coordinate the DOI Landscape funded projects with key Interior bureau regional partners through regularly scheduled meetings to discuss FY 2007 high priority resource management issues, review the results of current projects, and plan for future studies. Selections for DOI Landscape funding are based on multiple criteria that include: close alignment of the project with critical issues and regional and/or program goals; scientific merit, the extent to which the project will provide new insights to address the critical issues; and the potential for leveraging Department landscape funds with additional funding from Interior and other partners. ER leaders will discuss current work on mercury in the Mobile Bay, Alabama area and ground and surface water impacts on water quality and ecology in Biscayne National Park with regional officials from the NPS, FWS, and BLM to determine projects for FY 2007. Other areas of interest for Interior bureaus in the ER are forest pest management, restoration alternatives in urban ecosystems, salt marsh ecology, hurricane response, natural resource recovery from hurricanes, shoreline erosion and other coastal issues. CR leadership will focus on science priorities such as sagebrush habitats, agricultural practices, and water use and availability for BLM, BOR, FWS, and NPS. Rapid response projects, defined as short-term, technical support efforts that are designed to help Interior managers address immediate needs, will continue. The Western Region (WR) will continue to coordinate DOI Landscape projects through collaborative efforts with Interior regional partners (such as the North Slope Science Initiative with BLM and FWS), through consultations and meetings at the Regional Director and Regional Executive level, and through relevant issue-focused workshops (Water Availability for Ecosystems, Future Science Challenges, Fire Science, etc.) to determine new and continuing projects on the DOI Landscape in FY 2007.

FY 2006 Planned Program Performance

Plant Surveys Continue to Monitor Change from Energy Development and Drought — In FY 2006, data collected to monitor the impact to vegetation in the Powder River Basin will be used to help with on-the-ground verification of findings from a landscape change analysis study that is employing remotely sensed data. The site-specific information from the plant surveys will help document changes at a landscape scale in the coalbed methane area.

Expanding the Assessment of Environmentally Sound Water Disposal Practices — In FY 2006, the assessment of infiltration ponds that dispose of the water produced by coalbed methane production will be expanded to determine if the zone of very salty water beneath infiltration ponds is a local or widespread problem across the Powder River Basin. Findings from this new work are critical as there are now more than 3,000 infiltration ponds in the Wyoming portion of the Powder River Basin.

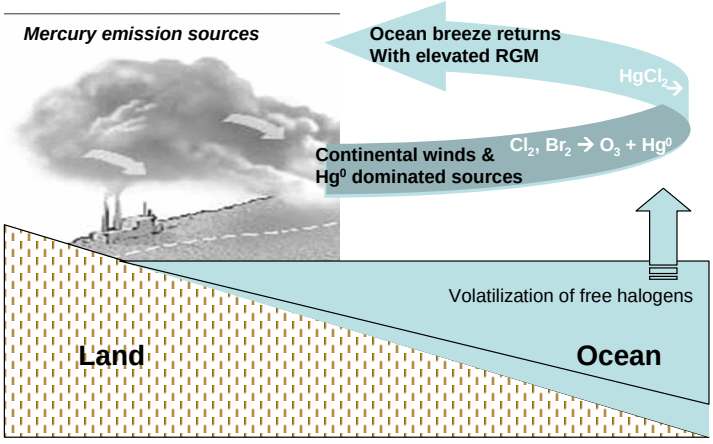
Mancos Shale: The Big File Cabinet Gets Bigger — The Big File Cabinet (BFC) is the Web-mapping tool for interim data and results of the Mancos Shale Landscapes project in the Gunnison Gorge National Conservation Area (GGNCA). In FY 2006, the BFC will be used to develop a Science Project Portal through which users can create maps and run geospatial analyses to provide enhanced data exploration capability to BLM personnel on the GGNCA.

Rapid Response: Building on Success — USGS will continue to build on the successful collaboration with NPS, FWS, BLM, and BOR to address immediate needs of land and resource managers in Colorado, Wyoming, and Montana. These projects will be identified through discussions with partners throughout FY 2006. Two short-term projects in progress are:

- For FWS, the effects of roads on surface water and shallow ground water on the Baca Ranch, CO, as it is being transformed from a private ranch to a National Wildlife Refuge.
- For BOR, the effects of produced waters in the western United States related to oil production and water quality.

Ground-Water and Surface-Water Impacts on Water Quality and Ecology at Biscayne National Park — Work will be done in FY 2006 to calibrate and verify a ground-water model of Biscayne National Park. The new model simulation can improve the estimations of flow paths and salinities for resource managers at the Park. In addition, current information on the hydrogeologic framework of the aquifer will be incorporated into the model. At this time, there are no straightforward methods for explicitly incorporating karst ground-water flow passageways into a ground-water flow and solute transport model. Therefore, several different methods will be utilized and evaluated in order to identify the best approach for incorporating flow zones. This evaluation is expected to produce results that will be transferable to other ground-water models of the area.

Are Coastal Settings Areas of Heightened Concern for Mercury Contamination? — The Mobile Bay, Alabama, ecosystem is an ideal situation for evaluating the sources that contribute to the high levels of mercury deposition in the Gulf Coast, and whether high deposition results in elevated mercury levels in fish. This area was selected after consultations with the FWS. Initial results in FY 2005 for identifying and quantifying mercury in the atmosphere showed evidence that the interactions of the marine atmosphere with mercury sources derived from the continent resulted in higher rates of atmospheric mercury oxidation and deposition at Weeks Bay Estuarine Reserve (a small embayment on the western shore of Mobile Bay). In



FY 2006 the USGS will extend observations of mercury deposition in the Mobile Bay area, and integrate these efforts with mercury bioaccumulation data from black-water streams draining into Weeks Bay to estuarine Mobile Bay, to the Gulf of Mexico. The overall goal of this project is to provide a general understanding of mercury sources and the cycling and bioaccumulation at the continental margins on Interior-managed lands. In future years this study will be expanded to other locations on the Gulf of Mexico and the Atlantic coastal seaboard.

Decision Support for Sustainable Oil and Gas Development on the North Slope of Alaska — The field work and development of decision support tools for this project will continue through 2007 with completion of products planned for 2008.

Support Tools for the Lower Colorado River Multi-Species Conservation Program — All of the tasks and subtasks of this project were in their second year in FY 2005. Three of the tasks are to be completed in FY 2006 and final reports will be prepared for BOR for those tasks in early FY 2007. Prototype maps for ultra-high resolution remote sensing of the vegetation in Cibola National Wildlife Refuge were presented to the refuge manager in FY 2005.

Mojave Desert Landscape: Understanding Ecosystem Function and Developing Tools for Management — In FY 2006, development and testing of monitoring protocols for the Mojave Desert continued with input and guidance from land and resource managers. Testing of monitoring protocols includes understanding the best means to detect change in soil physical properties, annual and perennial plant seedbanks and annual plant production associated with new disturbances and recovery from historic land use. USGS will continue to visit additional disturbed and undisturbed sites to continue development of indicators of ecosystem health for land managers. The results of this and previous years' efforts will be compiled in a final report synthesizing the information developed by Mojave DOI Landscape project.

FY 2005 Program Performance Accomplishments

Adaptive Management in Action: Environmentally Sound Water Disposal Practices — In the Wyoming Powder River Basin, daily production of coalbed natural gas results in over 200 acre-feet of water unsuitable for certain uses. As a result of a USGS and BLM collaboration, the permitting process for infiltration ponds has been amended to minimize the likelihood of similar occurrences. Partners and customers include BLM, the Wyoming Department of Environmental Quality, and industry.

Getting to Know Mancos Shale: All Salt is not the Same — Mancos Shale, which underlies much of the Upper Colorado River Basin, is estimated to contribute at least 50 percent of the salt to the river, resulting in approximately $330 million in annual remediation costs. Reducing salt levels depends on understanding ecosystem response to management activities. A collaboration among Federal, State, local government, academia, and NGOs has resulted in the Web-based interactive management tool, the Big File Cabinet. This tool is currently being used by the Gunnison Gorge National Conservation Area management group, the Colorado Salinity Control Forum, and other organizations to develop land-management alternatives. Web site: *http://minerals.cr.usgs.gov/projects/mancos_shale/index.html.*

Rapid Response: Providing Technical Assistance to Interior — USGS is cooperating with BLM, NPS, and FWS to address the immediate needs of land and resource managers in Colorado, Wyoming, and Montana. Accomplishments in FY 2005 include:

- For BLM, expertise in remote sensing to develop and implement a strategy on the impacts of West Nile virus on sage grouse on lands in Wyoming and Montana.
- For NPS, assessing invertebrate diversity in the Snake River near Jackson Lake Dam in the Grand Teton National Park, resulting in a genus and species guide and a poster of insect diversity for use in management plans.
- For FWS: advice on estimating populations and sustaining mortality limits for the Yellowstone grizzly bear.

Rapid Response

I have reviewed your letter and report entitles, "Provisional review comments of selected literature related to coal-bed methane production and hydrology of the Fruitland Formation in the San Juan Basin, southern Colorado and northern New Mexico"…. it will be quite valuable to us in our evaluation of opposing interpretations of data.

Robert Garrigues, Geologist
Bureau of Land Management
Durango, CO
October 2005

NIEHS and USGS Enter into Strategic Partnership to Mitigate the Risk of Exposure to Mercury and Other Environmental Contaminants — The National Institute of Environmental Health Science (NIEHS) and the USGS have entered into a strategic partnership to mitigate the effects of environmental contaminants. NIEHS and USGS have chosen mercury as a test contaminant to develop a prototype Web-based system called EMMMA (Environmental Mercury Modeling, Mapping, and Analysis). The EMMMA Website *(http://emmma.usgs.gov)* is designed to support environmental and health researchers, as well as land and resource managers by providing (1) easy access to key environmental mercury datasets, (2) an online model for mercury in fish tissue, and (3) online mapping tools. Application of the online model will allow scientists to detect spatial and temporal trends in fish-mercury concentrations. The model will help State and local agencies reduce the costs of their sampling efforts for estimating fish-tissue mercury concentrations without loss of effectiveness. Assembling exposure databases from diverse sources, including Federal, State, local or non-government organizations, and the integration of exposure data with detailed maps and online analytical tools has the potential to significantly aid a wide range of epidemiologic studies.

Atmospheric Deposition of Mercury in Urban Areas — Atmospheric deposition is the dominant source of mercury to ecosystems in New England; however, little is know about regional-scale gradients in mercury deposition, particularly in urban areas. Mercury data were collected around the Boston area through the collaborative contributions of the USGS, Frontier Geosciences, New Hampshire Department of Environmental Services, and the Blue Hill Observatory. The mercury wet-deposition rate at sites in metropolitan Boston was 28 percent higher than at the regional background site suggesting that localized urban emission sources may have significant effect on mercury deposition rates on a regional scale in New England. Results indicate dry deposition may account for as much as 90 percent of the mercury deposition in urban settings. In FY 2005, data from this study were part of a comprehensive analysis of the extent and effects of mercury pollution in northeastern North America. Regional gradients in mercury deposition are being used in FY 2006 to help interpret trends observed in sediment, water and fish tissue in the Boston area. Knowledge of regional patterns in atmospheric deposition relative to distribution of mercury and methylmercury in sediments, water and fish may provide information for assessing the relative risk of mercury contamination in different ecosystems.

Decision Support for Sustainable Oil and Gas Development on the North Slope of Alaska — The North Slope Science Initiative (NSSI) is a new partnership among Federal and State agencies, local government, and a major land-holding corporation to coordinate and

support inventory, monitoring, and research activities on the North Slope to understand and mitigate the effects of development on natural resources. In support of NSSI and BLM oil and gas leasing, exploration and development in the National Petroleum Reserve—Alaska (NPRA), the USGS, in collaboration with the BLM, FWS and the North Slope Borough, completed the second year of research. Accomplishments in FY 2005 include: detailed analysis of a 26-year data set of goose densities and distribution that demonstrates substantial changes in numbers and locations among the four species; measurement of primary productivity and nutrient quality of forage plants to understand what plant communities are essential to geese; analyses of aerial photography from 1950, 1979, and 2002 to assess the amount of lake area change and examine changes in amounts of foraging habitat; measurements of salinity, nutrient content, and other water quality parameters for key lakes with a focus on detecting the magnitude and spatial extent of saltwater intrusion into habitats important to geese; and continued monitoring of climate and permafrost data at multiple sites. Prototype geographic information system model includes data from historical and contemporary sources such as remotely sensed imagery, wildlife population surveys, elevation profiles, lake depths, hydrological parameters, land cover, climate parameters, sedimentary basins, and surficial geology. A major objective of this multidisciplinary research is to develop decision support tools for managers responsible for planning petroleum development while protecting important wildlife populations.

Mojave Desert Landscape: Understanding Ecosystem Function and Developing Tools for Management — Land mangers are increasingly challenged with making decisions about managing human activities on public lands in the Mojave Desert with limited reliable scientific information. In FY 2005, USGS refined techniques and developed new metrics for long-term monitoring for the Mojave Desert including seed reserves and seed movements, adapted, multiple soil and plant metrics, and historical long-term vegetation monitoring. In addition, USGS conducted water infiltration and redistribution analyses through simulated rainfall and collected remote sensing data to analyze vegetation patterns, geologic mapping, and geomorphology in the desert.

The Mojave Desert population of the desert tortoise (*Gopherus agassizii*) is federally protected in Utah, California, Nevada, and Arizona. USGS is determining the habitat requirements of the desert tortoise so that populations can be managed in the face of multiple land uses.

For modeling habitat of the federally protected desert tortoise, USGS drafted standards for sharing sensitive data among collaborators (NPS, BLM, FWS, Desert Research Institute, DOD, State agencies and university), provided expanded database, and allowed new modeling opportunities for conducting spatial analyses of desert tortoise habitat affinities.

Support Tools for the Lower Colorado River Multi-Species Conservation Program — The USGS Lower Colorado River (LCR) study team provides science support to BOR and other stakeholders in the Multi-species Conservation Program (MSCP). The MSCP is a 50-year collaborative partnership between 45 stakeholder groups and the Department to mitigate the effects of the control structures and water delivery systems on the mainstem of the Colorado River in the lower basin. The program is designed to protect native aquatic and terrestrial species while allowing the current water uses to continue. Four major projects include (1) evaluating the use of very high resolution aerial photography to map sediment deposits along and in the river, (2) determining soil salinity and moisture relationships that could affect

the success of revegetation efforts under the MSCP program, (3) providing a geospatial analysis of river channel location and vegetation over the past 100 years, and (4) preparing a summary of all available scientific information for the LCR region. Prototype maps for an ultra-high resolution remote sensing of the vegetation in Cibola National Wildlife Refuge was presented to the refuge manager in FY 2005 using preliminary data, and a final product will be delivered in FY 2006. Additional projects starting in 2006 include a study of evapotranspiration rates of various species along the LCR, a study that maps backwaters containing native fish reproduction and rearing habitat, a study of native fish populations, and a region wide survey of endangered yellow-billed cuckoo populations along the LCR. Final products will be used to guide management actions as outlined in the strategic plan for the MSCP.

Department Crosscuts

As the Department's science bureau, USGS conducts research that is foundational to numerous intradepartmental and interagency crosscutting activities. These crosscutting activities range from environmental issues such as the Everglades restoration and coral reef protection in the Pacific Islands to resource management issues such as salmon recovery in the Pacific Northwest. The following table provides a list of the crosscutting activities in which the USGS plays a prominent role.

(Dollars in millions)

	FY 2005 Enacted	FY 2006 Enacted	FY 2007 Request
California Bay-Delta	$4.9	$4.9	$4.9
Columbia River Basin Salmon Recovery	3.5	3.6	3.2
Coral Reef Protection	3.5	3.5	3.5
Global Change	27.0	26.6	26.5
Greater Everglades Ecosystem Restoration	7.8	7.8	7.8
Invasive Species	11.2	11.1	11.0
Klamath River Basin	1.7	1.7	2.0
Middle Rio Grande	2.0	1.6	1.5

California Bay-Delta — The Bay-Delta Program of the CALFED is a multi-agency, stakeholder-driven, multi-billion dollar, 30-year plan to restore ecosystem functions, improve water supply reliability, and sustain water quality for California watersheds. The USGS works with many Federal and State partners including BOR, FWS, BLM, USACE, EPA, Department of Commerce, National Marine Fisheries Service, USDA, USFS, NRCS, the Western Area Power Administration, California Department of Water Resources, California Department of Fish and Game, Reclamation Board, California EPA, State Water Resources Control Board, California Department of Food and Agriculture, and the Delta Protection Commission. The USGS provides leadership for the scientific aspects of the program, and specific studies that develop new knowledge to improve program decisions and expand the body of knowledge relevant to CALFED proposed actions. In FY 2007, USGS will continue work on identifying the effects of the changing hydrology on the physical, chemical, and biological processes of the system; the interaction between, and important processes of, Suisun Marsh and adjacent bays; and the restoration of salt ponds to ecosystems compatible with the needs of the San Francisco Bay and freshwater Delta.

Columbia River Basin Salmon Recovery — USGS collaborates with many partners including the Bonneville Power Administration, USACE, FWS, BLM, BOR, Department of Commerce, National Marine Fisheries Service, USDA, USFS, Washington and Oregon State government agencies, Umatilla Tribe, and citizen advisory groups. In FY 2007, USGS will use radio tagged

salmon to determine the impacts of water management and physical modifications to dam structure on salmon from the Lower Granite dam on the Snake River down to Bonneville dam on the Columbia River. Of special interest will be changes in survival rates associated with management alternatives such as timing and volume of spills and evaluation of guidance structures. In the Yakima Basin, the USGS will examine how water management can alter habitat, strand juvenile salmon, and influence spawning and rearing habitats of Pacific salmon. USGS work in the Wind River will involve life history research, evaluation, and monitoring of steelhead and salmon recovery in the sub-basin. USGS work in the White Salmon River will evaluate the environmental consequences of the removal of Conduit Dam scheduled for 2008.

Coral Reef Protection — Coral reefs worldwide are in decline. The Department of the Interior alone has responsibility for more than 3.5 million acres of coral reef habitat. Further, the U.S. scientific and management communities are only now becoming aware of the value, diversity and extent of deep reefs under Department responsibility. Local Action Strategies have been developed for various regions under Department and NOAA management (e.g., Hawaii, Florida, Caribbean, etc.) to combat coral reef degradation. Databases, maps, GIS visualization tools, USGS fact sheets, technical reports, oral presentations at stakeholder meetings and technical/professional conferences, and peer-reviewed publications are planned and are essential products that will transfer information to decisionmakers and the scientific community. Resource managers with the NPS, FWS, MMS, NOAA and coastal States have called upon USGS to help them understand the processes involved in reef decline so that local-scale stressors can be mitigated or removed, and reef recovery encouraged. USGS products are being and will continue to be used by members of the Coral Reef Task Force as they implement the various Local Action Strategies.

In FY 2006 and FY 2007, USGS research on shallow and deep reefs will include understanding conditions needed for productive and healthy reef communities, understanding terrestrial impacts to reef health in support of U.S. Coral Reef Task Force resolutions, assessing abiotic and biotic factors contributing to coral disease and decline, and evaluating how nature and human activities in marine parks and refuges and on the Outer Continental Shelf influence reef integrity and biodiversity.

Global Change — The USGS supports multidisciplinary studies of past environmental and climatic changes (climate history); process studies that explore the sensitivity of the Earth's surface, the hydrologic cycle, and ecosystems to climate variability; and forecasting of potential future changes and their effects on landscapes and ecosystems (particularly on public lands). The combination of these studies provides integrated long-term perspectives on the effects of climatic change and variability and on the interactions through time among climatic, geologic, and biologic systems on regional and landscape scales.

USGS Global Change Research activities strive to achieve a whole-system understanding of the interrelationships among Earth surface processes, ecological systems, and human activities. Activities of the program focus on documenting, analyzing, and modeling the character of past and present environments and the geological, biological, hydrological, and geochemical processes involved in environmental change so that future environmental changes and impacts can be anticipated. Specifically, USGS focus is on global warming, acid rain, oceanography and weather and climate data.

The U.S. Global Change Research Program integrates research carried out under the auspices of a number of agencies of the U.S. Federal Government, including the NSF, DOC, DOE, EPA, NASA, DOS, AID, Interior, DOA, HHS, NIH, DOT, DOD, and Smithsonian Institution. The

Geographic Analysis and Monitoring, Earth Surface Dynamics, Hydrologic Research and Development, and Biological Research and Monitoring programs contribute to this effort.

In FY 2007, global change activities will focus on the terrestrial and freshwater interactions with a changing climate in the Yukon River Basin. The USGS and the USFS are leading a consortium of U.S. and Canadian Federal agencies, university scientists, and Tribal organizations in implementing a prototype environmental monitoring and research strategy in the Yukon River Basin. The collaboration will link air, water, soil, and forest information across the basin to track and understand regional changes in carbon flux and storage.

Greater Everglades Ecosystem Restoration — Restoring the Nation's Greater Everglades and adjacent Florida Bay and Biscayne Bay coastal ecosystems in South Florida is the largest environmental restoration project ever attempted in the United States. The USGS continues to be a key partner in Greater Everglades restoration by providing scientific information on ecosystem history, water quality and contaminants, surface and groundwater flows, and species response to hydropattern dynamics. A major thrust of the USGS continues to be the development of new and improved models, including hydrologic, ecological, landscape, and water quality/contaminant models. These ecosystem models are being integrated into decision support tools to aid in restoration-related planning decisions by the USACE, NPS, Florida Department of Environmental Protection, EPA, FWS, and the South Florida Water Management District to predict the consequences of varied management alternatives, to set ecological goals by providing yardsticks to measure the success of the restoration, and to manage the natural resources of the system.

The initial Department of the Interior Everglades science plan was updated in 2005 with input from FWS, NPS and USGS and provides a basis for identifying the emerging high priority Interior science information needs. USGS has taken the lead in coordinating the Department's science effort to select new studies for initiating in FY 2006 and 2007 to address these information needs and has redirected several projects to be more responsive to the priorities identified in the updated Department science plan. USGS data are being used by the USACE to estimate changes resulting from restoration by NOAA to manage the Marine Sanctuary in Florida Bay, by the State to refine evaluation and monitoring programs and to improve their understanding of sediment re-suspension and seagrass community changes, by Tribes to assure water quality standards, and by communities in the Florida Keys to determine whether to modify their sewage-disposal practices.

Invasive Species — The USGS plays a significant role in implementing the National Invasive Species Management Plan, developed by the National Invasive Species Council, as called for in the Presidential Executive Order on invasive species. To meet the goals of the Plan, the USGS Invasive Species program provides management-oriented research and delivers information needed to prevent, detect, control, and eradicate invasive species and to restore impaired ecosystems. Facilitating these efforts is the National Institute for Invasive Species Science, a growing consortium of partnerships between government and non-governmental organizations that is administratively housed in the USGS Fort Collins Science Center in Colorado. USGS researchers are leading or cooperating in efforts to integrate the capabilities of the USGS and partners, including Federal and State resource agencies, to 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. An important focus is on developing models for predicting the probable spread and impacts of invaders, in cooperation with NASA Goddard Space Flight Center, the USGS EROS Data Center, and others.

Klamath River Basin — The Departments of the Interior, Commerce, and Agriculture are involved in a variety of activities throughout the Klamath River Basin in Oregon and California. USGS works closely with the BOR, BLM, FWS, NOAA Fisheries, Natural Resources Conservation Service, several Tribes, the Oregon Departments of Water Resources, Fish and Wildlife, and Environmental Quality, California Department of Water Resources, and Siskiyou and Modoc Counties in California to address environmental, economic, and statutory issues in the basin. In addition, USGS is collaborating with NRCS to improve the accuracy of seasonal forecasts of inflows to the BOR Klamath Project to help with water allocations among all beneficial uses. In FY 2007, USGS will continue work started in FY 2006, which is to help determine the water-quantity and water-quality benefits that can be expected in the Lake in response to various restoration activities. Further, USGS will investigate habitat used by juvenile and adult fish, movement, behavior, and survival in response to water availability, water quality, sediment, wetland, and watershed contributions to the ecological status of the Upper Klamath River basin and Klamath Lake. See Water Use and Availability section for FY 2006 outcomes and FY 2005 accomplishments.

Middle Rio Grande — The Middle Rio Grande Basin extends about 100 miles from north (near Cochiti) to south (near San Acacia) and is about 35 miles wide. The basin is bordered by the Sandia, Manzanita, Manzano, Los Pinos, and Jemez Mountains; the Sierra Ladrone to the south; and Mesa Lucero to about the Rio Puerco. Investigations of the geologic framework of the Rio Grande region in different areas along the course of the river through the southwestern U.S. are providing information on critical ground-water aquifers, hazards (seismic, subsidence, landslide), and resources. Basins of the Rio Grande encompass the main city areas of northern New Mexico (e.g., Santa Fe and Albuquerque) and are home of half the population and a similar part of the economy. In Colorado, the San Luis basin is center of an extensive agricultural economy and host of the Great Sand Dunes National Park and Monte Vista Wildlife Refuge. Linked by the through-flowing Rio Grande along the tectonic trough of the Rio Grande rift, the vitality of basin communities and economies depends on growing demands for water extracted from complex aquifers, mostly in Santa Fe Group rift-basin sediments. Knowledge of the aquifer systems and the linkages between recharge, ground water flow, lithologic and stratigraphic characteristics, fault displacements, alteration/cementation, and productivity/sustainability of the resource are poorly known outside areas of production wells. Project activities in the San Luis Basin will improve the geologic framework of ground water models used for management of the Rio Grande.

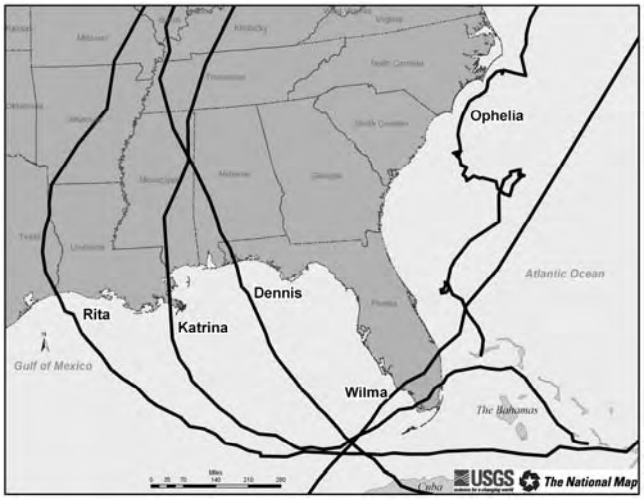
Drinking water supplied to residents living in the Middle Rio Grande Basin comes from ground-water resources. Recent studies completed by the USGS have improved understanding of the ground-water resources in the basin, particularly in the rapidly growing Albuquerque area. To obtain the kinds of information that are needed to plan for and manage the increased demand for water in the Albuquerque area, the USGS, in cooperation with the City of Albuquerque, New Mexico Office of the State Engineer, and Bernalillo County, is conducting a variety of research and monitoring projects. Work includes monitoring of ground-water-quality at multiple depths, research on the interaction between surface-water and ground-water resources to help local water managers determine the impact of withdrawals both from the aquifer system and from the Rio Grande, and research on the rate at which the aquifer can recharge itself after water is withdrawn.

Science Issues, Accomplishments, and Partnerships

	Hazards	Water Use & Availability	Fire	Landscape Change	Coastal & River Processes	Human Health	Priority Ecosystem Science
Department of the Interior							
Bureau of Land Management (BLM)		X	X	X			X
Bureau of Reclamation (BOR)	X	X					
Fish and Wildlife Service (FWS)	X	X		X	X	X	X
National Park Service (NPS)	X			X	X	X	X
Minerals Management Service (MMS)	X			X			
Other Federal Agencies							
Environmental Protection Agency (EPA)	X			X		X	
Federal Emergency Management Agency (FEMA)	X						
National Aeronautics and Space Agency (NASA)	X						
National Oceanic and Atmospheric Administration (NOAA)	X	X			X		X
U.S. Army Corp of Engineers (USACE)			X		X	X	X
U.S. Department of Agriculture (USDA)[2]		X	X				
Other Organizations							
Academia	X	X	X	X		X	
State and Local Governments	X	X	X	X	X	X	X
Tribal Governments		X			X		
Non-governmental Organizations	X		X	X			
International Organizations	X					X	
Private sector/Others	X			X			

Hazards

USGS Hurricane Response Efforts ––
The USGS activated the Storm Response Team for five hurricanes that affected the Gulf and Atlantic coasts between July and October 2005: Dennis, Katrina, Ophelia, Rita and Wilma (figure). The response team grew to include BOR, FWS, NPS, MMS, DOD, EPA, NOAA, USACE and others. Critical information was shared and used to understand the impact to managed parks, refuges and marine sanctuaries. The team also ensured that the right information was being communicated within Interior and to the public during this disaster.



Despite extremely difficult conditions, USGS hydrological technicians in Louisiana, Mississippi, and Alabama worked vigorously after Katrina to collect perishable scientific data to accurately document storm surge, water elevation and the extent of flooding. Temporary stream gages were installed on Lake Pontchartrain and in New Orleans to monitor the drop in water levels as the USACE worked to repair damage to levees and remove water from the inundated city. Water-quality and sediment sampling was conducted by USGS scientists in cooperation with the EPA and others to assess health hazards and the impacts of contaminants.

Over the storm season, USGS coordinated data collection and research efforts from Florida to Texas with Federal agencies that include NASA, NOAA, and USACE as well as universities. Numerous aerial surveys were flown to obtain video, still photography and laser altimetry surveys of post-storm beach conditions for comparison with earlier data to show the nature, magnitude, and spatial variability of coastal changes such as beach erosion, overwash deposition, and island breaching. Data were available through an enhanced USGS-developed data and information management system (DIMS) for response, relief, and research efforts. FEMA used the DIMS as a decision support tool in deploying emergency supplies post-Hurricane Katrina and for pre-Hurricane Rita planning activities. The Louisiana Department of Wildlife and Fisheries and the Louisiana State Police used it as a post-hurricane search and rescue tool. The Centers for Disease Control and Prevention used it to assess New Orleans' city population changes as the city deployed varying stages of disaster response. The impact to habitat of a wide variety of wildlife also can be evaluated. These data will also be used to further refine predictive models of coastal impacts from severe storms and help managers plan.

The DIMS is being used by USGS as a resource for the Gulf of Mexico Alliance Federal Partners database. The group, formed of USACE, EPA, NRCS, MMS, NPS, FWS, DOT, and NOAA, was created in support of the five Gulf States' initiative to protect the Gulf of Mexico in a regional effort. *(http://gulfsci.er.usgs.gov).*

Joining Forces With Natural Resources Canada (NRC) to Help Communities Assess Risks From Natural Hazards –– USGS and Canadian scientists are working together to apply the USGS Land Use Portfolio Model (LUPM) in the Squamish District of British Columbia, Canada prior to planned work in FY 2006 in the Nisqually River Basin, WA. The scientific information that is being gathered by the USGS, the Geological Survey of Canada, and other agencies will help local communities make sound investment choices based on the likelihood of hazard occurrence and potential damages, and the impact on property values. In FY 2005, the USGS and NRC worked together using the LUPM to create preliminary risk assessments for several flooding scenarios in Squamish; gateway to the 2010 Winter Olympics. The findings were presented at a community workshop to elicit feedback from stakeholders regarding community planning and zoning, risk tolerance, and potential economic impacts. Results of this feedback are being used to create more refined scenarios that will be used by the District of Squamish, British Columbia, and Canadian officials to guide future development alternatives. In FY 2006, a Canadian team will join with a group of multidisciplinary USGS scientists to take a more refined model to communities in the Nisqually River Basin.

Post Wildfire Debris-Flow Hazards and Risk in Southern California — Debris flows that originate from steep watersheds burned by wildfire in Southern California pose severe hazards to downstream urban communities and structures, endangered species populations and habitats. FY 2006, USGS developed an integrated strategy for addressing post-fire debris-flow hazards issues in southern California consisting of three primary developmental elements: (1) methods for assessing potential post-fire debris-flow impacts on urban and natural resources, (2) a prototype debris flow and flash flood warning system operated in cooperation

with the NWS, and (3) physically-based models for post-fire infiltration, runoff and sediment transport processes. In winter 2006, in cooperation with NOAA, the bureau will initiate a detailed meteorological and hydrologic monitoring program of recently burned basins in southern California. These data will be used to develop empirical models that characterize the probability and magnitude of post-fire runoff events, methods to characterize potential risks to endangered species populations and habitats, rainfall thresholds for the operation of the prototype warning system, and to calibrate and refine physical models for post-fire runoff and erosion processes.

Water Use and Availability

Satellite Data Key to Wildlife Refuge Water Management — Red Rock Lakes National Wildlife Refuge (NWR) in Montana is a critical wilderness wetland for many waterbirds, from lesser scaup to trumpeter swans. It supports the largest concentration of nesting swans in the U.S. portion of the Rocky Mountain Subpopulation. The FWS needs scientific information to use in the adaptive management of refuge wetlands. Beginning in FY 2005, tools were developed using Landsat satellite thermal data to determine the extent of ground water influence on montane wetlands in remote locations. FY 2006 research will include analysis of satellite imagery, continued monitoring of groundwater, collection and analysis of bird and aquatic plant information, and completion of detailed descriptions of near-surface geomorphology. Artificial intelligence-based methods will be use to design an interdisciplinary model of the system. The results from this work will provide key science support to Red Rock Lakes NWR for the management of key waterbird habitats, determining annual water level recommendations, and developing a Comprehensive Conservation Plan.

Scientists hand auguring a 5-meter deep monitoring well. Many wells unexpectedly turned out to be artesian documenting the presence of ground water near the surface, which is important for plant and bird communities.

Potential Impacts of Expanded Lead-Zinc Mining in Southern Missouri — Recent proposals to expand areas of prospecting for lead-zinc deposits in the Mark Twain National Forest (MTNF) of southeast Missouri have raised concerns about potential surface-water and ground-water degradation as a result of expanded mining, especially on Federal lands (the MTNF and the Ozark National Scenic Riverways). In response to these concerns, the USGS is evaluating the effects of ongoing and proposed mining activities on surface and

Potential Impacts of Expanded Lead-Zinc Mining in Southern Missouri

Thank you for the excellent work initiating a study looking at the long-term impacts of lead on Missouri's aquatic systems. … The information should prove useful to both the Environmental Protection Agency and the Missouri DNR when assessing potential clean up efforts and providing information in the case of proposed mining activities. Your work at developing a collaborative team effort between MDC and USGS will pay great dividends for the resources of our state in the future.

Ron Dent, Resource Science Field Unit Chief
Missouri Department of Conservation
September 2005

ground waters in the Missouri Ozarks. The effects of mining in the New Lead Belt, where mining of the Viburnum Trend has occurred since the mid-1960s using modern technology and environmental controls, are being studied as an indicator of potential impacts of future mining in the Ozarks. Results of the studies will inform the Missouri Department of Conservation, a partner in the study, in their decision whether to initiate remedial actions for affected streams. More information can be found at *http://minerals.cr.usgs.gov/projects/ozarks/; http://mo.water.usgs.gov/fact_sheets/fs-005-02-Imes/index.htm; and http://www.cerc.usgs.gov/pubs/center/pdfDocs/lead_mining_MarkTwain.pdf.*

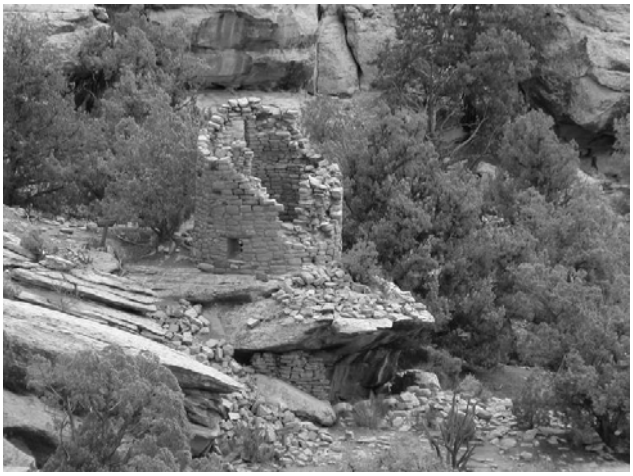
Competition for Water – Human and Ecological — Multiple demands for water in the West are resulting in depleted instream flows, commonly with the consideration for the biological inhabitants of impacted streams and rivers being an afterthought, at best. To address this water availability issue, USGS has undertaken a multidisciplinary and interagency effort to develop new strategic, tactical and science-based tools. On February 23, 2005, USGS hosted a workshop titled, "Linking Juvenile Salmonid Habitat Use to Hydrologic Change," with 59 attendees representing 14 State and Federal agencies (BOR, FWS, USFS, NOAA), universities and State agencies. This workshop was designed to explore issues dealing with the use of Physical Habitat Simulation modeling to predict the relationship between usable habitat area and discharge for juvenile salmonids to address current deficiencies in modeling of juvenile salmonids. The workshop also identified research needs that can improve the understanding of juvenile salmonid habitat use and streamflows. A follow-on workshop, convened May 2005 in Seattle, developed tools and information for water availability and ecosystems needs for resource managers. The intent for FY 2006 is to begin to implement these through multidisciplinary and interagency research.

Upper Klamath Basin – Endangered Suckers, Water Availability, and Water Quality — Water is a critical resource issue on the western landscape, and no place more so than Klamath Basin. Science activities are being addressed by the USGS in response to information needs and priorities identified by BOR, FWS, BLM, several Indian Tribes, NRCS, and NOAA. The USGS formed the Klamath Basin Science Planning Team in 2005 to oversee the implementation of multidisciplinary research described in the bureau's "An Integrated Science Plan for the Upper Klamath Basin, Oregon" (July 2005). Through combined efforts with the FWS and BOR, USGS installed a fish weir on the Williamson River in 2005. USGS also provided weekly water quality reports and sucker distribution reports to the FWS and BOR; peer-reviewed scientific articles published in 2005; and at the request of BOR, performed three hydrologic reviews of the Klamath Irrigation Project. Some USGS activities in 2006 include the continued monitoring of adult sucker spawning populations; identifying and researching the habitat use by young suckers; identifying the effects of water quality on and developing models to examine the population dynamics of suckers; monitoring survival rates of juvenile Coho salmon; conducting a study to characterize the ground-water hydrology of the basin and to predict the effects of ground-water pumping; augmenting existing research to clarify the processes that affect lake water quality; collaborating with NRCS to improve the accuracy of seasonal runoff forecasts; modeling hydrodynamics and heat transport of water in Upper Klamath lake; evaluating phosphorus sources and remediation strategies and in the Sprague River; measuring evapotranspiration levels in wetland environments and conducting research in the Wood River Ranch wetlands; executing computer models to determine water flow, quality and quantity in the lower basin; and surveying the river for impacts on fish by calibrating the SALMOD (salmon production) model.

Fire

Wildland Fire Workshop: Putting Science to Work for Management — The fourth USGS Wildland Fire Science Workshop in December 2005 brought wildland fire managers and scientists together to plan for wildland fire issues and efforts. In FY 2006 planned products include: a series of USGS fire science fact sheets; three pilot study efforts in Montana, Colorado, and Nevada; a national fire science workshop; and development of a Fire Science Channel on the Geospatial One-Stop Portal to provide a point of entry into fire-related data, information products, and tools from multiple sources. Two of the pilot studies will focus on wildland-urban interface zones in the West and one on the interactions of fire, invasive species, and changes in vegetation communities in the central Great Basin.

Fire Risk: Preserving Cultural Resources in the Canyons of the Ancients National Monument, Colorado — In a joint study, the USGS is working with the BLM to build a fire model for the pinyon juniper woodlands and the Canyon of the Ancients National Monument (Monument) cultural resources. The model will provide managers a method to balance management of wildland fire and cultural and natural resources both within and outside the Monument boundaries. In FY 2006, vegetation mapping for the entire Monument and a classification of cultural resources fire risk will be completed. Monument staff will determine a prioritized ranking of highest vulnerable areas. The vegetation classification will be used by local, county, and municipal leaders for protection regimes for homes and businesses adjacent to the Monument.



Tower at the Painted Hand Pueblo, Canyons of the Ancients National Monument, Colorado.

Landscape Change

Great Lakes Aquatic Gap: Preserving Aquatic Biodiversity in the Great Lakes Region — The aquatic biodiversity of the Great Lakes region is being threatened by habitat degradation, pollution, and invasive species associated with harmful water- and land-use practices. The USGS is working with Federal and State agencies in the Great Lakes region to preserve aquatic biodiversity by characterizing stream and near-shore coastal habitats, mapping and modeling fish distributions/abundance, identifying species/habitat relationships, and using the results to identify those species and habitats not adequately protected by existing conservation areas. In Ohio, model results indicate that 48 percent of the fish and 30 percent of the clam and mussel species occurred in less than 1 percent of Ohio's most highly managed conservation lands.

In Michigan, New York, Ohio, and Wisconsin, stream habitat characteristics and fish distribution/abundance data have been mapped and all data have been loaded into a regional database and geographic information system. In Ohio, the final report for the Ohio GAP Analysis Project was completed. In FY 2006 products include models that predict fish distribution/abundance and identify species/habitat relationships for streams and near-shore

coastal systems, a habitat classification for streams, and a habitat classification framework for near-shore coastal systems. In FY 2007 products include the results of gap analysis in Michigan, New York, and Wisconsin. Partners play an important role in this project and include the States of Michigan Department of Natural Resources (DNR), Wisconsin DNR, Illinois DNR, Ohio DNR, University of Michigan, the New York State Department of Environmental Conservation, the State of Ohio Environmental Protection Agency, FWS, The Nature Conservancy and The Great Lakes Commission. Results are already being used by cooperators in the Ohio to develop a decision support system that integrates watershed conservation and management with transportation planning.

Using Decision Analysis to Examine the Potential Effects of Selenium in Appalachian Watersheds — In FY 2005, USGS conducted a pilot workshop to evaluate the feasibility of utilizing a decision analysis (DA) approach to more fully involve USGS scientists and customers, particularly those from other Interior bureaus, in co-designing integrated science that addresses complex issues, and to permit USGS to appraise and learn how to enhance the value of its science and information in reducing uncertainty and evaluating risk. Participants included 15 individuals from the USGS, BLM, FWS and West Virginia Department of Environmental Protection, including scientific experts, resource managers, and regulatory decisionmakers. The workshop focused on selenium in Appalachians coal basin watersheds. A pilot study developed during the workshop served both as a training exercise for the participants and a feasibility study for the USGS to assess the potential value of adapting DA to convey USGS products and services more effectively to a variety of customers. During the workshop, the group developed a prototype model to characterize some of the issues surrounding policy decisions associated with selenium in coal, surface waters, and biota and the workshop provided a valuable starting basis for bringing disparate stakeholders together to understand these important issues. The USGS will conduct a second workshop to develop a full decision DA model of the geoenvironmental issue of selenium in Appalachian watersheds in FY 2006.

Understanding the Appalachians: Defining Strategic Management and Research Challenges — In FY 2005, the USGS with cooperation from the NPS and FWS planned and held a workshop entitled "Understanding the Appalachians: Meeting strategic management needs by developing research and partnership opportunities." The steering committee for the workshop consists of members of NPS, FWS and the USGS. Attendees of the workshop included Department of the Interior personnel from the BLM, NPS, OSM, FWS, EPA, several State agencies, and non-governmental organizations. The primary goal of the workshop was to develop of list of prioritized management needs for issues related to the Appalachians. As a result of the workshop, six special interest groups were created to help address specific areas of concern. These include: Appalachian Natural Resource Restoration, Appalachian Region Information Access, Environmental Economics, Extreme Storms Roundtable, National Forest Planning and Watershed Management: George Washington National Forest, and Threatened and Endangered Species. As a follow-up to the workshop, USGS is providing funding in FY 2006 for three of the top plans for small projects that were proposed by the special interest groups, whose members include representatives from several Department bureaus, especially the FWS, NPS, and USGS.

Environmental Effects of Agricultural Practices — Discovery and challenge were the target goals of the Environmental Effects of Agricultural Practices Workshop held in Denver, Colorado, June 2005. Workshop participants included USGS, USDA, EPA, International Association of Fish and Wildlife Agencies, Wildlife Management Institute, and Interior agencies. Fundamental questions exist regarding how to measure the effectiveness of conservation programs initiated in the 2002 Farm Bill. Workshop discussions produced cooperative agreements and the development of specific and targeted assessment strategies. In FY 2006, USGS will initiate a 2-year investigation into the assessment regarding sources of, and impacts from, nutrients derived from agricultural land use in Oklahoma and will develop an interactive digital data atlas for USDA and EPA.

Workshop on Environmental Effects of Agricultural Practices Results in Research to Address Partner Needs

Under the nation-wide CEAP project, the Fort Cobb Watershed has been selected as one of twelve Benchmark Watersheds...The proposed research by the USGS … will greatly enrich the types of analyses we anticipate …

Dr. Jean L. Steiner, Research Leader
USDA Agricultural Research Service, Oklahoma
September 2005

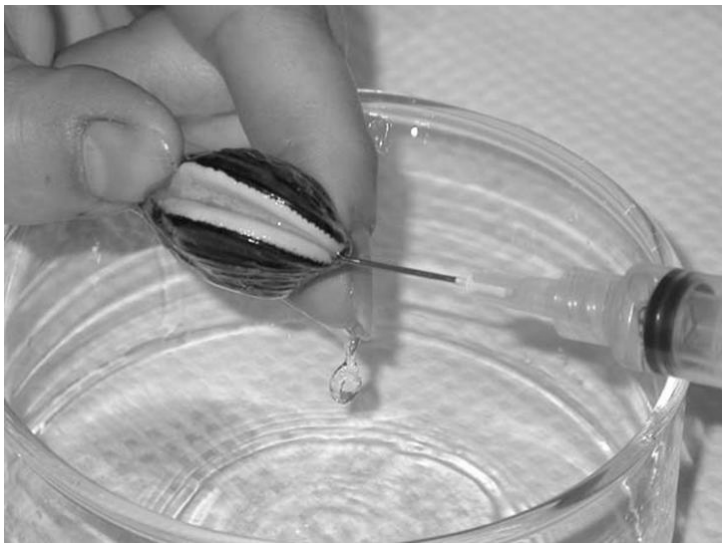
Effects of Land-Use Change and Aggregate Mining on Ground Water and Wetlands — When a pit dug for aggregate extraction penetrates the water table, ground-water flow and water levels can be affected in complex ways, and conflicts can occur among regulatory agencies, aggregate mining operators, and the public. A USGS computer model is being used to simulate the long-term effects of land-use change and aggregate pits on ground-water flow and wetlands along a reach of the South Platte River in the Colorado Front Range Urban Corridor. FY 2005 study results were used by the USACE, EPA, Colorado Division of Minerals and Geology, city and county planners, and aggregate operators to make decisions about planning and permitting aggregate mine sites so that adverse environmental effects may be minimized while meeting aggregate resource needs. Cooperative funding partnerships with the Cities of Fort Lupton and Brighton will support the expansion of the study to include simulations of the short-term effects of mining and the effects of different pit arrangements.

Energy, Wildlife, and Recreation in Sagebrush Ecosystems — The BLM owns and manages approximately 50 percent of remaining sagebrush habitats and has identified as a priority need tools for management at large landscape scales. In FY 2005, USGS scientists worked with the BLM, USFWS, NPS, USFS, state wildlife agencies, and local working groups to plan multiple lines of research. In FY 2006, work will assess and map the distribution of roads, trails, and oil and gas infrastructure and also develop, assess, and compare the accuracies of several remote sensing methodologies at identifying and mapping sagebrush in the Jack Morrow Hills/Pinedale Area in Wyoming. A second project will assess the physical impacts of reenacted Mormon handcart trekking across the historic Oregon/Mormon Pioneer/California/ Pony Express National Historic Trail Corridor in Wyoming. This work will provide a scientific foundation for BLM to develop management guidelines on "thresholds of use" above which alteration of the trail from its "native" or historic state will occur at various measured intensities.

Carbon Marketing: Trading Greenhouse Gases — In the United States, a voluntary market has been established for the trading of greenhouse gases. USGS is collecting scientific information on carbon sequestration and other greenhouse gases to quantify and predict the greenhouse benefit of Federal, State, and private sector wetland restoration programs. The data will be useful to a broad suite of interests, ranging from ecological groups to voluntary carbon traders. During FY 2005, intensive monitoring was started on 120 wetlands in the Prairie Pothole Region of the north central United States to quantify greenhouse gas offsets

associated with restoring wetlands and grasslands. This research builds upon partnerships between USDA, DOE, FWS, and NGOs, and results are being used by the North Dakota Farmers Union to evaluate the efficacy of marketing carbon produced by participating farmers in voluntary markets such as the Chicago Climate Exchange.

Ozark mussels: Sensitivity to Zinc, Lead, and Cadmium in Water and Sediment — Concentrations of zinc, lead, and cadmium are elevated in water and sediment habitats of numerous freshwater mussel species of the zinc and lead mining-related areas of the Ozark Plateau. USGS is collaborating with USFWS and Missouri State University to generate zinc, lead, and cadmium toxicity data in water or sediment for sensitive life stages of mussels native to the Ozarks USGS methods have also been used to develop standards for conducting toxicity tests on early life stages of freshwater mussels through the American Society for Testing and Materials. Studies in FY 2006 include toxicity testing of sediments collected from sites in the Ozark Plateau containing native mussels. Information generated by this project is providing FWS with a critical assessment tool for application in areas where zinc, lead, or cadmium could be a threat to the conservation of freshwater mussels.



Sampling a freshwater mussel.
Photograph by Chris Barnarhart, Missouri State University.

An Interdisciplinary Approach to Understanding and Monitoring a Critical Sagebrush Stronghold in the Owyhee Uplands of the Great Basin — Loss and degradation of sagebrush habitats in the Great Basin have resulted in altered disturbance regimes and long-term population declines of wildlife. In the Great Basin, populations of sage-grouse and relatively intact sagebrush communities dominate the Owyhee Uplands of Idaho, Nevada, and Oregon. BLM has designated the Owyhee Uplands as a pilot in their National Monitoring Strategy Program. USGS assists BLM by providing the supporting science necessary to better understand patterns and processes, such as exotic plant invasion, that influence the ecosystem integrity, and to identify indicators of habitat and population trends for monitoring and adaptive management. In FY 2005, USGS developed new statistical and field methods to map potential distributions of invasive plants, and to delineate bird community dynamics, and identified specific locales to study the interaction of soils, landforms, and other surficial features. In FY 2006 USGS is completing an annotated bibliography of effects of climate change on sagebrush communities; modeling sagebrush distribution based on precipitation and elevation; and conducting multiple analyses involving satellite imagery to estimate amount and primary causes of landcover change. These combined efforts enable an interdisciplinary approach to understanding the ecosystem dynamics and to monitoring long-term trends of habitats and wildlife. Work in FY 2006 - 2007 will emphasize the integration of field surveys, spatial analysis and modeling necessary to manage and conserve the Owyhee Uplands. Additional information maybe accessed via the sagebrush Web site at: *http://sagemap.wr.usgs.gov*.

Science for Resource Management of Arctic Alaska — USGS continues to bring broad multidisciplinary capabilities to bear as a member of the Policy Oversight Group of the North Slope Science Initiative (NSSI), where it joins senior leaders of BLM, FWS, MMS, NPS, and the State of Alaska to integrate inventory, monitoring, and research needs and efforts to improve support of resource management decisions on the North Slope. In direct response to NSSI, USGS has developed an expanded partnership with BLM that will increase stream gaging capacity and provide water flow and flooding information needed to plan development infrastructure. In addition, USGS recently joined the Arctic HYCOS effort, an international science-driven project aimed at monitoring freshwater fluxes and pollutants into the Arctic Ocean and coastal habitats. By joining in this circumpolar effort, USGS will bring the collective information forward to improve water use decisions in this otherwise data-poor environment. Through improved local coordination and partner communication, USGS will continue to increase the integration of USGS Program efforts, for example in oil and gas, mineral, land cover, and marine mammal and migratory bird assessments, into expanded BLM, FWS, and MMS resource management planning within the Northern Petroleum Reserve-Alaska and Arctic National Wildlife Refuge. USGS coordinated efforts in Alaska will result in increased science impact on key energy development and resource stewardship issues for these northernmost lands of the Nation. Additional information maybe obtained on the Web at *http://www.ipy.org.*

Coastal and River Processes

Estuarine Science Informs Land-Use Decisions Surrounding Acadia National Park — At Acadia National Park, nutrient enrichment of coastal waters associated with expanding development is one of the most significant resource management challenges. High nitrogen levels stimulate growth of algae, which can cause death of seagrasses, decreased concentrations of dissolved oxygen in the water, and loss of critical habitat for fish and shellfish. The USGS conducted a 4-year study to help Acadia National Park and its partners, including the Bar Harbor Town Council, Conservation Commission, and Planning Board, understand the potential impacts to estuarine condition from changing land-use in surrounding upland watersheds. Experiments were used to quantify the critical thresholds of nitrogen input that would cause changes in estuarine condition, and a spatially referenced computer tool was then developed to link watershed land-use, nitrogen load to the estuary, and estuarine resource response. This computer tool, or decision support system, has been used by Acadia National Park to inform local decisionmakers of potential ecological consequences of watershed development. The most recent publication emerging from this collaborative research was a description of the decision support system in a book chapter in FY 2005 entitled, "Valuing urban wetlands: Modification, preservation, and restoration."

Coral Reef Restoration in Virgin Islands National Park — USGS conducted a study to determine the feasibility of using naturally produced coral fragments as the source of colonies to transplant to degraded reefs in Virgin Islands National Park (VINP). The overall goal sought to develop a simple, inexpensive method that could be used by community volunteers to restore damaged reefs. The research involved USGS and National Park Service scientists, and nearly 100 community volunteers (including school groups and a non-governmental organization). The research was successful in showing that naturally-produced fragments of fast-growing corals can be transplanted to degraded reefs, survive and grow. VINP resource managers now have information about the survival of naturally occurring coral colonies on reefs and the feasibility of transplanting coral fragments to severely damaged reefs (as in large vessel groundings). This simple method has already been used by resource managers in the VINP in mitigating damage at a boat grounding site. A video produced about this research has been shown numerous times

on local television, at the VINP Visitor Center, and at local schools. In FY 2005, data analysis was completed and a preliminary manuscript detailing the research results was drafted. A final manuscript will be submitted for publication in a scientific journal in FY 2006.

Coastal Habitats: Science for the Puget Sound Nearshore Partnership — In FY 2005 USGS provided science support of the Puget Sound Nearshore Partnership (PSNP), a multi-agency effort to restore the fragile and increasingly degraded nearshore ecosystem of Puget Sound. USGS provides science that guides restoration, long-term monitoring, and adaptive management, co-sponsoring an 800-person international conference, "2005 Puget Sound Georgia Basin Research Conference," in Seattle, WA, and worked with Federal-State-local-tribal entities to develop a coordinated effort for partners (USACE, EPA, and NOAA). FY 2006 launches the USGS Puget Sound initiative, designed to provide science for key topics supporting the implementation of ecosystem restoration. This year the USGS effort will focus on three thematic issues for Puget Sound: (1) the Elwha River restoration (dam removal), (2) the Skagit River (restoration of large deltas), and (3) urban effects on nearshore ecosystems. USGS coordinated efforts in Puget Sound are resulting in increased science impact on key ecosystem restoration and resource stewardship activities for this critical national estuary. Information on the goals of the partnership, governance, and products can be found at: *http://www.pugetsoundnearshore.org/*.

Ridge to Reef: Assessment of Land-Based Pollution Impact on Hawaiian Reefs — Water-borne sediment flows onto reefs in streams and surface flows from rainstorms; it fills wetlands and smothers living corals. In FY 2005, work focused on investigation of vegetation factors in watershed function and coastal sedimentation processes, quantifying effects of sedimentation and herbivory on coral ecosystem processes, watershed stream gaging and monitoring, measuring, mapping, and modeling of landscape vulnerability to water erosion, documentation of vegetation components in the Hanalei watershed, and investigation of the use of airborne and ground-based remote sensing to detect, map, and monitor watershed vegetation, landslide distribution and dynamics, and watershed sediment loads. In partnership with NPS and FWS, over 10,000 high-resolution digital photographs were collected of a historical park and wildlife refuge, and numerous botanical samplings and ground-truthing surveys were conducted. In FY 2006, work will be expanded to include monitoring of sediment turbidity on the south Molokai reef flat, documenting the distribution, abundance, and dynamics of native and alien plant communities and species as they influence watershed function and coastal sedimentation processes, and new research on hillslope erosion monitoring and measurement of marine circulation and sediment transport in Hanalei Bay.

Human Health

***E. coli* is a Questionable Indicator of Fecal Pollution in Natural Freshwaters —** *E. coli* has been widely established as an indicator of fecal pollution in natural freshwater, but recent research disputes this. Scientists at the Lake Michigan Ecological Station (LMES) determined that *E. coli* naturally occurs in soil, sand, and aquatic environments, and these *E. coli* populations likely have an effect on nearshore recreational water quality. Scientists at LMES have worked extensively with beach managers both regionally and nationally to address the issue of beach closings and how to maximize accuracy, reliability, and effectiveness of the monitoring approach. In FY 2005, predictive models were developed for a single beach in the City of Chicago, a series of beaches for the City of Gary and NPS, and finally an entire region of southern Lake Michigan for a project funded by the EPA to understand better the transport and fate of *E. coli* in the lake water. Predictive models were overall more effective than current monitoring approaches, and the applicability improves with smaller spatial scales. Managers in

Chicago, Gary, and the National Park have begun to incorporate these models into their monitoring programs. In FY 2006 and FY 2007 LMES scientists will continue to examine potential alternative monitoring approaches, including application of predictive models, and to assess natural *E. coli* populations for growth, source, and association with contamination.

Improving Management of Large Rivers by Joining Research and Long-Term Monitoring — USGS, in cooperation with the USACE, FWS, and States, has conducted long-term monitoring on the Upper Mississippi River since 1988. In FY 2005, USGS published the first comprehensive reports on results from that monitoring for water quality, fish, invertebrates, and vegetation. These reports provide managers with data needed to evaluate the status and trends of various ecological measures. Researchers are using these data to investigate links between river modifications and environmental conditions. For example, it was determined that commercial navigation reduces the abundance of some fishes in river channels and that loss of backwater habitat, due mainly to sedimentation and flood control, can limit the abundance of important recreational fishes in off-channel areas. In FY 2006 and FY 2007, USGS will begin work to determine what aspects of river flow provide high quality habitat in river channels and how we can maintain those aspects in navigated channels. In addition, USGS will continue work to define the critical features of backwaters that result in high abundance of fishes and how those features can be improved by habitat rehabilitation projects. This information will help resource management agencies plan future management actions that can increase the environmental benefits currently provided by rivers while maintaining critical social benefits.

Bi-national Efforts to Improve Environmental Health in the U.S.–Mexico Border Region — In FY 2005, a bi-national, Web-based tool *(http://borderhealth.cr.usgs.gov*), which helps further our understanding of the links between the condition of the physical environment and environmental and human health issues, was completed. Fact sheets, in both English and Spanish, were written to describe availability and utility of the tool, and a number of bi-national demonstration workshops were held to inform stakeholders, partners, and potential users. Local, State, and U.S. and Mexican Federal entities are incorporating the tool into their business practices. Additionally, professors and students with the University of Texas at Brownsville have integrated the data into their analysis and research. In FY 2006, the base information will be extended to include satellite imagery and digital elevation models for the entire Rio Grande border region. For areas in Texas and the adjoining Mexican States of Chihuahua, Coahuila, and Nuevo Leon, local-level data sets such as high resolution aerial photos, land use and land cover, hydrography, demographics, transportation, potential sources of contaminants and contaminants in biota will be added.

USGS Gears Up for Avian Influenza (Bird Flu) Surveillance Monitoring in Alaska — Wild migratory birds, particularly waterfowl, are natural hosts of avian influenza viruses. A highly pathogenic avian influenza strain (H5N1) endemic in poultry in Southeast Asia, has spread to Russia and Eastern Europe, killing at least 57 humans. H5N1 has not been detected in humans, poultry or wild birds in North America; however, Alaska and corresponding areas of the Russian Far East are a unique area where migratory bird species mix during migrations to and from breeding and wintering grounds. Thus, if H5N1 is carried to North America in migratory birds, the virus would most likely arrive via Alaska. The USGS, in cooperation with the FWS, began targeted surveillance monitoring for H5N1 in wild birds in Alaska in 2005, collecting samples from 520 birds of 10 species that are known to migrate through the Russian Far East and Southeast Asia and analyses of the samples are underway. A national interagency working group was formed to develop a surveillance strategy and funding initiative. The first phase of the accelerated program, scheduled for Alaska in 2006, involves the USGS, FWS, the Alaska Department of Fish and Game, the University of Alaska-Fairbanks, and the USDA. In addition,

a steering committee was formed to plan a workshop on avian influenza for early winter 2006 with purpose to coordinate efforts and establishing standard operating procedures for sampling and analysis.

Priority Ecosystems Science

Through PES, the USGS provides integrated science support to better understand the interactive nature of resources and the environment. Land- and resource-management agencies require integrated scientific information and understanding to circumvent potential problems and implement needed improvements. USGS scientific information is provided within the adaptive management framework as improved scientific understanding can be incorporated into the planning and management of each area. Scientific information is used to ensure that future plans have realistic expectations for restoration, structures under construction are optimally managed, monitoring will yield the information desired, and managers have the tools to predict outcomes of possible restoration scenarios. PES supports ongoing studies in the Greater Everglades, San Francisco Bay, Chesapeake Bay, the Mojave Desert, and the Platte River. PES addresses the Department Serving Communities mission area of "advancing knowledge through scientific leadership and informing decisions through the application of science" by improving stakeholder access to needed science information through databases and methodologies. Additionally, PES activities expand the scientific base by providing temporal and spatial monitoring, research, and assessment/data coverage to meet land-use planning and monitoring requirements, as well as support the Department mission area of Resource Protection by providing information, assessments and technical assistance for decision making. Planned outputs include systematic analyses and investigations delivered to customers, formal workshops, and training that facilitate exchange and use of knowledge and long-term monitoring.

Restoring the Nation's Greater Everglades and Coastal Ecosystems — Restoring the Nation's Greater Everglades and adjacent Florida Bay and Biscayne Bay coastal ecosystems in South Florida is the largest environmental restoration project ever attempted in the United States. The USGS continues to be a key partner in Greater Everglades restoration by providing fundamental and applied scientific information on ecosystem history, water quality and contaminants, surface and groundwater flows, and species response to hydropattern dynamics. A major thrust of the USGS continues to be the development of new and improved models, including hydrologic models, ecological models, landscape models and water quality/contaminant models. These ecosystem models are being integrated into decision support tools to aid in restoration-related planning decisions by the USACE, NPS, Florida Department of Environmental Protection, EPA, FWS, and the South Florida Water Management District to predict the consequences of varied management alternatives, set ecological goals by providing yardsticks to measure the success of the restoration, and manage the natural resources of the system.

The initial Department Everglades science plan was updated in 2005 with input from FWS, NPS and USGS. The updated science plan provided a basis for identifying the emerging high priority Interior science information needs. USGS has taken the lead in coordinating Interior's science effort to select new studies for initiating in FY 2006 and 2007 to address these information needs. Many of the new studies are being jointly funded by the USGS PES and Interior's Critical Ecosystem Studies Initiative (CESI), which is managed through the NPS. In addition to the new studies, the USGS redirected several existing projects to be more responsive to the priority science information needs identified in the updated Interior science plan. USGS data are being used by the Corp to estimate changes resulting from restoration, by NOAA to manage

the Marine Sanctuary in Florida Bay, by the State to refine evaluation and monitoring programs and to improve their understanding of sediment re-suspension and seagrass community changes, by Tribes to assure water quality standards, and by communities in the Florida Keys to determine whether to modify their sewage-disposal practices.

Science Supports Restoration Efforts in San Francisco Bay — The USGS continues to be a key participant in the San Francisco Bay and Delta (SFBD) in support of the Bay-Delta Program CALFED, a 30-year plan to restore ecosystem function, improve water supply reliability, and sustain water quality and watershed habitat in the Bay. USGS provides leadership for CALFED's scientific program and contributes research to improve program decisions and expand the body of knowledge relevant to CALFED's proposed actions. USGS studies focus on the relations between proposed changes in the physical habitat of rehabilitated wetlands and the responses of biological resources to water flow, pesticide and metals concentrations, sediment concentrations and transport, and salinity distributions; and effects that these factors and their interrelations have on fish and avian populations in the Bay.

Beginning in FY 2006, USGS scientists will be working on a couple of two-year jointly funded SFBD PES/CALFED studies. The first study will forecast future ecological states of the Delta and estuarine ecosystem under prescribed scenarios of change using a series of linked climate, hydrologic, geomorphic and ecologic models. Findings will aid restoration and water quality goals. The second study will examine the reasons for the recent decline of fish (including the endangered Delta Smelt) in the system. PES activities will continue to support the South Bay Salt Pond Restoration Project, which covers fifteen thousand acres of former commercial salt ponds in South San Francisco Bay, which were purchased by State, and Federal agencies in March 2003. While, the FWS and conservation organizations have supported conversion of salt ponds and other bay lands to tidal wetlands to benefit species of concern, no guidelines, models, or management strategies for such conversions exist. This study will provide the research to develop guidelines.

USGS Meets New Challenges to Conserve and Restore the Chesapeake Bay Ecosystem — The Chesapeake Bay, the Nation's largest estuary, has been degraded due to water-quality problems, loss of habitat, and over-harvesting of resources. Since the mid-1980s, the CBP, a multi-agency partnership has worked to restore the Bay. To enhance restoration efforts, the CBP created Chesapeake 2000, an Agreement that establishes restoration commitments to the year 2010. The year 2005 marked the mid-point for most of the restoration commitments in Chesapeake 2000. There is growing concern that many desired ecological conditions will not be achieved by 2010 and a growing need for enhanced science to better understand the processes controlling status and change of the Bay. To meet the growing need, the USGS revised its science plan in consultation with the CBP, Interior, and academic partners to provide a more integrated understanding of the ecosystem.

USGS studies for FY 2006 through FY 2011 will be focused along four science themes: the impact of human activities on land use, the factors affecting water quality and quantity, the ability of habitat to support fish and water-bird populations, and synthesis and forecasting to improve ecosystem assessment, conservation, and restoration. Activities will include a combination of monitoring, research, assessment, and models to better target implementation of current restoration strategies, assess the effectiveness of restoration activities, forecast the potential impacts of human interaction, and synthesize the findings and provide implications to help resource managers adapt improved management approaches. Synthesis reports will be completed in FY 2006 that provide a summary of key findings in support of the previous Science Plan. Additionally, the USGS will work with the CBP to produce the first comprehensive assessments of the Bay as recommended by the GAO.

Mojave Desert — The Mojave Desert Ecosystem is a landscape of contrasts and challenges spread over southern Nevada, western Arizona, southwestern Utah, and a quarter of California. Encompassing six military bases, four national park units, and considerable Bureau of Land Management and other Federal lands, the Mojave Desert is home to a rapidly growing population of well over a million people. Human activities, such as animal grazing, off-road vehicle use, construction, mining, urban expansion, waste disposal, recreational uses, and water withdrawal, and natural processes influenced by man, such as fire and invasive species, have increased the vulnerability of the desert environment to soil erosion and ultimately habitat degradation. USGS is working closely with land management agencies and existing management groups in the Mojave Desert, including the Desert Managers Group to create a decision support system to (1) describe the vulnerability of the land to erosion, invasion by noxious weeds, climatic variability and other disturbances, (2) identify emerging patterns of resource use, and (3) determine the potential for recovery of degraded land so managers can better target management activities.

In FY 2007, USGS will continue (1) detailed studies of how geomorphic surfaces affect the response of plants and soil nutrient availability to drought and recovery from drought areas, (2) development of tools for analyzing these processes at a landscape scale, and (3) development of models for regional extrapolation of these processes using remote sensing and statistical procedures.

Platte River Ecosystem Resources and Management — The Central Platte River Valley (CPRV) is best known for the annual migration of nearly one-half million sandhill cranes and several million waterfowl and provides habitat for endangered species including the whooping crane, piping plover, and least tern. Changes in water and land use have transformed the river channel and altered the structure of riparian habitats. The USGS has worked with State, Federal, and local partners to develop successful adaptive management strategies to increase the habitat available to migratory birds. USGS research is being used to guide the development of a new 5-year management plan for the crane population. In FY 2006 and FY 2007, the USGS will continue to operate streamgaging stations along the river, continue monitoring radio-marked sandhill cranes to determine length and pattern of stay, and expand technological studies to better link surface and ground water levels and aid strategies to improve riparian habitat. A report documenting the success of the MRS technique at Cottonwood Ranch will be published.

Geographic Research, Investigations, and Remote Sensing

Subactivity	2005 Actual	2006 Enacted	2007 Fixed Costs & Related Changes[a/]	2007 Program Changes	2007 Budget Request	Change from 2006
Cooperative Topographic Mapping	71,393	68,855	-68,855	0	0	-68,855
FTE	*514*	*358*	*-358*	*0*	*0*	*-358*
Land Remote Sensing	32,730	45,713	+3,061	+12,980	61,754	+16,041
FTE	*83*	*85*	*+20*	*+2*	*107*	*+22*
Geographic Analysis and Monitoring	14,628	14,705	+2,155	-2,000	14,860	+155
FTE	*113*	*113*	*+3*	*-20*	*96*	*-17*
Total Requirements $000	**118,751**	**129,273**	**-63,639**	**10,980**	**76,614**	**-52,659**
FTE	***710***	***556***	***-335***	***-18***	***203***	***-353***

a/ Fixed cost increases for this activity total $945, of which $662 will be budgeted and $283 will be absorbed. Changes for this activity also include a net decrease of $64,301 and 335 FTE for the restructure of CTM to EI. Under the restructure, all of CTM was moved to EI with the exception of $2,768 and 20 FTE to LRS for NCAP and $1,786 and 3 FTE to GAM for Land Cover

Activity Summary

The 2007 budget request for the Geographic Research, Investigations, and Remote Sensing Activity is $76,614,000 and 203 FTE, which is a net change of -$52,659,000 and -353 FTE from the 2006 enacted level.

This is the activity formerly called, "Mapping, Remote Sensing, and Geographic Investigations;" the name was changed to align with the new philosophy of the program. In August 2005, the Director announced an organizational and management realignment that—

Use of Cost and Performance Information

This program makes better use of remotely sensed imagery by prioritizing federal agency requirements. Outreach on this effort included workshops on data applications; and conducting a survey that examined the market for moderate resolution satellite data.

- Positions the Geographic Analysis and Monitoring and the Land Remote Sensing programs to be the centerpieces of USGS geography research and applications, and
- Consolidates key elements of the USGS portfolio of national geospatial programs, such as the Federal Geographic Data Committee, the Geospatial One-Stop project, and *The National Map* into a National Geospatial Programs Office.

The decision to reorganize is in direct response to discussions with constituent groups about how best to meet their geospatial data needs, as well as recommendations from a report by the National Research Council of the National Academy of Sciences. The NRC report recommended that the USGS should give higher priority to fundamental geographic research to:

- Improve citizen involvement in decisionmaking for issues related to natural sciences by applying all the USGS primary spatial data sets,
- Expand the utility and application of place-based science by conducting integrative place-specific research in addition to topical research in individual disciplines, and
- Enhance the effectiveness of decision-support systems with increased geographic input and more effective map-like products as output.

Internal management and business practices were implemented in 2005. The USGS is submitting a reprogramming proposal during 2006 to implement the funding adjustments that reflect the new management approach to the geographic and geospatial data programs. The permanent budget restructure commensurate with this change is proposed for implementation through approval of the FY 2007 budget request. Within the Geography activity, the FY 2007 budget reflects realignment of the National Civil Applications Program activities under the Land Remote Sensing program where it has been managed, as well as realignment of the land cover characterization and analysis functions under the Geographic Analysis and Monitoring program, commensurate with other geographic research functions.

The USGS Geography program confronts some of the most pressing natural resource and environmental issues of our Nation by observing and analyzing changes on the land. The surface of the Earth is changing rapidly, at local, regional, national, even global scales, with significant repercussions for people, the economy, and the environment. Some changes have natural causes, such as volcanic eruptions or drought, while other changes on the land, such as resource extraction, agricultural practices, and urban growth, are human-induced processes. There are other types of changes that are a combination of natural and human-induced factors; for example, landslides and floods are fundamentally natural processes that are often intensified or accelerated by human land use practices. Land cover on the Earth's surface–the pattern of natural vegetation, agriculture, and urban areas–is the product of both natural processes and human influences. Land cover represents an unbiased signature of environmental conditions. Improved understanding about the consequences of landscape change assists decisionmakers in the fields of land use planning, land management, and natural resource conservation. The need for better information about land surface change is especially evident for changes brought about by wildfire, agricultural production, urbanization, forest logging, climate change, and other factors operating at broad regional scales.

By observing the Earth with remote sensing satellites, USGS geographers are able to monitor and analyze changes on the land, study the connections between people and those landscape changes, and provide society with relevant science information to inform public decisions. This is accomplished through the Land Remote Sensing (LRS) program and the Geographic Analysis and Monitoring (GAM) program.

An End Use of USGS Geographic Science

USGS scientists use information gathered by satellites to create different kinds of fire hazard maps. Some show where vegetation is unseasonably dry. Others show where dead trees and other fuels have accumulated to dangerous levels. Still others reveal the extent of damage after a fire. These maps and related data models help fire fighters and land managers predict where wildfires may strike, prepare for fires before they happen, and accurately assess a fire's impact

Together, these programs directly support the President's Management Agenda and priorities of the Secretary of the Interior for (1) science-based decisionmaking, by making geospatial data available to scientists and the public and (2) Government, by simplifying and enhancing the

delivery of geospatial data, information, and tools to citizens. They also support the Department of the Interior mission theme of Serving Communities and end outcome goal of advancing knowledge through scientific leadership and inform decisions through the applications of science. The Geography programs support the USGS goals of serving the Nation by providing reliable scientific information to describe and understand the Earth; minimizing loss of life and property from natural disasters; managing water, biological, energy, and mineral resources; and enhancing and protecting quality of life.

Congressional Directives

The FY 2006 Appropriations Act for the Department of Interior, Environment, and Related Agencies included the following directive for the USGS Geography programs:

> "In last year's Senate report, this Committee directed the Survey to provide quarterly reports for the Landsat program that would display operational costs, revenue, and any required supplemental funding. To date, none has been received. Between now and the time the 2006 Interior bill is conferenced, the Committee expects the Survey and Department to provide far greater detail and further explanation of this proposal before it will give this request further consideration."

The proposal mentioned in the language was a request for $6 million additional funding for the Landsat program. Subsequent to this language, the USGS complied with this directive and provided reports for each quarter in FY 2005. The majority of the additional funding requested was provided ($4 million appropriated) to the USGS. The remaining $2 million was funded with buyout savings from the Cooperative Topographic Mapping program.

Performance Assessment Rating Tool (PART) Evaluation

The FY 2004 OMB RePART of National Mapping and Geography programs received an "effective" rating. The USGS Geography program has made progress in achieving long-term performance goals related to land cover and ecosystem mapping. USGS has taken steps to improve the utility of remotely sensed imagery through the development of the Commercial Imagery-Derived Requirements (CIDR), a tool used to collect, report, and prioritize the near-term land remote sensing data requirements of Federal civil agencies and potential areas of collaboration. Based on the National Research Council recommendations, the USGS has developed a science strategy that sets an ambitious goal for a Geography program – to lead the Nation in advancing geographic science by improving and expanding Earth observation and by integrating natural and social science knowledge. The USGS Geography program will continue to further its effectiveness by:

- Developing priorities in the new research plan,
- Transitioning the National Land Cover Dataset from a research endeavor into an operational effort that provides updates every 5 years, and
- Working with the National Aeronautics and Space Administration and land observation data users to develop a plan to achieve technical, financial, and managerial stability for land surface observations.

Workforce Planning

The USGS is working hard to change skill sets, using VSIP/VERAs, to keep pace with changing customer needs. The bureau is using creative solutions for rapid changes in technology and workforce flexibility through the use of contractors and term appointments. In some cases, funding freed from salary load will be used to invest in partnerships through grants. However, in some cases the nature of the work requires the use of government employees. Thus, some of the positions vacated through the VSIP/VERA process will be filled with new employees who possess the requisite skills.

For example, the workload in Eastern Region Geography is increasing as a result of the new directions for geographic science and the expanding need to collaborate with multiple organizations (e.g., other Federal agencies, States, regional planning organizations, local governments, universities, NGOs) to better serve the USGS programs support. The VSIP/VERA process is one management tool that can help better align workforce skills to meet these objectives within level or declining budgets.

Subactivity Overview

The **Land Remote Sensing (LRS) program** acquires, archives, disseminates, and promotes the application of remotely sensed data of the Earth's land surface. The program operates the Earth-observing satellites (Landsats 5 and 7) and acquires additional data through a multimission ground station. The LRS program procures commercial data from both aircraft and spacecraft operators and maintains a comprehensive archive of Earth observation data at the USGS EROS Center in Sioux Falls, SD. Data from this archive are distributed to Business Partner retailers and customers. The LRS program manages the National Civil Applications Program, including the Global Fiducials Library, rapid exploitation applications, and source management for classified and unclassified data. It also promotes the application of remotely sensed information and advances the state of remote sensing technology. Data acquired and managed by the LRS program are vital to applications such as support for national defense; global agricultural crop monitoring; monitoring and assessing the impacts of natural disasters; aiding in the management of water, biological, energy, and mineral resources; and analyzing the impacts of climatic and other global changes.

The **Geographic Analysis and Monitoring (GAM) program** provides the analysis and applications needed to address natural and human-induced changes on the landscape. Activities conducted in this program include land cover applications, global change research, ecosystems research, and producing a series of Status and Trends reports that document a national assessment of land surface change. Science Impact program**,** part of GAM activities, is a nascent, cross-discipline effort to increase the use and value of USGS science in making informed decisions at Interior, at other Federal, State, and local agencies, and by citizens. The effort encompasses developing, testing, evaluating, and applying improved methods and processes to enhance linkages between science and decisionmaking.

Activity: Geographic Research, Investigations, and Remote Sensing

Subactivity: Land Remote Sensing

Subactivity	2005 Actual	2006 Enacted	2007 Fixed Costs & Related Changes[a/]	2007 Program Changes	2007 Budget Request	Change from 2006
Land Remote Sensing	32,730	45,713	+3,061	+12,980	61,754	+16,041
Total Requirements $000	**32,730**	**45,713**	**+3,061**	**+12,980**	**61,754**	**+16,041**
FTE	***83***	***85***	***+20***	***+2***	***107***	***+22***

a/ Fixed cost increases for this activity total $418, of which $293 will be budgeted and $125 will be absorbed. Changes for this subactivity also include an increase of $2,768 and 20 FTE to LRS for NCAP as a result of the EI/Geography restructure

Summary of FY 2007 Program Changes for Land Remote Sensing

Request Component	Amount	FTE
Program Changes		
• AmericaView	-2,970	-2
• LDCM	+15,950	+4
TOTAL	**+12,980**	**+2**

Justification of FY 2007 Program Changes

The 2007 request for the Land Remote Sensing program is $61,754,000 and 107 FTE, which is a net program change of +$12,980,000 and +2 FTE.

AmericaView (-$2,970,000 and -2 FTE) — This decrease will end Federal funding for a State-level network that provides access to information and imagery archives for university participants and other users at all levels of public service. Federal outreach activities begun under the program will be eliminated, as will limited support for research and applications development, curriculum development and student support.

LDCM (+15,950,000 and +4 FTE) — The Landsat Data Continuity Mission (LDCM), also known as Landsat 8, will acquire and deliver highly calibrated, moderate resolution remotely sensed data that will extend the legacy of continuous collection of Landsat-like data. The Interior/USGS pivotal role in the mission is to design, implement and operate ground systems to provide the user community easy, reliable, and long-term access to geo-corrected products generated from the Landsat 8 data.

Between now and the launch of the satellite, the USGS will conduct engineering studies, develop a design, and implement a system capable of supporting the LDCM requirements. The

USGS is responsible for designing, developing, and integrating a complex ground processing system that will acquire, process, archive, radiometrically and geometrically correct, and distribute Landsat 8 data to a well-established worldwide remote sensing community. Landsat 8 data and products will be available to the user community during FY 2011. The volume of data will be four times greater than that collected by Landsat 7, due to a combination of more daily acquisitions, additional spectral bands, and higher radiometric (brightness) resolution. This initiative meets both USGS and Department of Interior strategic objectives.

Total Performance Change	**+84% of ground system designed, built and tested**				
	A	***B***	***C***	***D= B+C***	***E***
	Overall Performance Changes from 2006 to 2007				
Measure	**2006 Enacted Performance**	**2007 Base Performance Level**	**2007 Impact of Program Change on Performance**	**2007 Budget Request Performance**	**Out-year Impact of 2007 Program Change on Performance**
% of ground system designed, built and tested	**28%**	**28%**	**+16%**	**44%**	**+56%**

Column B: The performance level you expect to achieve absent the program change (i.e., at the 2006 enacted level plus/minus funded fixed cost/related changes); this would reflect, for example, the impact of prior year funding changes, management efficiencies, absorption of fixed costs, and trend impacts.

Column E: The out-year impact is the change in performance level expected in 2008 and Beyond of ONLY the requested program budget change; it does not include the impact of receiving these funds again in a subsequent outyear.

Program Overview

Continuous monitoring of Earth processes and their local, regional, and global effects is vital to the economic and environmental well being of the Nation. Improving our ability to monitor and analyze changes on the surface of the planet, as well as keeping a constant record of the status of the Earth's surface, enables continued economic expansion, environmental awareness, and the development of information to help scientists support policy officials and decisionmakers in fulfilling their public service responsibilities. With the passage of the Land Remote Sensing Policy Act of 1992 (P.L. 102–555), Congress endorsed the need for continuous monitoring of the Earth and especially for maintaining a readily available record of information displaying the status of its resources and environment. The USGS Land Remote Sensing program (LRSP) (*http://remotesensing.usgs.gov/*) is responsible for implementing the provisions of the Act and for ensuring the continuous availability of moderate resolution and other remotely sensed imagery for the Nation.

> "Earth observations are a very important part of our space policy and will continue."
>
> Dr. John H. Marburger III
> Science Advisor to the President
> June 2005

The primary objectives of the Land Remote Sensing (LRS) program are to:

- Collect, process, archive, and distribute scientifically relevant global land and near-land observations acquired from aircraft or satellite,
- Ensure that these data are maintained and easily accessible and available to USGS partners, cooperators, stakeholders, and other customers,

- Conduct and sponsor research in land remote sensing data collection, accessibility, distribution, and application, and
- Investigate future remote sensing missions, sensors, and data relevant to the preceding objectives.

The LRS program objectives are aligned with the science plan, "Geography for a Changing World" (*http://geography.usgs.gov/documents/SPfinal.pdf*) and supports USGS strategic objectives by making high-quality remotely sensed data widely and inexpensively available without restrictions to a global community of international, Federal civil, defense, NGO, State, local, academic, commercial, and individual users in both operational and research environments. The LDCM also supports Interior's Serving Communities strategic goal of advancing knowledge through scientific leadership and information decisions through the application of science using the strategy of improving the information base, information management, and technical assistance. The LRS carries out its program in three major areas:

- Remote Sensing Missions and Data Acquisition,
- Long-Term Data Preservation and Access, and
- Remote Sensing Research and Data Utilization.

Remote Sensing Missions and Data Acquisition
(Estimates for FY 2005, $12.8 million; FY 2006, $20.3 million; FY 2007 $36.25 million)

The LRS program acquires remotely sensed data to support Interior and other U.S. operational responsibilities and the global Earth science community. This is accomplished by operating the Landsat system, leveraging the USGS infrastructure to receive data from other satellites (e.g., EO-1, Terra and Aqua), coordinating Federal purchases of commercial data, and acquiring data through international partnerships. These data are also used to fulfill the mandate to expand the National Satellite Land Remote Sensing Data Archive (NSLRSDA).

> "Landsat has provided the longest and best-calibrated time series of information about changes in land cover and land use for over 30 years."
>
> Committee on Earth Science and Applications from Space: A Community Assessment and Strategy for the Future, National Research Council, 2005

Commercial Remote Sensing and the President's Space Policy — The USGS is leading the near-term requirements component for the Federal civil community in implementing the President's Commercial Remote Sensing Space Policy (CRSSP). The CRSSP directs the U.S. Government to rely to the maximum practical extent on U.S. commercial remote sensing space capabilities for filling the imagery and geospatial needs of military, intelligence, foreign policy, homeland security and civil users *(http://crsp.usgs.gov)*. The USGS also works with other civil agencies and the National Geospatial-Intelligence Agency to share and leverage common requirements, infrastructure, and procurement capabilities as part of the CRSSP implementation. By FY 2007, the requirements process should be operational in facilitating joint procurement and data sharing by the civil agencies of the Federal government and by informing them of future sensor technology development in the commercial and civil arenas. To achieve this, the underlying CRSSP Imagery-Derived Requirements (CIDR) database will be more robust in terms of the number and breadth of requirements, the sophistication of the query and reporting tools and the interoperability with related Federal efforts such as Geospatial One-Stop (and potentially with emerging commercial geospatial discovery tools such as Google Earth and Globe Explorer). Interoperability should enhance collaborative civil use of remotely sensed data

for national priorities in environmental monitoring, economic growth, and in mitigating the impacts of natural disasters.

Landsat Data Gap Study — Current projections show that Landsat 5 and Landsat 7 will both continue to operate well into FY 2010 before their orbit-positioning fuel is depleted. A new Landsat Data Continuity Mission (LDCM) could launch by early FY 2011 and become operational by the summer of that year after on-orbit checkout procedures are completed. This scenario would result in a relatively brief data gap; however, if the current satellites fail well before FY 2011, a substantial gap will occur.

The USGS is working with NASA and the Federal civil community to address the possibility of a data gap beginning as early as FY 2007. Several potential data sources are being investigated under full awareness that there is no direct substitute for Landsat in orbit today or planned for the near future. For example, some systems capture "Landsat-like" images, but while Landsat 7 provides global data sets on a seasonal basis, no other domestic or international moderate-resolution or high-resolution satellite system is currently collecting global coverage even once per year. The study team hopes to identify data sources with sufficient image quality and volume to at least partially mitigate a gap in global coverage. Initial findings indicate that foreign sources are the most Landsat-like and have the broadest area of coverage, but all reasonable sources are being examined, including commercial U.S. high-resolution satellites.

Long-Term Data Preservation and Access

(Estimates for FY 2005, $6.9 million; FY 2006, $12.9 million; FY 2007, $12.9 million)

The Land Remote Sensing program has the responsibility to preserve, provide access to, and distribute products from the Long Term Archive of aerial and satellite data in the USGS EROS archives, the National Satellite Land Remote Sensing Data Archive (NSLRSDA) and the NASA-sponsored Land Processes Data Active Archive Center, to a worldwide community of operational and scientific users.

The USGS is a world leader in archiving remotely sensed data, and in providing those data to users quickly, affordably, and in the most accessible format. Currently, the archive consists of over 107,000 rolls of aerial and satellite imagery containing in excess of 13 million frames. It also includes a digital inventory of various aerial and satellite earth science data sets totaling over 2,800 terabytes stored in multiple robotic mass storage systems (see fig. 1).

Figure 1. Historic film archive (left) and automated silo storage (right) located at the USGS EROS Center.

The archive holdings are used for environmental research, homeland security, land management, natural hazard analysis, and natural resource management and development, with applications that extend beyond America's borders. The worldwide community of users includes personnel in Federal, State, and local governments, researchers at academic institutions, and private enterprise.

Through the Land Remote Sensing Policy Act of 1992 the Congress directed the Department of the Interior to establish a permanent government archive containing satellite remote sensing data of the Earth's land surface, and to make them available for study. This collection, formally known as the NSLRSDA, is managed and maintained at the USGS EROS Center in Sioux Falls, SD.

While initiated to ensure the preservation of the Earth's natural history as captured by the Landsat program, the law mandates that the archive should include other valuable land data acquired by satellite. To fulfill that mandate, the archive has been augmented with data from a number of sources including data purchased from the commercial sector and declassified images acquired by national reconnaissance systems long before the inception of the Landsat program. An Archive Advisory Committee, chartered under the Federal Advisory Committee Act, provides expert advice on how to manage and prioritize the ever-growing volume of data *(http://edc.usgs.gov/archive/nslrsda).*

The USGS projects an exponential growth in satellite data archival volume of the NSLRSDA (see fig. 2). The core of NSLRSDA consists of Multispectral Scanner (MSS) and Thematic Mapper (TM) image data (1972 to present) from Landsat 1-5 and Landsat 7 satellites; Advanced Very High Resolution Radiometer (AVHRR) data (1986 to present) over the Earth's land surface from NOAA weather satellites; and more than 880,000 declassified intelligence satellite photographs (1960 -1972). As stated in an MOU between NASA and the USGS dated February 18, 1993, the NSLRSDA will eventually hold satellite data sets from NASA's EOS missions, such as MODIS data from Terra and Aqua. Archiving and distribution of these data sets from the Land Processes Distributed Active Archive Center will continue through FY 2006 and beyond as defined by the NASA-USGS agreement.

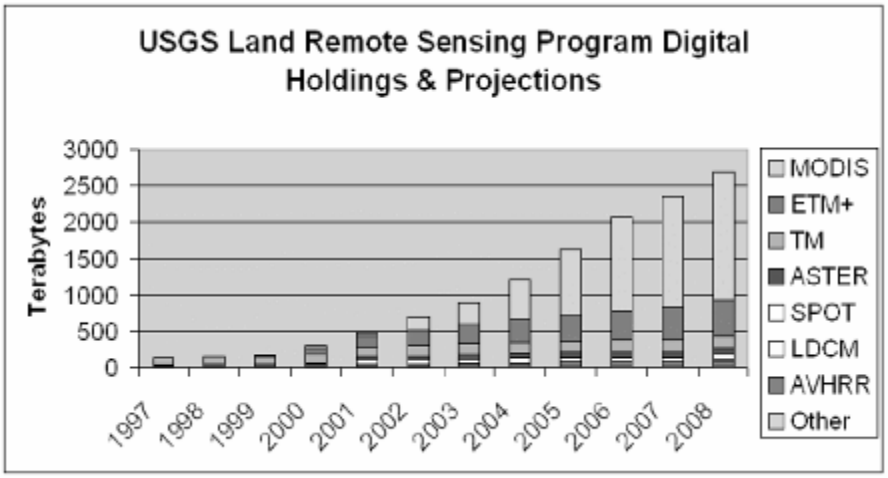


Figure 2. The projected exponential growth of satellite data in the USGS archive.

Remote Sensing Research and Data Utilization
(Estimate for FY 2005, $13.0 million; FY 2006, $13.2 million; FY 2007, $13.2 million)

Research, Development and Applications — The LRS program conducts research in remotely sensed land data collection, access, distribution, and applications from current and possible future data sources. Scientists and engineers sponsored by the LRS program are investigating new types of satellite systems and sensors, studying promising new data sources, developing new data acquisition programs and sources, and assessing the potential for new data applications. In addition, the program is seeking new ways to make remotely sensed data products more accessible to the land remote sensing user community, as well as ways to expand and enhance the overall use of remotely sensed data. LRS projects will continue scientific research in all these state-of-the-art systems (*http://remotesensing.usgs.gov/researchapps.html)*.

"A central responsibility for the coming decade is to ensure that established societal needs help guide scientific priorities more effectively, and that emerging scientific knowledge is actively applied to obtain societal benefits. New observations, analyses, better interpretive understanding, enhanced predictive models, broadened community participation and improved means for information dissemination are all needed. If we meet this challenge, we will begin to realize the full economic and security benefits of Earth science."

Committee on Earth Science and Applications from Space: A Community Assessment and Strategy for the Future, National Research Council, 2005

Providing Decisionmakers with the Latest Information through the National Civil Applications Program (NCAP) — The mission of NCAP is to serve the Federal civil community by providing modernized acquisition, dissemination, and exploitation of classified remote sensing systems and data to address land and resource management, environment, natural hazards, disasters, and other scientific analyses for policy issues. Through NCAP, the USGS provides decisionmakers with the best available, scientifically sound information based on the awareness, utilization and synthesis of all classified, commercial, open source, and governmental remotely sensed data. NCAP's contributions under the LRS program include critical support to the continuity of operations and continuity of Government. In addition, the NCAP activities also support the Civil Applications Committee (CAC), a Presidentially-chartered interagency committee that provides coordination and oversight of Federal civil use of classified collections. The FY 2007 budget reflects realignment of the NCAP activities under the LRS program where it has been managed.

FY 2007 Program Performance Estimates

The FY 2007 increase will enable USGS to achieve it target of 44 percent completion of the ground data processing system to meet the scheduled launch of Landsat 8. This will encompass the following activities and deliverables:

- Design and develop all ground system components,
- Implement ground system test plan,
- Conduct preliminary design review (PDR) of all ground system elements,
- Refine design in preparation for future critical design review (CDR),
- Support the Landsat Science Team, to define the suite of Landsat products,
- Participate with NASA in coordination meetings and development reviews, and

- Coordinate with other Landsat-continuity partners, including Interior, international cooperators, and others.

The LDCM objectives are to ensure continuation, post Landsat 7, of a collection of consistently calibrated imagery of the Earth's landmasses, coastal boundaries, and coral reefs. Also, LDCM will ensure the data acquired are of maximum utility to support the scientific monitoring of changes in the Earth's land surface and associated environment. Image data from satellites such as the Landsat series are one of the most efficient, cost-effective sources of essential geospatial information to meet the science and operational needs of the land and resource management communities. The LDCM will improve customer satisfaction through faster, easier access to data (Strategy 1, "Improve Information Base, Information Management, and Technical Assistance").

FY 2006 Planned Program Performance

Remote Sensing Missions and Data Acquisition

The FY 2006 program performance examples listed below are linked to performance measures for "satellite data collected over global land surface" and ensuring "satellite data available from archive within 24 hours of capture."

FY 2006 planned performance for Landsat 5 and 7 include:

- Flight operations for both satellites including data downlink (collecting over 400 scenes (World Reference System) per day globally from Landsat 7 and approximately 350 scenes/day for Landsat 5).
- Improving flight operations systems for Landsat 5. The Landsat 5 Missions Operations Center (MOC) will work on implementation of a limited backup MOC capability focused on health and safety of the spacecraft in an emergency situation.
- The Landsat 7 MOC team will continue to improve onboard software for reduced gyroscope operations. In FY 2005, one of three gyroscopes failed. Software onboard requires at least two working gyroscopes for spacecraft maneuvers, leaving the mission in a higher state of risk. The team installed initial software changes in FY 2005 that will allow control of the satellite after the failure of an additional gyroscope. This software will be further refined in FY 2006.
- The Landsat flight operations team will complete the investigation and mitigation of recently occurring anomalies relating to the solar array drive on Landsat 5. Battery power obtained from the solar array is critical to sustain proper operation of the spacecraft. On November 26, 2005, the Landsat 5 back-up solar array drive began exhibiting unusual behavior. The primary solar array drive encountered a similar performance problem in January 2005.
- Continue daily capture and processing success rates of at least 95 percent and 90 percent respectively as part of the primary mission of the Data Capture Processing Facility (DCPF). The DCPF captures and processes image data from Landsats 5 and 7 while providing command and control capabilities. The DCPF is comprised of the Landsat Ground Station, the Data Capture System, the Landsat Processing System, and the Landsat Archive Conversion System to provide end-to-end image processing (ingest, process, archive, and prepare and distribute products).

- Landsat project management will continue planning/engineering support as appropriate to the Landsat Data Continuity Mission (LDCM) and will work with the LDCM staff toward a combined Science Advisory Panel in order to explore potential new product options and business model changes as needed. Updated reporting, risk assessment and operational analysis in accordance with Exhibit 300 guidance will be continued.
- Coordination of International Cooperator activities required to ensure data collection will be tasked, along with:
    - Coordination of agreements required to ensure data delivery to cooperators,
    - Maintenance of an international ground station directory, and
    - Summarizing international requirements for Landsat data.

Landsat Data Continuity Mission (Landsat 8 and beyond) — At the direction of the Administration, the USGS team will be working to develop a long-term, sustainable, operational Landsat Program. As a first step the USGS and NASA will build, launch and operate a Landsat 7 follow-on mission, Landsat 8. The USGS role is to operate the mission, acquire and archive the data, and provide access to, produce, and distribute remote sensing data and products, and perform data calibration.

In FY 2006, the USGS will work with NASA to develop, evaluate and award a Request for Proposal for Landsat 8. The USGS will continue engineering analyses in order to prepare procurement for a ground data processing system. The initial procurement for ground processing hardware and software will be in FY 2007. Additional procurements, installation, launch-readiness testing, and staffing would take place during the following years.

USGS is starting system development activities to ensure capabilities are in place to ingest, archive, process, and distribute the next generation of Landsat data. The USGS is also engaged in systems engineering, algorithm development, software development, requirements management, documentation control, testing support, and management needed to implement new systems and software that will support Landsat 8 ground system functions. A portion of the ground system development may be contracted to commercial system builders.

During FY 2006, the development effort will encompass the following activities and deliverables:

- Documentation of operational concepts for each ground sub-system,
- Documentation of sub-system requirements, and formal review,
- Initiate ground system design,
- Documentation and exchange of interface requirements,
- Documentation of interface design and data formats,
- Develop of a security plan,
- Identification of sub-systems or components for outsourcing,
- Acquisition of some hardware components for in-house system development,
- Participation with NASA in coordination meetings and design reviews,
- Coordination with other potential Landsat-continuity partners, including International Cooperators, and
- Communication and coordination with USGS and Interior management.

Long-Term Data Preservation and Access

National Satellite Land Remote Sensing Data Archive (NSLRSDA) — The project will continue to maintain, preserve and provide ready access to historical remote sensing film and digital databases and archives. Planned activities include data organization, ingest, metadata generation, data set appraisals and assessments, dispositions including transfer to the National Archive and Records Administration (NARA) and preservation activities such as data set transcriptions and media migrations for collection in both the long-term archive and the NSLRSDA.

Some additional details of FY 2006 project tasks for the long term archive include:

- Continue to operate and maintain systems that acquire, process, and ingest satellite imagery into the archive,
- Support initiatives to partner with NARA to become an affiliated NARA archive,
- Continue to manage, operate, and maintain photographic and digital archives and ensure long-term preservation of archival holdings,
- Appraise and dispose of the historical collections; add new collections in archive that are aligned to program objectives and the USGS mission,
- Improve easier, faster public access to archive holdings through continued digitizing of USGS historical film collections; create and place browse images online and create single-frame coordinate metadata (to better assist customers in acquiring data and imagery tailored to their needs),
- Provide for effective and efficient user and customer service, data sales activities, and dissemination of products, and
- Provide certified reproductions of archived film sources to the public.

Long-Term Land Processes Distributed Active Archive Center (LP DAAC) — In continued support of NASA's Earth Observing System, the project is responsible for successful ingest and archive of MODIS and ASTER data from NASA's Aqua and Terra satellites. Since the data are archived in the LP DAAC, it will also be distributed via network, or on media. Product generation includes creation of ASTER digital elevation models (DEMs) and various other on-demand products. Monitoring of routine operations performance will also be provided through the LP DAAC Operations.

The LP DAAC science team will host and participate in various meetings of NASA-affiliated science data providers (instrument science teams) and data users. The LP DAAC science team is responsible for performing characterization studies of Terra and Aqua land data products and performing data quality assessment studies in response to reports of data anomalies from users. LP DAAC science team coordinates with user services and the instrument science teams in conducting outreach services and enhancing customer service support.

The USGS is a world leader in archiving remotely sensed data and in providing those data to users quickly, affordably, and in the most accessible form. These archival data form a baseline chronology of environmental change on the Earth, both natural and human-induced and an invaluable tool for scientific assessment and prediction. Through access to holdings in this archive, stakeholders can learn from the past to benefit the future.

Remote Sensing Research and Data Utilization

FY 2006 planned activities include:

- Infrastructure enhancement including program oversight, space/facilities management, security services, collection management; and systems support, and
- Science and Applications including science support for Interior land management issues, hazards support (hurricane and wildfire support), and research including evaluation of Department of Defense/Intelligence assets for dual use and emerging sensor technological analyses.

Landslide Delineation and Slope Morphology Characterization — Landslides are a significant geological hazard. In the United States, landslides cause over $1 billion in damages and as many as 50 deaths annually. Although typically associated with mountainous terrain, landslides also occur in lower elevations due to excavation failures, river/streambank failures, mine waste collapse, excessive rains that weaken hillsides, etc. Using remotely-sensed radar image data, the LRS program will characterize critical slope formations in order to better predict slope failure potential. This knowledge will inform local planners and emergency responders of potential hazards to their communities.

The LRS program will develop a research partnership with the University of Missouri's Natural Hazards Mitigation Institute and the USGS landslide program to more effectively map and monitor landslides through emerging technologies such as radar. The program's research on evolving radar-derived digital terrain data will better define measures such as slope shape, length and aspect in order to better support such efforts as the multi-agency, interdisciplinary focus on slope failures associated with fire/flood sequences in Southern California.

Unmanned Aerial Systems (UAS) to Assist in Wildfire Mapping — The National Civil Applications Program (NCAP) is collaborating with the U.S. Forest Service and the NASA Ames Research Center to investigate the use of Unmanned Aerial Systems (UAS) carrying multispectral sensors to assist in applications for wildfire mapping. This collaborative remotely sensed wildland fire research is being conducted through the multi-agency Tactical Fire Remote Sensing Advisory Committee (TFRSAC). The committee is investigating the use of large and small UAS, equipped with various multisensor payloads and capabilities, to monitor wildfires and for post wildfire analysis and assessment. Investigations are focused on sensor technology, on-board processing, telemetry, and dissemination of wildfire data via the Internet. Planned activities in FY 2006 include further evaluation and demonstration of small UAS capabilities including a UAS demonstration at the Fort Hunter Liggett Garrison in central California to evaluate small UAS capabilities during actual wildfire conditions.

FY 2005 Program Performance Accomplishments

Remote Sensing Missions and Data Acquisition

The FY 2005 program performance accomplishments listed below are linked to performance measures for "satellite data collected over global land surface" and ensuring "satellite data available from archive within 24 hours of capture."

"Landsat data and data products have made – and continue to make – essential contributions to U.S. economic, environmental, public safety, emergency relief, and national security interests."

Ken Fleming (Management Association for Photogrammetric Surveyors (MAPPS) President) and Karen L. Schuckman (ASPRS President) in April 6, 2005, letter to Dr. John Marburger

Landsat — Data acquisition continued for Landsat 7 for the U.S. archive at a rate of 300 scenes/day per the Long Term Acquisition Plan (LTAP). The LTAP, designed and monitored by an interdisciplinary science group, has been modified to acquire scenes that are good candidates for later combining into the new gap-filled products. Orbital position and velocity have been and continue to be maintained to specification through weekly delta-velocity and yearly delta-inclination spacecraft maneuvers. A software gyroscope for use onboard the spacecraft has been developed and installed on-board Landsat 7. This software will mitigate the risk of operation without hardware gyroscope redundancy. Landsat 5 data acquisitions continued for the U.S. archive over the 48 contiguous States (60 scenes/day). Data over the continent of Australia was also processed into the U.S. archive and is available through a U.S. Australia Cooperative Agreement (30 scenes/day). Orbital position and velocity continue to be maintained to specification through weekly delta-velocity and yearly delta-inclination spacecraft maneuvers. A large increase in International Cooperator stations wishing to receive Landsat 5 data downlinks has created a scheduling bottleneck; upgrades to the scheduling system and software have been accomplished to alleviate this issue, thereby improving customer service. The Landsat 5 Flight Operations Contract entered its last year during FY 2005. A contract re-compete effort was started in FY 2005 and will be implemented in FY 2006. This new contract will span the remaining life of the mission.

"Just wanted to pass along my extreme gratitude towards the USGS Interagency Operating Picture team…they've come to bat for us time and time again and in the past few weeks we've been nothing but impressed at their turnaround time and support.

For Hurricanes Katrina, Rita and Wilma, the amount of data they were able to pass to us and get on the Web just in time was a paramount addition to our command situational awareness. I can't thank them enough."

Chris Mayfield, SPAWAR NORTHCOM COP/GIS Manager (2005)

Development and delivery of new Landsat 7 products to help mitigate the impact to the users of the Scan Line Corrector (SLC) anomaly have been ongoing. The current collection of post-anomaly Landsat 7 data has been reprocessed to provide new information (gap location statistics, higher resolution browse) to aid the user in effective selection of post-anomaly products. Migration of old computer systems to commodity computer systems holds down operating costs and increases throughput (the new gap-filled products are very computationally complex). The historic Landsat 1 - Landsat 5 data on old tape media continue to be migrated to new media. Due to the tens of thousands of tapes involved, and the condition of the old tapes, this data migration effort will take over 2 years to fully complete. A Landsat 5 Thematic Mapper sensor calibration capability will be developed and delivered into operation.

Landsat Images Acquired for Disaster Response — Landsat 7 continues to provide useful data for disaster response. In addition to the USGS support of the December 2004 tsunami in Asia, Landsat is especially useful for disasters that affect widespread areas.

The USGS provided Landsat imagery to many Federal and international organizations to assist those who have been affected by Hurricane Katrina, Hurricane Rita, Hurricane Wilma, the Pakistan earthquake, the Alaskan fires, and the Indonesian tsunami during FY 2005. Landsat images are invaluable for emergency response and disaster relief since the advances made in data reception and processing permit rapid access to imagery in times of natural or man-made disasters. Within hours of data acquisition, the USGS provided relief organizations worldwide with pre- and post-disaster satellite images. Emergency responders and relief organizations use these images to make practical, well-informed decisions as to where rescue and relief efforts are most urgently needed and how to best carry out those efforts.

Landsat 7 was a prime source of remotely sensed imagery for recent disasters. These Landsat 7 images (see fig. 3) show the damage that New Orleans, Louisiana received as a result of Hurricane Katrina. The image on the left shows New Orleans and the surrounding area on April 24, 2005, a few months before Hurricane Katrina. The image on the right shows New Orleans on the morning of August 30, 2005, just one day after Katrina made landfall.

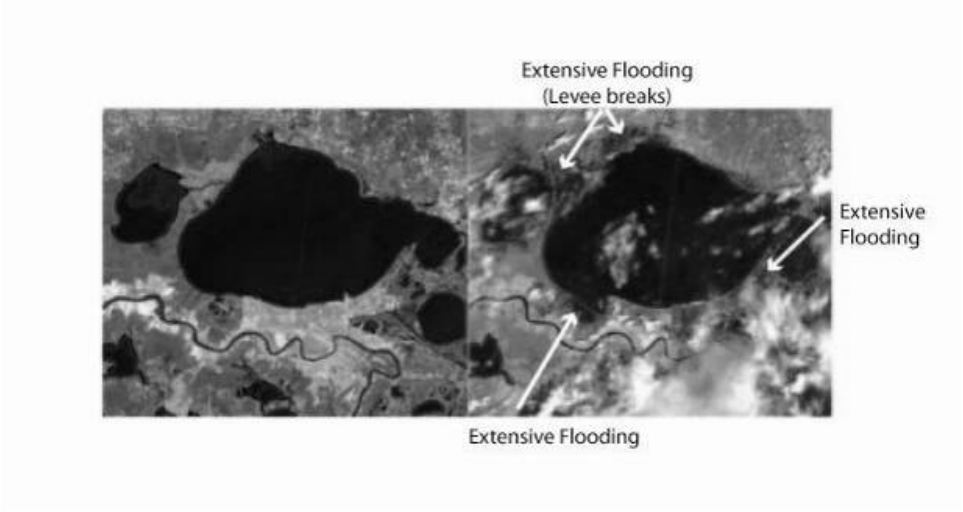


Figure 3. Emergency responders used these Landsat 7 images before (left) and after (right) Hurricane Katrina hit New Orleans.

Long-Term Data Preservation and Access

The FY 2005 program performance examples listed below are linked to performance measures for ensuring "satellite data available from archive within 24 hours of capture."

FY 2005 data management activities in support of Long-Term Data Preservation and Access focused on maintaining, preserving, and providing ready public access to historical remote sensing film and digital databases and archives. Work included data and metadata receipt, coordination and ingest processing, and inventory and storage area management. It also included data set preservation actions such as copying data from obsolete to new media, performing data sets appraisals and transferring vinegar syndrome-affected historical film to the National Archive and Records Administration to ensure long-term preservation.

Infrastructure was developed, appropriately sized to product demand, and operated to generate scanned and digitized products from the film-based historical archives. Products from both the historical aerial and satellite archives were delivered to the public using standard digital media such as CD, DVD, and FTP. Additionally, public access to the historical film archives was improved by creating and placing browse and digitized photo indexes online and creating single frame coordinate metadata.

Increased customer demand for digital products has resulted in photographic production equipment and lab spaces being decommissioned. Activities included cleanup, disassembly, and removal of all equipment; disposal and cleanup of chemical management and storage areas; and disposal of excess equipment and unused film raw stock and chemical inventories.

Data Capture — An agreement between EROS, NOAA/NESDIS Fairbanks Command&Data Acquisition Station (FCDAS), and University of Alaska Geographic Information Network of Alaska (GINA) has expanded the view of Landsat 5 into Alaska. Data are received at FCDAS (at Gilmore Creek just outside Fairbanks, AK) and transmitted by GINA via high-speed network to EROS for processing. On June 21, 2005, Landsat 5 acquired imagery of the Sheenjek River fire near Fort Yukon, Alaska. In less than 24 hours, these data were captured, processed, and available for wildfire managers in the Alaska Fire Service. The data captured over Alaska through this agreement are archived at EROS and available to any user through EarthExplorer (*http://earthexplorer.usgs.gov*) or the USGS Global Visualization Viewer (GloVis) (*http://glovis.usgs.gov*).

At the start of the Landsat 7 mission, the capture success rate requirement was 95 percent. Over the years, EROS has maintained a capture success rate that exceeds this requirement and typically averages over 99.9 percent capture success per fiscal year. Data are also received through a cooperative agreement with Australia. Landsat 7 downlinks on-board recorded data at the Australian station daily. Capture success rates at this station also are typically in the 99 percent success range (see fig. 4). These extraordinary success rates are a tribute to improved automation and efficiencies as well as excellent operational procedures and highly skilled staff.

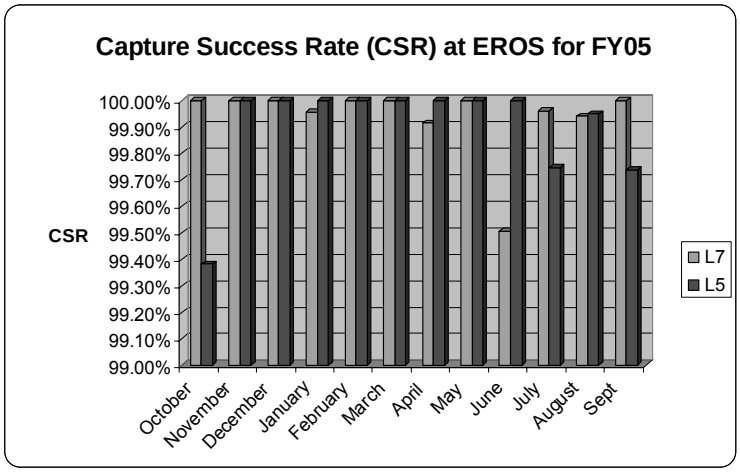


Figure 4. FY 2005 Capture success rates of Landsats 5 and 7.

Remote Sensing Research and Data Utilization

The FY 2005 accomplishments listed below are linked to the performance measure to provide "% of land with temporal and spatial monitoring, research, and assessment to meet land use planning and monitoring requirements."

Data Collections Added for Easier, Online Access — New Landsat-related and Earth Observing-1 (EO–1) data collections were added to the Global Visualization (GloVis) Viewer application and made available to all A*mericaView* members. The GloVis application serves an increasing number of state-based data access applications as more State viewers are adapted to use GloVis *(http://glovis.usgs.gov*), resulting in easier, faster online access for scientific researchers, students and the public.

Browse Capability Created — The GloVis development team collaborated with the USDA Foreign Agricultural Service (FAS) to provide access to the GloVis satellite browse-level imagery to users of the USDA Web-based CropExplorer system. CropExplorer (*http://www.pecad.fas.usda.gov/cropexplorer/*) provides agriculture market intelligence to decisionmakers, including farmers, agribusinesses, commodity traders, and Federal, State, and local government agencies (see fig. 5). As part of that information, the USGS browse images are used, as an example, to illustrate general crop conditions over areas of interest. For example, an image of central Illinois was sent, through the USDA CropExplorer, to a network of 300 brokers, elevators, and cooperatives in central Illinois during the 2005 summer growing season.

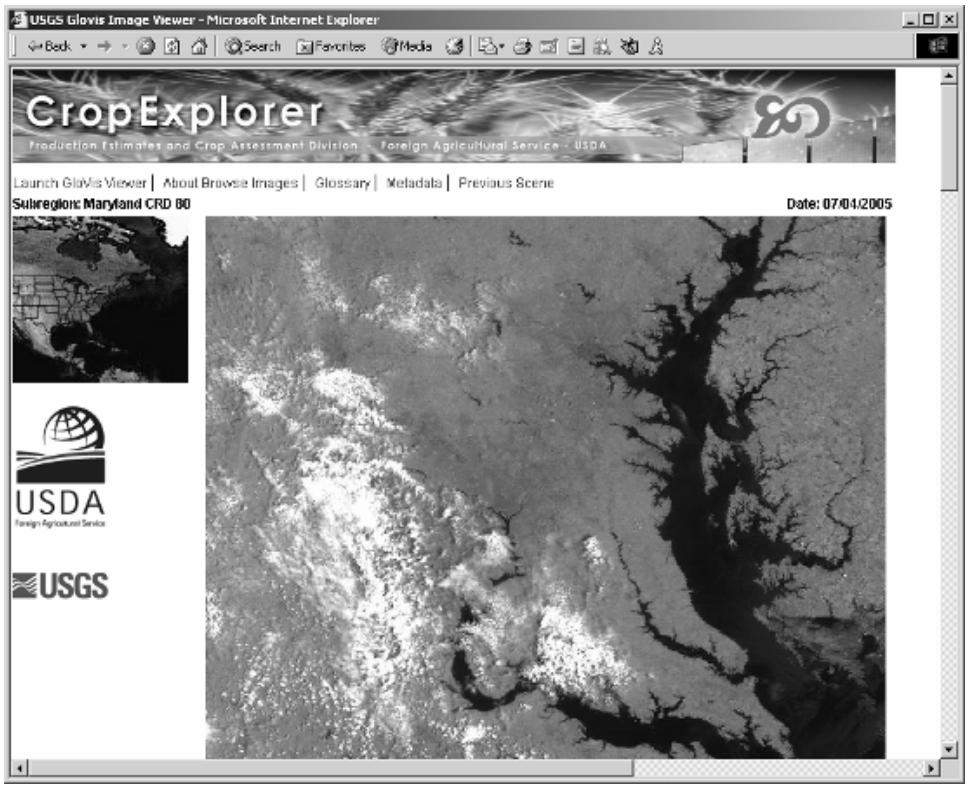


Figure 5. USGS Landsat browse imagery is provided to the USDA Crop Explorer system.

Enhancements to the MODIS Direct Broadcast System during FY 2005 allowed users to begin receiving daily access to several new products and services. The major changes included upgrades to the Normalized Difference Vegetation Index (NDVI)/Enhanced Vegetation Index product, which quantify the concentrations of green leaf vegetation around the globe used to create detailed drought maps.

A new service was also added in June 2005 that allows for the user-specified creation of a State composite product on demand. This new feature, requested by the *AmericaView Inc*. members, permits a user to generate and download a State-based cutout from the NDVI conterminous United States composite.

Hazards and Emergency Response to Natural Disasters

Hazards and Emergency Response — The Natural Hazards Support System *(http://nhss.cr.usgs.gov)* was developed by the USGS Rocky Mountain Geographic Science Center (RMGSC) to aid in monitoring and responding to natural hazard events. The Natural Hazards Support System (NHSS) provides a one-stop Web-based approach to hazards monitoring by combining easy access to current hazard information, geospatial data, and direct access to more detailed information from the source agencies. This Web-enabled combination of information, packaged with unique functionality, supports the public, and aids both the Federal and emergency response community in planning for response and recovery activities. NHSS currently contains dynamic near real-time natural hazards information from a wide variety of agencies. NHSS provides not only near-real time dynamic event information for a widerange of natural hazards, but it also provides a direct link to the primary agency for more detailed information. This allows NHSS to provide high level overview of all events while at the same time easily directing those needing more detailed/specific information to the appropriate agency/location/place. Data in NHSS are presented to the user in two separate, easily accessible map modes, North American and World. The North America mode is the default. While viewing data for North America, the user has available national seamless reference data up to 1:100,000 scale for the eight themes. FEMA HAZUS data have been seamlessly integrated and are available for critical infrastructure (i.e., schools, hospitals, fire stations) from 1:50,000 to 1:24,000 scale. The North America map mode contains near real-time dynamic data for earthquakes, fires, hurricanes, weather warnings, RAWS weather stations, REXRAD weather radar, and USGS stream gages with a hyperlink to the originating agencies. The World map mode presents globally seamless reference data available up to 1 million scale for six of the eight themes. The World map mode currently contains near real-time dynamic data for earthquakes and hurricanes.

Performance Overview

Measures	FY 2005 Plan	FY 2005 Actual	Change from 2005 Plan	FY 2006 Enacted	2006 Change from 2005 Actual	FY 2007 Request	2007 Change from 2006
Content and expanse of knowledge base: X% of surface area with temporal and spatial monitoring, research, and assessment/data coverage to meet land use planning and	100%	100%	0	100%	0	100%	0

Measures	FY 2005 Plan	FY 2005 Actual	Change from 2005 Plan	FY 2006 Enacted	2006 Change from 2005 Actual	FY 2007 Request	2007 Change from 2006
monitoring requirements **(SP Geography)** (satellite data collected over global land surface)							
Content and expanse of knowledge base: X% of data accessible: X% of satellite data available from archive within 24 hours of capture **(PART Geography)**	90%	97.2%	+7.2%	90%	-7.2%	90%	0
Quality: X% of studies validated through appropriate peer review or independent review **(SP)**	100%	100%	0	100%	0	100%	0
# of annual terabytes collected **(Geography)**	527.2	438.8	-88.4	534.0	+95.2	534.0	0
# of cumulative terabytes managed **(Geography)**	2,975.8	2,887.4	-88.4	3,509.8	+622.4	4,043.8	+534.0
# of systematic analyses and investigations delivered to customers **(Geography) (PART)**	78	83	+5	77	-6	49	-28
# of formal workshops or training provided to customers (instances/issues/events) **(Geography)**	12	17	+5	14	-3	11	-3
LDCM: X% of ground system designed, built, and tested **(Geography)**	UNK	UNK	0	28%	+28%	44%	+16%

Activity: Geographic Research, Investigations, and Remote Sensing

Subactivity: Geographic Analysis and Monitoring

Subactivity	2005 Actual	2006 Enacted	2007 Fixed Cost & Related Changes	2007 Program Changes	2007 Budget Request	Change from 2006
Geographic Analysis and Monitoring	14,628	14,705	+2,155	-2,000	14,860	+155
Total Requirements $000	**14,628**	**14,705**	**+2,155**	**-2,000**	**14,860**	**+155**
FTE	***113***	***113***	***+3***	***-20***	***96***	***-17***

a/ Fixed cost increases for this activity total $527, of which $369 will be budgeted and $158 will be absorbed. Changes for this subactivity also include an increase of $1,786 and 3 FTE for Land Cover research as a result of the EI /Geography restructure.

Summary of FY 2007 Program Changes for Geographic Analysis and Monitoring

Request Component	Amount	FTE
Program Changes		
• Pilot Multi-Hazards Initiative	+300	+1
• Geographic Research	-2,300	-21
TOTAL	**-2,000**	**-20**

Justification of FY 2007 Program Changes

The 2007 budget request for the Geographic Analysis and Monitoring program is $14,860,000 and 96 FTE, which is a net program change of -$2,000,000 and -20 FTE.

Pilot Multi-Hazards Initiative (+$300,000 and +1 FTE) — The Integrated Multi-Hazards Demonstration Project in Southern California, part of a multi-year initiative, focuses on (1) research and assessments on the cause and consequences of natural hazards, (2) response to the hazard events that merges information about disparate hazards into integrated products to support land-use planning, hazards mitigation, emergency response, and business recovery, and (3) information-sharing with the community to help society prepare for and recover from natural disasters. One goal of this work is to reduce losses of life and property from natural disasters, which supports the end outcome goal of "Protect lives, resources, and property" under the mission goal of Serving Communities.

The Geographic Analysis and Monitoring part of the project will leverage $300,000 of new funds with $700,000 from cost savings or from the redirection of lower priority work to provide interactive GIS databases and decision support tools that incorporate new and existing information from seismic, flood, and geodetic monitoring systems for six natural hazards

(earthquakes, tsunamis, fires, landslides, extreme coastal storms and floods) and land use/land cover characteristics. Web-based techniques that incorporate spatial and temporal hazards data will be developed to improve risk communication processes. These databases and decision support tools will assist in developing integrated hazard products for use in hazard mitigation planning, emergency management operations, and protection of business, industry, and government facilities in Southern California. The USGS will form 1 partnership in 2007 to link scientific information to societal decisions and 3 more in 2008 and beyond.

Geographic Research (-$2,300,000 and -21 FTE) — The FY 2007 budget request proposes a decrease to lower priority research within Geographic Analysis and Monitoring program to assist in funding the costs of the LDCM. The following lower priority programs will be affected:

- Urban studies — Monitor the environmental conditions of urban areas across the United States and model the impacts of increasing urbanization on environmental quality. This reduction to the GAM program will terminate these urban studies and reduce staff (-9 FTEs).
- Interior Lands Studies — Conducts research to analyze environmental impacts on Department of Interior lands and areas of interest. The proposed reduction eliminates funding for these projects, resulting in the reduction of staff (-4 FTEs) and ending current agreements with Interior bureaus.
- Human Health — Participates in human health studies related to assessments of water quality and the spread of the West-Nile virus across the country. Geographic research on all health-related research will be stopped and staff reduced (-8 FTEs).

Total Performance Change		*-33 Systematic analyses and Investigations delivered to customers -5 Formal workshops or training provided to customers +1 Partnership formed to link scientific information and societal decisions*			
	A	*B*	*C*	*D= B+C*	*E*
	Overall Performance Changes from 2006 to 2007				
Measure	**2006 Enacted Performance**	**2007 Base Performance Level**	**2007 Impact of Program Change on Performance**	**2007 Budget Request Performance**	**Out-year Impact of 2007 Program Change on Performance**
# of systematic analyses and investigations delivered to customers **(Geography)**	**77**	**77**	**-28**	**49**	**-4**
# of formal workshops or training provided to customers (instances/issues/events) **(Geography)**	**14**	**14**	**-3**	**11**	**-2**
# of partnerships formed to link scientific information and societal decisions **(Science Impact - Geography)**	**8**	**8**	**+1**	**9**	**0**

Column B: The performance level you expect to achieve absent the program change (i.e., at the 2006 enacted level plus/minus funded fixed cost/related changes); this would reflect, for example, the impact of prior year funding changes, management efficiencies, absorption of fixed costs, and trend impacts.

Column E: The out-year impact is the change in performance level expected in 2008 and Beyond of ONLY the requested program budget change; it does not include the impact of receiving these funds again in a subsequent outyear.

Program Overview

The surface of the Earth is changing rapidly, at local, regional, national, and global scales, with significant repercussions for citizens, the economy, and the environment. Some changes have natural causes, such as volcanic eruptions or drought, while other changes on the land, such as resource extraction, agricultural practices, and urban growth, are human-induced processes. In addition, there are other types of changes that are a combination of natural and human-induced factors; for instance, landslides and floods are fundamentally natural processes that are often intensified or accelerated by human land use practices. A recent example of the combination of natural and human-induced factors in landscape change is the canalization of the Mississippi River and the degradation of coastal wetlands, factors that amplified the devastating effects of Hurricane Katrina.

The GAM program addresses the Department of the Interior's strategic goal of serving communities by advancing knowledge of the Nation's land resources through scientific leadership and by informing public decisions through the application of science. GAM provides the analysis and applications needed to address natural and human-induced changes on the landscape. Improved understanding about the consequences of landscape change assists decisionmakers in the fields of land use planning, hazard response and mitigation, and the use and conservation of natural resources.

Researchers funded by the GAM program use earth observation data supplied by remote sensing platforms, coupled with scientific data gathered in the field, and socio-economic data to quantify the rates of landscape change, identify key driving forces, and forecast future trends of landscape change. Studies are conducted within a geographic context at a range of spatial and temporal scales, in order to provide a comprehensive, interdisciplinary perspective. This perspective is necessary to understand the threats impacting our Nation's quality of life, such as natural disasters, spreading diseases, and suburban sprawl. All of GAM's research is aligned with the Discipline's strategic science plan, "Geography for a Changing World."

> Objectively derived land cover information can serve as an instrument to transform information into knowledge – a particularly solid knowledge that can be verified on the land and cross-referenced within datasets to provide a bridge between science and policy. The broad scientific knowledge that can be gained from extensive land cover information, such as the National Land Cover Dataset, is not just a matter of intellectual curiosity, but it has great value for society.
>
> *P. Lynn Scarlett, Deputy Assistant Secretary, Program, Management, and Budget, Interior*
> *Selected remarks from keynote address,*
> *DOI Land Cover Summit,*
> *January 26, 2005*

The research conducted by GAM scientists consists of six geographic analysis components:

Landscape Status and Trends

(Estimates for FY 2005, $5.4 million; FY 2006, $5.5 million; FY 2007, $5.5 million)

Research under this activity involves identifying the characteristics of the land surface and understanding the forces shaping the land. Identifying and forecasting changes on the land, an essential element of the USGS science strategy, aids Federal and other government managers as well as non-government and academic practitioners in the fields of land use planning, watershed management, and environmental restoration activities. State and Federal natural resource agencies and land conservation organizations rely on authoritative USGS information in this area.

Terrestrial Monitoring

(Estimates for FY 2005, $1.1 million; FY 2006, $1.4 million; FY 2007, $1.1 million)

Research in this area assesses the impacts of landscape change on natural processes and involves the development of monitoring protocols that consistently correlate data acquired from remote sensing platforms with field conditions. Topics include: calibrating data at varying temporal and spatial resolutions, improving digital image change detection techniques, and the development of low cost ground-based sensors. The research goal is to provide improved landscape monitoring of both Federal and State lands over large areas at sharply reduced costs. Wildfire fuel condition mapping is just one of many applications.

Hazards and Risk Assessment

(Estimates for FY 2005, $1.3 million; FY 2006, $1.3 million; FY 2007, $0.4 million)

Research in this area focuses on the impacts of environmental conditions on human endeavors. It assesses changing human land-use patterns that can increase the likelihood of hazards, such as floods, landslides, and earthquakes. GAM scientists, in collaboration with colleagues from Department of Homeland Security and the Environmental Protection Agency, apply innovative geographic methods and models to assess the effectiveness of mitigation strategies and risk-management scenarios.

Biogeographical Analyses

(Estimates for FY 2005, $1.7 million; FY 2006, $1.6 million; FY 2007, $1.6 million)

Involves mapping and monitoring landscape characteristics, such as animal and plant habitat and condition. The accelerating loss of biodiversity is one of the major environmental issues of our age. GAM researchers in this field use remote sensing imagery to characterize regional patterns of biodiversity and monitor long term changes in land use, land cover, and species distribution. This information directly supports managers of both State and Federal lands.

Urban and Regional Geography

(Estimates for FY 2005, $2.3 million; FY 2006, $2.3 million; FY 2007, $1.2 million)

GAM scientists conduct multidiscipline, multi-scale research to understand the impacts of an increasingly rapid rate of urbanization on both natural and human systems. Researchers develop environmental monitoring systems linking air quality, hydrological, and forestry information across a landscape to holistically assess the quality of our built-up landscape. Major collaborators include other Federal agencies, the Chesapeake Bay Program and nongovernmental organizations.

In addition, the program contributes to bureauwide initiatives regarding priority ecosystems and integrated monitoring of critical landscapes ($2,000,000 per year, not included in the estimate above). The program is active in international efforts to monitor the global environment, such as the U.S. Group on Earth Observation (GEO) and the Global Earth Observation Systems of Systems (GEOSS) through the Global Integrated Trends Analysis Network (GITAN). This network is a multidisciplinary, interagency, and international collaboration focused on understanding the types, causes and consequences of landscape change around the world.

Scientists funded by the GAM program are regularly called upon to provide expertise on issues of land management, hazards mitigation and environmental change at the national and international levels to Interior, other bureaus within the Department, as well as local, State, and other Federal agencies. GAM research is formally presented at national and international conferences and workshops, including the Association of American Geographers, American Geophysical Union and the American Society of Photogrammetry and Remote Sensing, and is published in both internal and external reports, as well as in peer-reviewed publications.

Science Impact

(Estimates for FY 2005, $2.0 million; FY 2006, $2.0 million; FY 2007, $2.0 million)

USGS continues to promote the use and value of its scientific information by the Department, other Federal agencies, State, and local government organizations, and the public to make informed decisions. USGS multidisciplinary teams are working with external partners to develop, test, evaluate, and apply innovative methods to enhance linkages between science and decision making. Research activities currently underway include risk and vulnerability analyses for natural and environmental hazards, development of decision support tools, participatory processes, economic analyses, and institutional analyses. For example, within the Geography program the Land Use Portfolio Model (LUPM), a modeling, mapping, and risk communication tool is being developed to assist public agencies and communities to understand and reduce their risks from natural hazards and environmental impacts.
In addition, the Program contributes to bureauwide initiatives regarding priority ecosystems and integrated monitoring of critical landscapes. The program is active in international efforts to

monitor the global environment, such as GEO, GEOSS, and GITAN. This network is a multidisciplinary, interagency, and international collaboration focused on understanding the types, causes and consequences of landscape change around the world.

Scientists funded by the GAM program are regularly called upon to provide expertise on issues of land management, hazards mitigation and environmental change at the national and international levels to Interior, other bureaus within the Department, as well as local, State, and other Federal agencies. GAM research is formally presented at national and international conferences and workshops, including the Association of American Geographers, American Geophysical Union and the American Society of Photogrammetry and Remote Sensing, and is published in both internal and external reports, as well as in peer-reviewed publications.

FY 2007 Program Performance Estimates

The reductions in lower priority research in GAM will have an effect on the performance in the program. For example, the number of systemic analyses delivered to customers will fall from 77 in FY 2006 to 49 in FY 2007. Also, the number of formal workshops provided will decrease from FY 2006 to FY 2007, from 14 to 11, respectively.

Within funding levels GAM will continue the transition of the National Land Cover Dataset (NLCD) to an operational program that provides updates every 5 years, and make the necessary corrections to ensure that the 2001 NLCD is comparable with the 1990 dataset.

The increase in funding through the Multi-Hazards Initiative will lead to an increase in the number of partnerships formed to link scientific information and societal decisions by 1. These partnerships will include all sectors of the community that engage in planning mitigation strategies, warning the public, and restoration.

FY 2006 Planned Program Performance

Landscape Status and Trends

Land Cover Status and Trends — The Land Cover Trends project is planning to complete 13 ecoregion-based assessments of contemporary land use and land cover change. The completed assessments will bring the U.S. total to 44 ecoregions completed or approximately 52 percent of the conterminous United States. This study is the first comprehensive land cover change analysis ever conducted. The data collected will form the basis of projecting future land cover changes and their possible consequences. Publication plans will include the preparation of 15 ecoregion reports documenting the estimated rates of land use and land cover change from 1973 to 2000. The reports will provide a discussion of the forces driving that change and of the potential consequences. The project will also complete the fieldwork necessary to document the current status of land use and land cover in the sample blocks from 9 ecoregions.

National Land Cover Database (NLCD) — The NLCD project is compiling land cover information across all 50 States and Puerto Rico, using a partnership of eight Federal agencies and private outsourcing, with USGS as lead. This database captures the type of land cover, the proportion of urban development, and the proportion of trees for every 1-acre patch across the United States. Land cover information is used in a wide variety of applications among Federal, State and private organizations, including pesticide management, fire risk modeling, watershed

runoff modeling, wildlife habitat characterization, and economic development. In FY 2006, the percent impervious surface and canopy percentage datasets for all 65 mapping units will be completed, as well as all but 5 land cover mapping units. In addition, mapping efforts in Alaska will continue as well.

Terrestrial Monitoring

Landscape Monitoring Protocols using Satellite, Airborne, and Ground-Based Instrumentation — High resolution imagery will be acquired for three sites along the Colorado River to detect and map riparian vegetation, including sagebrush and invasive grasses, such as cheatgrass. The three sites encompass National Park, Wildlife Refuge and Bureau of Land Management lands and are critical habitats for birds and fish along the Colorado River corridor. Stand-alone automatic digital camera stations with wind and soil moisture sensors will be established to get on-the-ground monitoring capabilities within critical habitat areas. Results of the project will be use to assess the spread and impacts of invasive species in the Colorado River valley.

Hazards and Risk Assessment

Fort Apache Indian Reservation Water Monitoring — The surface area of water bodies (at maximum capacity), including lakes, ponds, sediment traps, earth embankment tanks and stock tanks will be delineated using Landsat data. Accuracy of the total water surface area delineated will be compared with tribal data to determine the percentage of water bodies identified using the Landsat imagery. The goal is to develop a relatively rapid method of accurately assessing water conditions throughout the Reservation. Tribal personnel will be provided training on the processing and use of Landsat data. They will also be heavily involved in the acquisition of ground points and analysis of data products. This rapid water monitoring system will enable tribal and Bureau of Indian Affairs personnel to identify areas of water stress, which may lead to catastrophic forest fires and possible pest outbreaks.

Biogeographical Analyses

National Park Service Vegetation Mapping Program — Vegetation maps for six parks in the National Park system will be created including, Canyonlands National Park, Fossil Butte National Park, Bryce Canyon National Park, Cedar Breaks National Park, and Great Sand Dunes National Park. The National Park Service is actively looking for assistance to augment or replace the traditional, but labor-intensive, process of manual photo-interpretation. In order to accomplish this objective, automated classification techniques will be used to map the vegetation of the park to comply with National Vegetation Classification Standards. These data, along with other ancillary datasets, will help create map units for a digital vegetation database. This database will enable Park personnel to effectively manage their resources and provide educational opportunities to the public.

Urban and Regional Geography

National Urbanization Monitoring Assessment (NUMA) — The NUMA project will aid in improving the understanding of the rural to urban transition and the rates, patterns, trends and factors causing these human-induced land transformations. Socioeconomic, demographic, and land use transition indicators will be used to monitor urbanization for two Bureau of Economic Analysis (BEA) Economic Areas and to assess the environmental and societal impacts as a

result of continued land use change in these regions. Temporal (e.g., 1970s to 2000s) landscape change information from existing LULC data sources (i.e., GIRAS, NLCD and GAP) will be analyzed for the Austin-Round Rock and San Antonio Economic Areas in conjunction with historical and projected statistical and visualization products in an attempt to identify effective indicators for monitoring and assessing urbanization**.** The results of the study will enable city planners to assess the forces impacting land cover decisions in their jurisdictions and plan changes to their local land use zoning laws.

Science Impact

Integrating Science and Economics in South Florida Interior Land Acquisition/ Stewardship Decisions — South Florida's national parks and wildlife refuges are threatened by accelerated growth of the surrounding built environment which alters the natural hydrology and ecology, and introduces harmful levels of sediment, nutrients and toxins. Interior scientists and land managers are faced with major informational and financial challenges and conflicting stakeholder interests in their efforts to manage and protect resources to fulfill their stewardship responsibilities. The primary objective of this effort is to develop an Ecosystem Portfolio Model (EPM) for Interior scientists and managers to use to develop and prioritize strategies to restore and preserve the ecological health of the South Florida National Parks and Refuges in the face of intense population growth and development pressures. The EPM will integrate natural science and economic information in a decision framework to assist with land use planning, land acquisition, and land management decisions. The integrated ecological and economic portfolio framework will allow Interior resource managers and decisionmakers to consider multiple objectives, while considering the quality of the scientific and economic information supporting management decisions. Ultimately, success will depend on well coordinated, collaborative, and integrated efforts among participating agencies and stakeholders to implement a reasonable balance between human needs and the needs of the ecosystem. The USGS Priority Ecosystem Science (PES) program, the Interior Critical Ecosystem Studies Initiative (CESI), and the USGS Science Impact Program have contributed to this effort.

FY 2005 Program Performance Accomplishments

The example program accomplishments described below demonstrate the breadth and utility of GAM research.

Landscape Trends

Status and Trends: Conterminous U.S. Land Use and Land Cover — In FY 2005, the Land Cover Trends research project completed the assessment of land use and land cover change for 10 U.S. ecoregions and initiated analysis on 6 new ecoregions. Progress on the national assessment begun in FY 2002 now stands at 31 out of 84 ecoregion assessments completed (i.e., 37 percent of the conterminous United States done) which places the project on target relative to GPRA goals. There does not appear to be a single national profile of change, rather it appears to vary both spatially and temporally. Land uses are being converted to higher-value uses based on enabling natural characteristics, contemporary drivers, and the influences of historical settlement patterns and traditions.

Status and Trends: Alaska Land Use and Land Cover — An analysis of statewide status and trends of Alaska's land cover was completed as part of the national USGS assessment of the rates, trends, and consequences of land cover change in the United States. The study found

that anthropogenic changes to the Alaskan landscape are concentrated in the south central portion of the State, with land development limited to specific localities, such as areas surrounding population centers, mining sites, and oil production facilities. Most vegetation changes appear to be climate-related, due to a lengthening of the growing season. The final report is currently undergoing review.

The National Land Cover Database — The National Land Cover Database (NLCD 2001) is a project sponsored by a consortium of Federal agencies to map the land cover of the United States. Partners in the Multi-Resolution Land Characteristics (MRLC) Consortium provide funding and personnel to map the land cover at a spatial resolution of 30 meters, using 2001-era Landsat satellite imagery and supporting data. The resulting database includes land cover, percent canopy density, and percent impervious surface. This database is a major component of national environmental assessments, such as the Heinz Center's *State of the Nation's Ecosystems* and the Environmental Protection Agency's Report on the Environment. At the end of fiscal year FY 2005, 65 percent of the project for the conterminous United States was completed.

Terrestrial Monitoring

Elevation Measurement of the Everglades — The USGS continues to develop and apply technologically advanced elevation measurement systems in the Florida Everglades. Results from these high-precision measurements, conducted in an exceptionally challenging environment, provide the foundation for research, management, and restoration of this critical ecosystem. In FY 2005 the USGS Airborne Height Finder (AHF) Geodetic Control Network and elevation data base was expanded to cover most of southern Florida.

Elevation Derivatives for National Applications (EDNA) — Accurate elevation data can be used to provide critical information on watersheds. This knowledge is used to support investigations of floods, pollution events, hydroelectric power potential and other applications. During FY 2005, GAM researchers created a series of geospatial Web-enabled tools that provide integrated seamless national topographic databases for scientific research and applications. Interactive capabilities include watershed delineation estimates of mean annual streamflow, and watershed characteristics for any location in the Unite States.

Hazards and Risk Assessment

Decision Support for Earthquake Risk Mitigation: City of Memphis and Shelby County, Tennessee — Earthquakes and associated seismic hazards, such as liquefaction and landslides, pose significant threats to the public safety and economic health of many communities throughout the world. Over the past year, a multidisciplinary team of USGS economists, geologists, and geographers developed a decision support system to assist the City of Memphis and Shelby County, TN in mitigating the risk of a major earthquake. The project combines high-resolution seismic hazard maps, detailed aerial photography, parcel maps, estimated building and land values in USGS Land Use Portfolio Model (LUPM). This model allows planners to compare alternative earthquake-hazard mitigation policies. In FY 2005, a prototype version of LUPM was installed on computer systems of the City of Memphis and Shelby County's Office of Planning and Development and Office of the Tax Assessor.

Lead and Other Trace Metals in the Environment: Clearwater Lake, Missouri — Missouri has a long history as a major producer of lead ore. Possibly the most famous of the State's ore

deposits is the New Lead Belt, also called the Viburnum Trend, in southeast Missouri. In FY 2005, USGS researchers analyzed the spatial and temporal distribution and concentration of trace metals in the sediments of Clearwater Lake, which is located near many mining activities. Results indicate that the sediments in the Lake act as a sink for mining related trace elements and that the source of these trace elements can be identified through isotopic "fingerprinting." Researchers found that the increased amounts of lead and zinc found in the sediments were from watersheds containing mining activities

Biogeographical Analyses

Innovative Approaches for Mapping the Vegetation of Colorado National Monument — In FY 2005, GAM researchers collaborated with the National Park Service to map approximately 12,000 hectares of the Colorado National Monument and its environs. The National Park Service is actively looking for assistance to augment or replace the traditional, but labor-intensive, process of manual photo-interpretation. In this study, innovative mapping methods were developed to delineate physiognomic classes and tree cover densities using automated image processing that comply with National Vegetation Classification Standards.

Urban and Regional Geography

City Green: the Value of Trees in Urban Areas — Healthy trees provide valuable environmental benefits to cities which can be measured in terms of ecosystem services. The USGS Comprehensive Urban Ecosystem Studies (CUES) project, working cooperatively with American Forests, has developed a Web-based tool that utilizes USGS land cover data to estimate the economic value of trees in urban areas. The tool combines measures of tree canopy and impervious surface with scientific and engineering equations with construction and remediation costs to estimate the economic benefits of urban tree cover. The CUES Web site contains analyses of land cover for over 2000 U.S. urban areas and can be used to calculate savings due to reduced runoff, improved air and water quality, and increasing carbon sequestration.

Science Impact

Developing Tools to Improve the Application of Science Information to Inform Earthquake Risk Mitigation Decisions in the City of Memphis and Shelby County, Tennessee — A multidisciplinary team of USGS economists, geologists, and geographers is working with the City of Memphis and Shelby County, Tennessee to mitigate the risk of a major earthquake. The project combines high-resolution seismic hazard maps, detailed mapping and remotely-sensed data, parcel maps, estimated building and land values, in the USGS - LUPM for planners to compare alternative earthquake-hazard mitigation policies. By helping evaluate the socioeconomic consequences of alternative mitigation strategies, the LUPM assists local planning agencies make more efficient use of public funds to lessen the risk of damages from a major earthquake.

The Use and Value of Science in Managing Natural and Environmental Hazard Risk in the Transboundary Puget Sound Area — The USGS is working with Natural Resources Canada to develop new ways for decisionmakers and planners in the transboundary Puget Sound area (Vancouver, British Columbia - Seattle, WA region) to apply scientific information about natural hazards and the potential risks to communities. In FY 2005, the USGS - LUPM was used in the District of Squamish, British Columbia in a preliminary evaluation of mitigation alternatives for

flood hazards. Squamish is planning for a sharp increase in population related to the 2010 Winter Olympic Games to be held in Vancouver. The LUPM will be used by practitioners to analyze hazards scenarios to assess community vulnerability and risk and the impact that proposed mitigation strategies may have on reducing that risk.

Priority Ecosystems Studies, Bureau Support and Science Thrusts

GAM provides support for Priority Ecosystems Science (PES) studies which are described in more detail in the Regional Activities section of this report. Through PES, GAM supports multidisciplinary research on critical ecosystems to achieve a system-scale understanding of the natural and anthropogenic factors affecting ecosystems and to better understand the interactive nature of resources and the environment. Study units include the Greater Everglades, San Francisco Bay, Chesapeake Bay, the Platte River and the Mojave Desert to provide science in support of adaptive management of ecosystems that have near-term societal concern and significant long-term societal value. GAM also provides support for four USGS-wide Science Thrusts on Water Availability, Landslides, Fire Science, and Integrated Landscape Monitoring. The science thrusts are an effort to provide an interdisciplinary and integrative framework for scientific studies in important ecological systems in the United States. Current thrust foci in which GAM participates include the Flint River, Colorado Front Range, Western Montana, Puget Lowlands, the Great Basin, the Prairie Potholes region, and the Gulf Coast/Lower Mississippi Valley.

Integrated Modeling Survey

In an effort to better support USGS scientific modeling and forecasting activities, the GAM program is conducting a survey of USGS scientists in all disciplines and all regions in order to build a comprehensive, descriptive database of environmental models. The goal is to identify opportunities for sharing and collaborating data and methodologies across the bureau. The resulting searchable database contains a detailed description of the model, as well as system and data requirements. It is a useful reference tool for both researchers and managers. Phase 1 of this project commenced in April 2005 and is focusing on populating the database. As of September 2005, 99 models have been submitted. Models were submitted by scientists in the Biology (39), Geologic (23), Water (22), and Geography (14) disciplines as well as the GIO (1). Hydrology (37percent), habitat (25 percent), landscape ecology (24 percent), and water quality (21 percent) models were the most common main subjects indicated by model developers and users.

Performance Overview

Measures	FY 2005 Plan	FY 2005 Actual	Change from 2005 Plan	FY 2006 Enacted	2006 Change from 2005 Actual	FY 2007 Request	2007 Change from 2006
Content and expanse of knowledge base: X% of surface area with temporal and spatial monitoring, research, and assessment/data coverage to meet land use planning and monitoring requirements **(SP Geography) (PART)** (2001 Nat'l dataset – 66 mapping units across the country)	60%	65%	+5%	75%	+10%	95%	+20%
Content and expanse of knowledge base: X% of surface area with temporal and spatial monitoring, research, and assessment/data coverage to meet land use planning and monitoring requirements **(SP Geography) (PART)** (Number of completed eco-region assessments out of a total of 84 eco-regions)	38%	37%	-1%	48%	+11%	53%	+5%
Content and expanse of knowledge base: X% of data accessible: X% of satellite data available from archive within 24 hours of capture **(PART)**	90%	97.2%	+7.2%	90%	-7.2%	90%	0
# of annual terabytes collected **(Geography)**	527.2	438.8	-88.4	534.0	95.2	534.0	0
# of cumulative terabytes managed **(Geography)**	2,975.8	2,887.4	-88.4	3,509.8	622.4	4,043.8	+534.0
# of systematic analyses and investigations delivered to customers **(Geography) (PART)**	78	83	+5	77	-6	49	-28
# of formal workshops or training provided to customers (instances/issues/events) **(Geography)**	12	17	+5	14	-3	11	-3
# of partnerships formed to link scientific information and societal decisions **(Science Impact - Geography)**	3 (cum 9)	2 (cum 8)	-1	0 (cum 8)	0	1 (cum 9)	+1

Geologic Hazards, Resources, and Processes

Subactivity	2005 Actual	2006 Enacted	2007 Fixed Costs & Related Changes[a/]	2007 Program Changes	2007 Budget Request	Change from 2006
Geologic Hazard Assessments	84,079	81,000	+896	+500	82,396	+1,396
FTE	*401*	*401*	*-11*	*+1*	*391*	*-10*
Geologic Landscape and Coastal Assessments	76,253	77,752	+992	-638	78,106	+354
FTE	*462*	*465*	*-13*	*0*	*452*	*-13*
Geologic Resource Assessments	77,014	76,534	+1,325	-20,943	56,916	-19,618
FTE	*583*	*581*	*-16*	*-180*	*385*	*-196*
Total Requirements $000	**237,346**	**235,286**	**+3,213**	**-21,081**	**217,418**	**-17,868**
FTE	***1,446***	***1,447***	***-40***	***-179***	***1,228***	***-219***

[a/] Fixed cost increases for this activity total $4,591, of which $3,213 will be budgeted and $1,378 will be absorbed. FTE changes result from rebalance and renew skills mix to gain functional and position flexibilities identified through an extensive workforce planning effort (page H-2).

Activity Summary

The 2007 budget request for the Geologic Hazards, Resources, and Processes Activity is $217,418,000 and 1,228 FTE, which is a net change of -$17,868,000 and -219 FTE from the 2006 enacted level. Additional information on program changes is provided in each subactivity of this document.

The Geologic Discipline provides earth science information needs for a wide variety of partners and customers, including Federal, State, and local agencies, non-government organizations, industry, and academia. This information is used by the USGS and its partners, cooperators, and customers in evaluating resource potential, defining and mitigating risks associated with natural hazards, and characterizing the potential impact of natural geologic processes on human activity, health, the economy, and the environment.

Use of Cost and Performance Information

USGS has ABC data for FY 2004 and FY 2005, but these two years of data demonstrate that more detail is required for decisionmaking. Beginning in FY 2006, data are collected for each task within a project. After several years of collecting at this level, USGS will be better able to track and analyze trends in program funding and expenditures, as well as links to the Department's goals and priorities. Use of ABC is also being incorporated into new 5-Year Program Plans.

Using PART, ABC, and other performance information, the USGS will continue to meet the Department's needs for geologic hazard assessments, landscape and coastal assessments, and resource assessments.

The mission of the USGS Geology Discipline contributes to the achievement of the Department's strategic goals of providing for responsible use of resources and serving communities by providing information to protect lives, resources, and property and advancing knowledge through scientific leadership and supports the mission and goals of the USGS FY 2000–2005 Strategic Plan.

Program Assessment Rating Tool (PART) Evaluation

The OMB has reviewed Geology Discipline programs within all three subactivity levels using the PART. One additional program is scheduled for review in FY 2006 for the FY 2008 budget. The reviews concluded that all programs reviewed have a clear purpose, do a good job at leveraging resources, work with a wide array of partners, and were rated "moderately effective."

Recommendations for improvement include:

- Improve earthquake risk estimates by integrating seismic monitoring information with FEMA's HAZUS risk and loss modeling capabilities,
- Work with other Federal agencies to evaluate new shared measures for geologic hazard reduction,
- Evaluate efforts to coordinate hazard investments across programs,
- Conduct regular, independent reviews of the geologic map program,
- Increase integration of geologic information to facilitate analysis and decision making,
- Set standards for data collection preservation and exchange,
- Target funding to activities that support long-term land use and economic policy decisions and improve accessibility and application of minerals information,
- Continue to make energy reports and data more accessible and user friendly.

Action Plans have been developed to carry out PART recommendations, with milestones being met on schedule or close to schedule.

Workforce Planning

The Geology Discipline has implemented a workforce planning strategy aligned with USGS science goals and tied to GPRA goals. The plan identifies areas in which the USGS needs to build internal capacity, contract with the private sector, and partner with other organizations; forecast future critical skill needs and identify mechanisms for recruiting, developing, and retaining a diverse workforce with those critical skills; align individual employee performance and rewards with organizational performance; and make effective use of technology.

Efforts are underway to rebalance and renew the skill mix to gain functional and position flexibilities identified through an extensive workforce planning effort. Employees with updated skills are needed to meet current science and business program requirements, changing program goals, new science priorities, and advances in technology. To phase in new skills, a VSIP/VERA, is currently being offered to employees in positions with non-transferable skills and skills that are overrepresented.

Upon completion of VSIP/VERA, new positions will be developed in future years to strengthen hazard and resource assessments, engineering, seismology, geodesy, geomagnetism, information technology, new technological skills in modeling and statistics, and monitoring and analysis, mapping, oceanography, physics, sedimentation, biogeochemistry, and toxicology.

Subactivity Overview

Geology Discipline comprises three subactivities:

Geologic Hazard Assessment programs conduct basic and applied research, gather long-term data, operate monitoring networks, perform assessments and modeling, and disseminate findings to the public, enabling the Nation's emergency response capabilities to warn of impending disasters, better define risk associated with natural hazards, encourage appropriate response, and mitigate damage and loss. These programs produce information and understanding that will lead to a reduced impact of natural hazards and disasters on human life and the economy. The United States is subject to a variety of inevitable and uncontrollable natural hazards (earthquakes, volcanic eruptions, landslides, coastal erosion, tsunami, floods and magnetic storms) that can result in considerable human suffering and billions of dollars in property and business losses. Damage and loss of life can be reduced through preventative planning; social, economic, and engineering adaptations; provision of real-time warning capabilities; understanding vulnerability, and more effective post-event emergency response. Central to this preplanning are accurate, scientifically based geologic hazards assessments and real-time monitoring systems that define the nature and degree of risk or potential damage. The more precisely risks can be defined, the greater the likelihood that appropriate mitigation strategies will be adopted (e.g., building codes for new construction and retrofitting, and land-use plans). The sooner information reaches emergency response centers, the sooner warnings can be issued to protect lives and teams can be dispatched to resolve urgent medical, utility, or other infrastructure problems.

Geologic Landscape and Coastal Assessments programs focus on understanding geologic processes at or near the Earth's surface through research, monitoring, and assessment of the landscape. Information and modeling derived from these geologic process studies allow scientists to distinguish the effects of human activities from natural changes and enable more effective, adaptive, and efficient resource and environmental management decisions. The USGS provides scientific data to understand issues such as coastal erosion and pollution, sea-level rise, loss of wetlands and marine habitats, the geologic processes controlling the invasion of cheat grass, and the role of dust in desert ecosystem health. Armed with this knowledge, decisionmakers can respond better to both natural and human-induced changes. Extreme changes in the environment are less costly if their likely effects can be mapped, quantified, and anticipated. Resources can be more efficiently used if the impacts of their extraction can be predicted and mitigated. Damaged or endangered ecosystems can be repaired more effectively if the natural processes that form and maintain them are accounted for in remediation and restoration plans. Strategies for conserving and using the Nation's lands and resources are improved when the natural processes at work are incorporated into predictive models and management plans in an adaptive manner.

Geologic Resource Assessment programs assess the availability and quality of the Nation's mineral and energy resources, including the economic and environmental effects of resource extraction and use. The Mineral Resources Program is the sole Federal provider of scientific information for objective resource assessments and unbiased research results on mineral potential, production, consumption, and environmental effects, and also provides comprehensive baseline data in the fields of geochemistry, geophysics, and mineral deposits. The Energy Resources Program conducts research to understand the processes that lead to the accumulation of energy resources (oil, natural gas, coal, gas hydrates, and others such as geothermal) and the environmental and human health effects of energy resource usage. USGS conveys results from these studies to land and resource managers and policymakers in support

of the Department's strategic goal of managing resources to enhance public benefit, promote responsible use, and ensure optimal value.

Activity: Geologic Hazards, Resources and Processes

Subactivity: Geologic Hazard Assessments
Program Component: Earthquake Hazards

Program	2005 Actual	2006 Enacted	2007 Fixed Cost & Related Changes [a/]	2007 Program Changes	2007 Budget Request	Change from 2006
Earthquake Hazards Program	50,864	50,583	+578	+300	51,461	+878
Total Requirements $000	**50,864**	**50,583**	**+578**	**+300**	**51,461**	**+878**
FTE	***227***	***227***	***-6***	***0***	***221***	***-6***

[a/] Fixed cost increases for this activity total $826 of which $578 will be budgeted and $248 will be absorbed. FTE changes result from rebalance and renew skills mix to gain functional and position flexibilities identified through an extensive workforce planning effort (page H-2).

Summary of FY 2007 Program Change for Earthquake Hazards Program

Request Component	Amount	FTE
Program Changes		
• Multi-Hazards Initiative	+300	0
TOTAL	**+300**	**0**

Justification of FY 2007 Program Changes

The 2007 budget request for the Earthquake Hazards Program is $51,461,000 and 221 FTE, which is a program change of +$300,000 and 0 FTE.

- **Integrated Multi-Hazards Demonstration Project (+$300,000 and 0 FTE)** — The Integrated Multi-Hazards Demonstration Project in Southern California, part of a multi-year initiative, will focus on integrating information and products about multiple hazards to improve the usefulness of this information in reducing loss of life and property from natural hazards, which supports the end outcome goal of "Protect lives, resources, and property" under the mission goal of Serving Communities. The development of integrated databases and the enhancement of IT systems to track multiple hazards will facilitate more rapid communication and response to the user community, regardless of the timeframe of a natural disaster.

The requested increase for the Earthquake Hazards Program (EHP) component of this demonstration project is $300,000, to be enhanced by $700,000 from the redirection or postponement of lower priority work. The EHP role will be to conduct a systematic study of the earthquake history of the southernmost 550 kilometers of the San Andreas Fault. Another component is analysis of the geodetic information about land-surface movements collected by the NSF-funded Plate Boundary Observatory, which is deploying a network of GPS sensors

along key portions of the plate boundary in the region. This work will benefit from leveraging the activities of the Southern California Earthquake Center (SCEC) which has identified the southern San Andreas Fault as a concentrated research topic for the next several years. The results from this assessment will be incorporated into a multi-hazard GIS framework developed in partnership with State and local emergency managers tasked with responding to earthquake events. Redirected funds will be used to initiate development of a first-ever time-dependent seismic hazard assessment for California. This effort will expand upon the time-independent assessment being conducted in FY 2006 in concert with the California Geological Survey and SCEC, and will be leveraged with support from the California Earthquake Authority (CEA). Redirected funds will also be used to seismically instrument structures in high-hazard areas of Southern California in order to collect data on building fragility, a key factor in understanding the region's earthquake risk.

The USGS would provide (1) one workshop for customers in FY 2007 that will discuss USGS earthquake response products with emergency managers and receive direction on what new products are needed and one workshop in 2008 to engage potential users of time-dependent hazard maps, (2) one systematic analysis or investigation in FY 2007 constraining the earthquake history of the southern San Andreas Fault, providing constraints on the magnitude of future earthquakes on that fault system, and one more in 2008 or beyond that will constrain the magnitude of future earthquakes on the San Jacinto Fault, and (3) complete detailed seismic hazard maps for the Los Angeles basin in FY 2008 or beyond. It is expected that one county or comparable jurisdiction in Southern California will adopt improved building codes, land-use plans, emergency response plans, or other hazard mitigation measures in FY 2008 or beyond, based on USGS earthquake hazards information developed through the initiative in FY 2007.

Program Performance Change Table

Total Performance Change		***+2 systematic analyses +2 workshops or training***			
	A	***B***	***C***	***D= B+C***	***E***
	Overall Performance Changes from 2006 to 2007				
Measure	**2006 Enacted Performance**	**2007 Base Performance Level**	**2007 Impact of Program Change on Performance**	**2007 Budget Request Performance**	**Out-year Impact of 2007 Program Change on Performance**
# of systematic analyses & investigations delivered to customers (risk/hazard assessments)	**2**	**2**	**+1**	**3**	**+1**
# of formal workshops or training provided to customers (instances/ issues/ events)	**7**	**5**	**+1**	**6**	**+1**

Column B: The performance level expected to be achieved absent the program change (i.e., at the 2006 request level plus/minus funded fixed cost/related changes); this would reflect, for example, the impact of prior year funding changes, management efficiencies, absorption of fixed costs, and trend impacts.

Column E: The out-year impact is the change in performance level expected in 2008 and Beyond of ONLY the requested program budget change; it does <u>not</u> include the impact of receiving these funds again in a subsequent outyear.

Program Overview

The USGS EHP provides the scientific information and knowledge necessary to reduce deaths, injuries, and economic losses from earthquakes and earthquake-induced tsunamis, landslides and liquefaction. Products of this program include timely notifications of earthquake locations, size, and potential damage; regional and national assessments of earthquake hazards; and public outreach to communicate advances in understanding earthquakes, their effects, and the degree to which they can be predicted.

Of all natural hazards facing the United States, earthquakes have the greatest potential for inflicting casualties, damage, economic loss, and disruption. Although damaging earthquakes are infrequent, their consequences can be immense. According to recent studies, a major earthquake in an urbanized region of the United States could cause several thousand deaths and a quarter trillion dollars in losses, impacting the national economy. Although the risk from earthquakes is famously high in California, many other parts of the country are also at risk, including the Mississippi River valley, Pacific Northwest, Intermountain West, Alaska, Hawaii, and parts of the eastern seaboard. Over 75 million people, including 46 million outside California, live in metropolitan areas with significant earthquake risk. Through the Advanced National Seismic System (ANSS), USGS and its State and university partners provide seismic monitoring coverage for the Nation with a national ANSS Backbone network, National Earthquake Information Center (NEIC), National Strong Motion Project, and 15 regional networks in areas of moderate-to-high seismic activity.

For coastal communities, the seismic risk is compounded by the potential for damaging tsunamis generated by large earthquakes. Increasing the safety of coastal communities requires a broad program of monitoring, warning system development and public education, accompanied by research into earthquake and tsunami sources and processes. The Indian Ocean tsunami starkly illustrated the potential dangers of earthquake-generated tsunamis, and highlights opportunities for increasing the Nation's ability to (1) rapidly determine the location, size and depth of large earthquakes, (2) discriminate those likely to have caused a tsunami, and (3) work with Federal, local and foreign partners to ensure timely warnings can be issued. For example, tsunami warnings issued by the NOAA Pacific and Alaska Tsunami Warning Centers rely on seismic data transmitted from the USGS National Earthquake Information Center. With support received from the Presidents' tsunami initiative, the USGS has accelerated upgrades to its NEIC and has implemented 24x7 staffing at the Center, greatly improving the speed and reliability of information provided immediately following damaging earthquakes.

Worldwide, 2005 delivered many highly damaging earthquakes, at least 17 of which were deadly. In March, a magnitude 8.7 earthquake off the coast of Sumatra was the second largest in 40 years, killing at least 1,300 and generating a 3-meter tsunami that caused extensive damage to coastal and island communities. This quake was likely triggered by stress changes in the Earth's crust caused by the catastrophic, magnitude 9.0 earthquake of four months earlier. In October, the Kashmir province of Pakistan and northern India was struck by a magnitude 7.6 earthquake that killed over 80,000 and caused widespread destruction including the collapse of tens of thousands of buildings. This earthquake was felt from central Afghanistan to western Bangladesh. An estimated 4 million people in the area were left homeless, and landslides and rockfalls damaged roads and bridges blocking access to many of the heavily damaged areas. This earthquake caused the most deaths in over a quarter century by shaking-induced building collapse – a stark reminder that the first line of defense against earthquakes is the construction of buildings that withstand strong shaking. Earthquakes are inevitable, but earthquake damage and life-loss are not. In the United States, the EHP provides

the seismic assessments that underlie modern building codes, as well as the scientific information and knowledge necessary to reduce deaths, injuries, and economic losses from earthquakes.

The EHP is the applied earth science component of the multi-agency National Earthquake Hazard Reduction Program (NEHRP), most recently re-authorized by the Earthquake Hazards Reduction Authorization Act of 2004, P.L. 108–360 enacted on October 25, 2004. The National Institute of Standards and Technology is the lead agency, and it coordinates the activities with USGS and the two other NEHRP agencies: the National Science Foundation (NSF), and Federal Emergency Management Agency (FEMA).

Partnerships are crucial to the program's success. Approximately 25 percent of the total EHP budget is directed toward research grants and cooperative agreements with universities, State agencies, and private technical firms to support research and monitoring activities. This external funding is highly leveraged by funds from other Federal agencies, States, and the private sector.

This program supports the Department's "Serving Communities" strategic goal to protect lives, resources, and property by making information available to communities to use in developing earthquake hazard mitigation, preparedness, and avoidance plans. As described in the OMB PART review of Geologic Hazard Programs, the EHP role is clearly defined and unique from other Federal, State, local, or private entities. The USGS programs in Earthquake Hazards, Volcano Hazards, Landslide Hazards, Global Seismographic Network and Geomagnetism were reviewed as a group in FY 2003 for the FY 2005 Budget using the PART, and were found to be working effectively with partners and fulfilling the USGS mission. As a result, they were found to be "moderately effective." An example of responding to a PART recommendation, the EHP has worked with the other USGS geologic hazards programs to link performance measures to measures in other agencies such as FEMA and NOAA that use USGS information to reduce loss of life and property.

Overall direction for the EHP is established by a 5-Year Plan that results from internal and external inputs such as the USGS and the Department's strategic plans, the results of periodic reviews by the Scientific Earthquake Studies Advisory Committee, workshops with stakeholders on specific topics, and the advice of senior scientists both within and outside the USGS. The appropriateness of the specific directions being taken by the EHP to meet the goals of the plan is assured by requiring both management and scientific review of project concepts and of final project proposals when submitted for initial funding. Additionally, periodic reviews are

Use of Cost and Performance Information

The EHP annual and 5-year planning procedures have been organized to respond to PART recommended actions and the Department's performance and cost-efficiency metrics. As an example of responding to a PART recommendation, the program has worked with the other USGS geologic hazards programs to link performance measures to measures in other agencies such as FEMA and NOAA that use USGS information to reduce loss of life and property. Other examples appear throughout this chapter.

Gathering ABC information at the task level is new for FY 2006. After several years of tracking this valuable detailed information, EHP will be better placed to track and analyze important trends in program funding and expenditures, as well as scientific emphases within each program and links to Departmental goals and priorities. In current and future fiscal years, the program will continue to review and revise ABC code assignments to ensure that they adequately reflect work performed at the task level, and that overall expenditures are properly aligned with the 5-year plan.

To track cost, budget, and schedule for the implementation of ANSS, the Program employs the Earned Value Management System (EVMS) and reports quarterly EVMS results to the Department and OMB.

conducted on progress of multiyear projects and peer review of reported project results when completed.

The following section on 2007 Program Performance Estimates describes the three primary EHP components.

Assessment and Characterization of Earthquake Hazards (Estimates for FY 2005, $18,500 million; FY 2006, $18,500 million; FY 2007, $19,000 million) — The USGS contributes to earthquake hazard mitigation strategies by (1) estimating and describing the likelihood and potential effects of moderate-to-large earthquakes in high-risk regions of the United States, such as Southern California and the Pacific Northwest and (2) making this knowledge available to others so it can be used to reduce the impact of potentially damaging earthquakes. Federal, State, and local government agencies, architects and engineers, insurance companies and other private businesses, land-use planners, emergency response officials, and the general public rely on the USGS for earthquake hazard information to refine building codes, develop land-use strategies, safeguard lifelines and critical facilities, develop emergency response plans, and take other precautionary actions to reduce losses from future earthquakes.

Monitoring and Reporting Earthquake Activity and Crustal Deformation (Estimates for FY 2005, $20,500 million; FY 2006, $24,100 million; FY 2007, $24,300 million) — As required under the Disaster Relief Act of 1974 (P.L. 92–288), the USGS has the assigned Federal responsibility for monitoring and notification of seismic activity in the United States. The USGS is the only agency in the United States that routinely and continuously reports on current domestic and worldwide earthquake activity. Reports of potentially damaging earthquakes are provided to the National Command Center; the White House; the Departments of Defense, Homeland Security (including FEMA), Transportation, Energy, and the Interior; State offices of disaster services; numerous public and private infrastructure management centers (e.g., railroads and pipelines); the news media, and the public. Rapid earthquake notifications are delivered by e-mail, pager, fax, and through USGS Web sites. USGS also provides near-real-time data to NOAA's tsunami warning centers, supporting tsunami monitoring in the Pacific Rim and disaster alerting in Alaska, Hawaii, Washington, California, and U.S. territories in the western Pacific.

Conducting Research into Earthquake Causes and Effects (Estimates for FY 2005, $7,500 million; FY 2006, $7,700 million; FY 2007, $7,879 million) — The USGS conducts research on causes, characteristics, and effects of earthquakes. This research has direct application in increasing the accuracy and precision of the agency's earthquake hazards assessments, forecasts, and mitigation practices.

Priority goals for each component are outlined in the 5-Year Plan for 2004–08, which was approved by OMB in September, 2005. The new plan also includes a fourth component—*Earthquake safety policy*—that features activities embedded in each of the other program components and reflects the overall NEHRP mission to translate improvements in understanding into loss-reduction results.

2007 Program Performance Estimates

The 2007 request for the Earthquake Hazards Program is $51,461,000 and 221 FTE, which is a program changes of +$300,000 and 0 FTE.

EHP performance changes from FY 2006 to FY 2007 include:

- One additional systematic analysis delivered to customer and one additional workshop as a result of the Integrated Multi-Hazards Demonstration Project funding increase.
- Forty additional real-time ANSS earthquake sensors, for cumulative sensors at 709.

At the FY 2007 funding level, EHP accomplishments will include the following:

Assessment and Characterization of Earthquake Hazards

National Seismic Hazard Maps — USGS national-scale seismic hazard maps are used to develop new, unified building codes for the United States. These digital maps integrate a wide range of geological and geophysical information to provide the maximum severity of ground shaking estimates that a given location is expected to experience during the next 50, 100, and 250 years. Periodic review and updating of the seismic hazard maps to incorporate new information are among the highest priorities for the EHP. The latest generation of maps was released in FY 2003, and maps are scheduled for updating every five years, conforming to the schedule for re-issue of national and international building codes. During FY 2007, USGS will issue draft revisions of the next-generation maps for external peer-review as the final stage before release of the final maps in FY 2008. The USGS works closely with earthquake researchers, engineers, and State and local government representatives across the Nation to ensure that the maps represent the most current and accurate information available. Release of the final maps will respond to the program's PART output measure for "number of systematic analyses & investigations delivered to customers" for FY 2008.

New California Working Group to Release Updated Earthquake Probabilities — To improve the assessment of earthquake shaking hazard in California, the USGS has joined forces with the Southern California Earthquake Center (SCEC) and the California Geological Survey (CGS) to convene a new Working Group on California Earthquake Probabilities. The goal is to provide users with a uniform, California-wide earthquake-rupture forecast that is time dependent, taking into account the best available science regarding earthquake return intervals and fault interactions. This forecast will be endorsed by the USGS, CGS, and SCEC. The effort is heavily leveraged with support from the California Earthquake Authority (CEA), the agency responsible for setting earthquake insurance rates in the state. The final forecast model is scheduled for delivery to the CEA by September 1, 2007. Results will be incorporated into the USGS National Seismic Hazard maps, and the model and results will be formally evaluated by the California Earthquake Prediction Evaluation Council and the recently re-established National Earthquake Prediction Evaluation Council.

Maps for Urban Areas — The scale of the national earthquake hazard maps precludes taking into account local variations in the amplitude and duration of seismic shaking caused by small-scale geologic structures and soil conditions. For high-to-moderate risk urban areas, the USGS is generating more detailed products that make it possible for local officials to make informed zoning and building code decisions. Modeling of ground motion is provided for engineering applications. In conjunction with release of these targeted products, the USGS conducts workshops to assure the proper transfer of knowledge and to help design effective mitigation strategies. During FY 2007, the USGS will focus efforts on collaborative urban seismic hazard mapping projects in the high-risk St. Louis urban area and the Tri-State (Evansville) area of Indiana, Kentucky, and Illinois. In both these efforts EHP serves primarily as coordinators, with most of the technical work being done by local partners. Partners in the St. Louis project include the University of Missouri at Rolla, Missouri Department of Natural

Resources, and the Illinois State Geological Survey. Those for the Tri-State (Evansville) project include the State Geological Surveys of Indiana, Kentucky, and Illinois, the Southwest Indiana Disaster Resistant Community Corporation, Association of Central United States Earthquake Consortium (CUSEC) State Geological Surveys, and Purdue University.

Monitoring and Reporting Earthquake Activity and Crustal Deformation

The Advanced National Seismic System (ANSS) — The ANSS initiative is focused on expanding and improving the performance and integration of national, regional, and urban seismic monitoring networks in the United States. Begun in 2000, ANSS implementation efforts have focused primarily on the installation of new urban recording sites in five high-risk metropolitan areas: Los Angeles, CA; Salt Lake City, UT; San Francisco, CA; Seattle, WA; and Anchorage, AK. Increasing seismic monitoring capability in urban regions has two major benefits: (1) provide rapid assessments of the distribution and severity of strong ground shaking just after an earthquake–information used by emergency response officials to determine the scope and scale of the crisis they face and (2) provide detailed and accurate data on the shaking of the ground and structures during a damaging earthquake. These data can be used in the recovery and rebuilding phase for more earthquake-resistant design and construction in the future. In FY 2007, USGS will increase the number of structures instrumented, adding 40 equivalent stations to the ANSS total. Two structures will be instrumented in Southern California, the region of the Multi-Hazard Demonstration Project. A key component of ANSS is the National Earthquake Information Center (NEIC). By mid-FY 2007, the NEIC will complete a substantial upgrade to its software systems, called the National Operations Center. Through the President's tsunami warning initiative, new software system will allow faster identification and analysis of earthquakes in the United States and worldwide, faster reporting of earthquake locations and magnitudes, and improved integration of ShakeMap real-time shaking intensity estimation. The system will also incorporate a full suite of modern network security measures. In FY 2007, the USGS will assume the costs of operation and maintenance of 17 new and 8 upgraded ANSS Backbone stations installed in FY 2005 and FY 2006 through a significant partner contribution by the NSF *EarthScope* initiative. A slower increase in station installation performance metrics is therefore expected in comparison to FY 2006, and an increased cost per unit of input data.

Release of National Research Council Report on the Economic Benefits of Improved Seismic Monitoring

In 2003, USGS commissioned a study by the NRC on the economic benefits of improved seismic monitoring. Specifically, USGS asked the NRC to examine how improved monitoring could reduce future losses and to estimate the benefits that could be realized by full deployment of the ANSS. In June of 2005, the NRC's Committee on Seismology and Geodynamics released the 148 page report, entitled *Improved Seismic Monitoring—Improved Decision-Making: Assessing the Value of Reduced Uncertainty.* This report represents the most rigorous effort ever to examine costs and benefits of earthquake monitoring, and it clearly justifies current and future USGS investments in this area. In the committee's judgment, potential benefits of improved seismic monitoring far exceed the costs: annualized building and building related earthquake losses are estimated to be about $5.6 billion. The annualized cost of enhanced seismic monitoring is about $96 million, less than 2 percent of the estimated losses. The committee found that in one benefit area, performance-based engineering, estimates for benefits are estimated at $142 million annually—about three times the cost of operating the full ANSS.

Regional Earthquake Monitoring — As part of ANSS, the USGS and cooperating universities operate regional seismic networks in areas of high seismicity. Data from all U.S. seismic networks are used to monitor active faults in much greater detail than is possible with the national-scale network. Each region has a local data center where the data are processed and regional catalogues of earthquakes are produced. These data centers serve as local distribution points for information about earthquakes to the public, local, and State agencies, and other regional interests. The regional data centers relay earthquake data in real time to the NEIC as

well as to other regional networks. They also provide information about regional earthquake hazards and accepted mitigation practices, and those centers located at universities provide training and research facilities for students. To support partner activities in regional earthquake monitoring, approximately $5.5 million will be provided in FY 2007 through cooperative agreements, $3.0 million of which comes from base program funds and $2.5 million of which comes from funds specified for construction and maintenance of the ANSS.

Regional Earthquake Monitoring Supported by the USGS

ANSS Earthquake Monitoring Region	Cooperating Institutions
Southern California	California Institute of Technology University of California at San Diego USGS – Pasadena
Northern California	University of California at Berkeley USGS – Menlo Park
Pacific Northwest	University of Washington University of Oregon USGS – Seattle and Vancouver, WA
Alaska	University of Alaska, Fairbanks
Inter-mountain West	Montana Geological Survey University of Utah University of Nevada, Reno
Central United States	University of Kentucky University of Memphis St. Louis University Ohio Geological Survey
Eastern United States	Boston College Columbia University University of South Carolina Virginia Polytechnic Institute

Conducting Research into Earthquake Causes and Effects

Internal Research Activities — A major focus of USGS earthquake research is to understand earthquake occurrence in space and time. On-going USGS investigations seek to determine the physical conditions for earthquake initiation and growth; processes of earthquake triggering; how individual faults in the same region interact; why some faults slip slowly without generating earthquakes while others generate earthquakes; and the factors that control variations in recurrence intervals of earthquakes along the same fault. USGS research efforts are also directed at improving the understanding of earthquake-induced strong ground shaking and its effects. Specifically, USGS researchers are investigating how complexities in the earthquake source, Earth's crust, and near-surface soils and deposits influence seismic wave propagation and strong ground motion. Improving current techniques for forecasting the effects of strong ground motion will greatly improve seismic hazard maps for urban regions. These efforts are thus critical for cost-effective earthquake hazard mitigation. Another research priority is the identification and understanding of behavior of weak soils that liquefy and fail when subjected to earthquake shaking. Research on ground failure, carried out in collaboration with structural and geotechnical engineers, will lead to improved design of earthquake-resistant infrastructure and lifelines, such as bridges and airports, commonly built on fill or weak soil.

Supporting External Research Partnerships — EHP provides competitive, peer-reviewed, external research support through cooperative agreements and grants that enlist the talents and expertise of State and local government, the academic community, and the private sector. Investigations and activities supported though the external awards are closely coordinated with

and complement the internal USGS program goals. Many of the external projects are co-funded with other agencies and sources, leveraging the effect of USGS support. External program activities include (1) mapping seismic hazards in metropolitan areas, (2) developing credible earthquake planning scenarios including loss estimates, (3) defining the prehistoric record of large earthquakes, (4) investigating the origins of earthquakes, and (5) improving methods for predicting earthquake effects. By involving the external community, the USGS program increases its geographical and institutional impact, promotes earthquake awareness across the Nation, encourages the application of new hazards assessment techniques by State and local governments and the private sector, and increases the level of technical knowledge within State and local government agencies. To support external work, $4.9 million is requested in FY 2007 for competitively awarded earthquake research grants, $0.5 million through cooperative agreements for the operation and maintenance of regional geodetic networks and other long-term research efforts, and $1.1 million to the Southern California Earthquake Center (SCEC), a 40-institution research consortium that USGS funds in partnership with the National Science Foundation. The FY 2007 request maintains the same level of funding and effort as FY 2006. In both FY 2006 and 2007, EHP will support targeted research to improve algorithms used to rapidly and accurately determine the magnitude and shaking intensity of large earthquakes. Implementation of such algorithms into NEIC analysis operations will shorten the time needed to report on potentially damaging or tsunamigenic earthquakes.

FY 2006 Planned Program Performance

In FY 2006, EHP plans several key accomplishments in areas related to earthquake monitoring, hazard assessments, and research. Several of these anticipated accomplishments are outlined in the following paragraphs. The activities listed below contribute to USGS products that are counted under the program performance measures of "hazard monitoring networks maintained," "risk/hazard assessments completed," "ANSS real-time earthquake sensors installed," "workshops or formal training provided to customers," and "metropolitan regions where ShakeMap is incorporated into emergency procedures."

USGS Contributions to Improved Global Tsunami Warning and Earthquake Response — The Administration committed $37.5 million in FY 2005–06 for NOAA and USGS in an initiative to improve tsunami detection and warning systems. For FY 2005, USGS received $8.1 million in an Emergency Supplemental Appropriation, and $5.4 million was requested in the FY 2006 President's budget. With these funds, USGS is taking steps to improve seismic monitoring and information delivery from the National Earthquake Information Center (NEIC) and Global Seismographic Network, a partnership with the National Science Foundation and the IRIS university consortium. These activities support both NOAA's tsunami warning responsibility and the USGS responsibility for earthquake notification and hazard reduction. In FY 2006, the USGS is initiating full, on-site 24x7 operations at the NEIC, continuing hardware and software upgrades, and will complete deployment of the Prompt Assessment of Global Earthquakes for Response (PAGER) system, which uses advanced seismological methods to predict damage from major earthquakes in their immediate aftermath. The prototype PAGER system was put to the test during the magnitude 7.6 Pakistan earthquake in October 2005, giving aid agencies their first indication of the tragedy that manifested itself in the subsequent days and weeks.

USGS to Release New Seismic Hazard Map for Alaska — The USGS has completed a major update to its seismic hazard map for Alaska. The new map incorporates information learned since the map was last updated in 1999, most significant being new data on the Denali strike-slip fault in south-central Alaska, the fault that hosted the magnitude 7.9 Denali earthquake November 2002. The USGS will release the map in FY 2006 following review by

the 2008 NEHRP Seismic Provisions Update Committee, which has responsibility for determining the seismic engineering provisions to be included in future building codes.

Seattle Urban Seismic and Landslide Hazard Maps to be Completed — The USGS, working with State and local partners, will complete and release a suite of seismic and landslide hazard maps for the Seattle urban corridor. The USGS partnered with the University of Washington Pacific Northwest Center for Geologic Mapping Studies to produce a new geologic map for the region, which allows more precise calculations of earthquake shaking and landslide susceptibility. Building on existing relations with the City of Seattle, the USGS will develop uses for the maps in establishing city seismic hazard policies and retrofit priorities.

Workshops and Training Sessions — Several workshops are planned for FY 2006, including those related to hazard mapping, ShakeMap implementation, ANSS structural instrumentation planning and development, and research. The National Hazard Mapping project and the new Working Group on California Earthquake Probabilities will convene several workshops to collect and review the latest scientific information on hazardous faults and their rates of slip. This effort relates to the Assessment and Characterization of Earthquake Hazards Program component.

ANSS Activities — In FY 2006, the ANSS Backbone network will be completed in the contiguous United States, through a partnership with the USArray element of *EarthScope*, a program of the NSF. Targeted 2006 funding will go to completion of software development efforts, including a major upgrade of the NEIC, improvements to data communication and earthquake reporting products (including the ShakeMap and ShakeCast products), and to the operation and maintenance of the installed station base. Also planned for FY 2006 is the instrumentation of several structures (buildings and bridges) in high hazard urban areas, for which sensors were procured in FY 2005. This push will expand ANSS significantly into this realm of earthquake engineering data gathering, an activity that has been emphasized by the ANSS advisory committee for several years. The table below provides the ANSS funding history to date.

Advanced National Seismic System Funding
(dollars in millions)

Year	Base	Change	Annual Funding	Cumulative Expenditure	Number of Stations Installed
FY 2000	0.0	+1.6	1.6	1.6	171
FY 2001	1.6	+2.0	3.6	5.2	303
FY 2002	3.6	+0.3	3.9	9.1	382
FY 2003	3.9	0.0	3.9	13.0	428
FY 2004	3.9	+0.5	4.4	17.4	523
FY 2005	4.4	*+3.8	8.1	25.5	563
FY 2006	8.066	-0-	8.066	33.566	669

* FY 2005 funding included increases of $0.85M in Interior Appropriation and $2.95M in Tsunami supplemental appropriation.

National Earthquake Prediction Evaluation Council to be Re-established — Due to the high level of interest and scrutiny in the field of earthquake prediction and forecasting, it is imperative that the USGS continue to provide scientific and public leadership, by evaluating proposed earthquake prediction methods, providing guidance to the government on appropriate public policy, and managing public expectations when earthquake predictions arise. To this end, USGS is re-establishing NEPEC to provide the Director and the Nation with authoritative evaluations of proposed earthquake predictions by individuals and organizations within the

United States and worldwide. The Council is established pursuant to Earthquake Hazards Reduction Act of 1977 and furthers the objectives of Sec. 202 of the Disaster Relief Act of 1974. The Council is required by Sec. 101 (e)(2) of P.L. 96–472, October 19, 1980. Membership will include USGS and non-USGS scientists.

Centennial of the Great San Francisco Earthquake — April 18, 2006 will mark the 100th anniversary of the San Francisco earthquake and fire, a seminal event in the scientific study of earthquakes as well as in the cultural and social history of California. The 1906 earthquake is generally regarded as the birth of modern earthquake science. Its upcoming 100th anniversary provides a unique opportunity to increase public awareness of seismic hazard as well as earthquake preparedness and mitigation. The USGS has joined with partner groups to form the 1906 Earthquake Centennial Alliance to help coordinate efforts and activities between organizations throughout Northern California planning to commemorate the earthquake. The Alliance (1) brings together policymakers, scientists, engineers, historians, teachers, and emergency responders, (2) will take advantage of this unique "teachable moment" to deliver messages to the California public on what scientists know about earthquakes and where earthquake research is going in the future, and (3) along with engineers and emergency responders, will encourage implementation of policies to minimize the impact of future earthquakes. The USGS and its partners will prepare and release a suite of new research and information products for this occasion, including (1) a database of active faults, (2) a highly detailed simulation of the ground motion induced by the 1906 earthquake, (3) a modern geologic bedrock map for the greater San Francisco Bay Area, (4) a 45-minute television program highlighting the century of progress in understanding earthquakes and their effects, and (5) printed materials for broad distribution.

Supporting External Research Partnerships — In FY 2006, about 90 research grants are planned to be supported, 73 with universities and colleges, 3 with State geological surveys, and 14 with private sector companies. Many of the external projects are co-funded with other agencies and sources, leveraging the effect of USGS support.

USGS FY 2006 Earthquake Program Cooperative Agreements and Research Grants **Cooperative Agreements for Research, Seismic Networks and Geodetic Networks**	
Boston College	University of California – Los Angeles
Brigham Young University	University of California - San Diego (2 agreements)
California Geological Survey	University of Colorado
Central U.S. Earthquake Consortium	University of Kentucky
Central Washington University	University of Memphis
Commonwealth Scientific & Industrial Research Org.	University of Nevada
Lamont Doherty Earth Observatory	University of South Carolina
Montana Bureau of Mines and Geology	University of Southern California
Oregon DOGAMI	University of Utah (2 agreements)
Saint Louis University	University of Washington
San Francisco State University	Utah Geological Survey
University of Alaska	Virginia Polytechnic Institute
University of California - Berkeley (3 agreements)	
Grants	
AIR Worldwide Corp.	Simon Fraser University
Arizona State University	Stanford University (2 grants)
Boise State University	State University of New York - Stony Brook
Boston College	Universidad de Granada (2 grants)

Grants (Continued)	
Brown University	University of Arizona
California Institute of Technology (2 grants)	University of California - Berkeley (2 grants)
California State Polytechnic University	University of California - San Diego (3 grants)
Central U.S. Earthquake Consortium	University of California - Santa Barbara (6 grants)
Clemson University	University of Durham
Drexel University	University of Illinois - Champaign
Harvard University (2 grants)	University of Kentucky
Independent (3 grants)	University of Memphis (6 grants)
Indiana University	University of Missouri (3 grants)
Lamont-Doherty Earth Observatory (4 grants)	University of Puerto Rico Mayaguez (2 grants)
M Tuttle & Assoc	University of Southern California
Nevada Bureau of Mines and Geology	University of Texas - Austin (2 grants)
Oregon DOGAMI	University of Utah (2 grants)
Oregon State University (2 grants)	University of Washington
Pacific Geoscience Centre	University of Wisconsin (2 grants)
Pennsylvania State University	URS Corporation (5 grants)
Purdue University	Utah State University
Saint Louis University (2 grants)	Virginia Polytechnic Institute
San Diego State University (4 grants)	William Lettis and Associates (5 grants)
San Francisco State University	Woods Hole Oceanographic Institute (2 grants)

2005 Program Performance Accomplishments

The accomplishments listed below demonstrate the value of USGS products that are counted under the program performance measures of "hazard monitoring networks maintained," "risk/hazard assessments completed," "ANSS real-time earthquake sensors installed," and "workshops or formal training provided to customers."

Daily Earthquake Hazard Forecasts on the Web — The USGS released new public Web pages that show the probability of earthquake shaking in the next 24 hours in California. These maps graphically illustrate the change in earthquake probability during aftershock and possible foreshock sequences. The maps are updated at least once an hour and are available to the public at *http://pasadena.wr.usgs.gov/step/*. Seismologists have known for decades that the occurrence of one earthquake makes another event more likely. The probability of one earthquake triggering another has been quantified and depends on magnitude, distance and time from the triggering event. The new maps represent a synthesis of current scientific knowledge about earthquakes in California. The methodology was developed by a team from the Swiss Federal Institute of Technology (ETH) in Zurich, Switzerland, and the USGS, with funding from the Southern California Earthquake Center, ETH and the USGS. Implementation of these maps for other areas outside California depends upon both a robust real-time seismic network and the research to establish the average rate of aftershocks for that area.

Earthquake Outreach Document Released — *Putting Down Roots in Earthquake Country* is a graphically illustrated, color handbook on earthquake science, mitigation, and preparedness. Originally developed by the USGS and SCEC for Southern California, a new version of *Roots* for northern California was released in FY 2005. It features current scientific understanding of when and where earthquakes will occur, and how the ground will shake as a result. Updated maps of earthquakes, faults, and potential shaking are included, as well as instructions on how

to get information after earthquakes. Its "Seven Steps on the Road to Earthquake Safety" provide a simple set of guidelines for preparing and protecting lives and property, and for surviving and recovering from a damaging earthquake. In fall of 2004, 760,000 copies were printed, with funding from the CEA, FEMA, the Red Cross, and other contributors, of which 500,000 were distributed in Bay Area newspapers, and an additional 110,000 copies were printed with funding from the CEA and USGS. Copies of the document are distributed at home improvement centers, via the American Red Cross, and many other avenues.

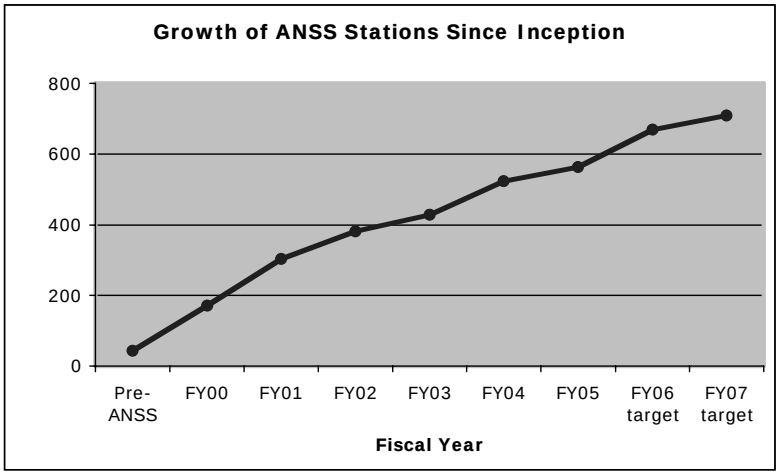
SAFOD Borehole Crosses San Andreas Fault — The San Andreas Fault Observatory at Depth (SAFOD) reached a significant goal on August 2, 2005 when scientists drilled into a seismically active section of the fault approximately two miles below the surface of the Earth. This is the first time that scientists have drilled directly into the San Andreas Fault Zone at a depth that will allow observation of earthquakes up-close for decades to come. When completed in 2007, SAFOD will be the only earthquake observatory with instruments installed directly within an active fault where earthquakes form or "nucleate." Launched in 2003, SAFOD is one of three major components of *EarthScope*, an NSF-funded initiative being carried out in collaboration with USGS. SAFOD instrumentation will provide around-the-clock observations of temperature, fluid pressure, strain accumulation and other processes before, during and after earthquakes. The observatory is expected to operate for 20 years and give researchers a unique window into the process of stress buildup and release on faults.

Urban Hazard Maps for the Memphis Urban Region — The USGS released a suite of urban hazard maps for the Memphis and Shelby County (TN) metropolitan area. Products include ground-shaking hazard maps, liquefaction susceptibility maps, six first-of-a-kind 1:24,000-scale geologic maps covering the central Memphis metropolitan area, and a new publicly available database of geotechnical and geophysical well-log information that is of use to local engineers and city planners. To maximize the use of these hazard assessment tools, USGS scientists gave talks, held numerous workshops, and created publications on a wide range of topics related to urban hazard mapping, for both technical and lay audiences.

Improvements in Global Tsunami Warning and Earthquake Response — As part of the President's tsunami warning initiative, the USGS made numerous improvements to its ANSS seismic data collection, analysis, processing, and notification procedures. These have increased the speed and accuracy of earthquake data for tsunami assessment, and of rapid earthquake information worldwide. Key accomplishments include the following: (1) *Response Hydra v1.0*, the component of the *Hydra* seismic event processing system that identifies, locates, and measures earthquakes for reporting purposes, was "code complete" in August 2005, and installed as a parallel earthquake processing system in the NEIC in October 2005. (2) The USGS has made significant progress in fortifying its computer support and IT security operations at the NEIC and maintained its IT security certification and accreditation for the ANSS. New contracts are providing IT security support, Web content hosting (to protect USGS servers and ensure information delivery during peak demand times) and for backup power systems. (3) Software development efforts included CAP-formatted earthquake information messages, support for the expansion of the *CISN Display* PC software to include access to NOAA tsunami warnings, and an expanded geographic information system (GIS) data set for that software. (4) Contractors were funded to support and enhance several existing earthquake information products used by emergency managers, lifeline operators, and state highway departments. These products (ShakeCast, CISN Display, and ShakeMap) allow rapid delivery of earthquake and shaking information critical to decisionmakers who must manage the event.

Scenario Earthquake Loss Models for Planning — To facilitate planning for catastrophic earthquakes in major urban areas in the United States, the USGS worked with local emergency planning and response officials to develop earthquake loss scenarios for Los Angeles, Memphis, the San Francisco Bay Area, and Seattle. Scenario earthquake losses were estimated using the HAZUS software tool developed by FEMA, and teams of practicing engineers, economists and emergency managers vetted the results. In the Seattle scenario, developed under the leadership of the Earthquake Engineering Research Institute and the Washington State Department of Emergency Management Division, a magnitude 6.7 earthquake on the Seattle fault was projected to induce $33 billion in direct economic loss, another $33 billion in indirect loss, and nearly 10,000 buildings destroyed. Scenario development helps identify key vulnerabilities and to prioritize among actions that can be taken to mitigate loss of life and property, damage to transportation infrastructure, and economic impacts.

New ANSS Station Installations — In FY 2005, ANSS pushed ahead with 40 new station installations and upgrades in all seven ANSS regions, bringing the total number of ANSS sensors installed to 563. Equipment was purchased to allow nearly 100 stations to be installed in FY 2006. The accompanying figure shows the growth of ANSS seismic stations since the system was established in FY 2000.



Performance Overview

The table below summarizes the performance measures that either relate exclusively to the EHP or are shared among the USGS programs in Earthquake Hazards, Volcano Hazards, Landslide Hazards, Global Seismographic Network, and Geomagnetism.

Measure	2005 Plan	2005 Actual	Change from 2005 Plan	2006 Enacted	2006 Change from 2005 Actual	2007 Request	2007 Change from 2006
Use Rate: Earthquakes: X% of communities using DOI science on hazard mitigation, preparedness and avoidance for each hazard management activity **(NK)** (baseline is 860 counties at risk- results feed combined end outcome measure))	63.4%	63.4%	0	63.9%	+0.5%	64.0%	+0.1%
Adequacy: X% of sampled stakeholders reporting adequacy of science base to inform decision-making for each hazard management activity (volcanoes, earthquakes) **(SP)**	≥80%	≥99%	NA	≥80%	NA	≥90%	0
# of systematic analyses & investigations delivered to customers (risk/hazard assessments)	3	4	+1	2	-2	3	+1
# of real-time ANSS earthquake sensors (reported yearly and cumulative at the end of the year **(PART)**	40 (cum. 563)	40 (cum. 563)	0	106 (cum. 669)	+106	40 (cum. 709)	+40
# of formal workshops or training provided to customers (instances/issues/events)	6	11	+5	7	-4	6	-1
# of urban areas for which detailed seismic hazard maps are completed **(PART)** (cumulative)	3	3	0	3	0	3	0
# of metropolitan regions where Shakemap is incorporated into emergency procedures **(PART)** (cumulative)	5	5	0	5	0	5	0
# of counties, or comparable jurisdictions, that have adopted improved building codes, land-use plans, emergency response plans, or other hazard mitigation measures based on USGS **earthquake** hazards information **(PART)**	565	565	0	569	+4	570	+1

This page intentionally left blank.

Activity: Geologic Hazards, Resources, and Processes

Subactivity: Geologic Hazard Assessments
Program Component: Volcano Hazards

Program	2005 Actual	2006 Enacted	2007 Fixed Cost & Related Changes [a/]	2007 Program Changes	2007 Budget Request	Change from 2006
Volcano Hazards Program	20,714	21,466	+206	0	21,672	+206
Total Requirements $000	**20,714**	**21,466**	**+206**	**0**	**21,672**	**+206**
FTE	***135***	***135***	***-4***	***0***	***131***	***-4***

[a/] Fixed cost increases for this activity total $294 of which $206 will be budgeted and $88 will be absorbed. FTE changes result from rebalance and renew skills mix to gain functional and position flexibilities identified through an extensive workforce planning effort (page H-2).

Program Overview

The 2007 budget request for the Volcano Hazards Program is $21,672,000 and 131 FTE. The USGS proposes no program changes for this program.

Under the Stafford Act (P.L. 93–288), the Department of the Interior has the responsibility to issue timely warnings of potential geologic disasters to the affected populace and civil authorities. Accordingly, the mission of the USGS Volcano Hazards Program (VHP) is to provide the earth science data and information, analyses, and research needed to reduce the loss of life, property, and economic impact of hazards related to volcanoes. The VHP addresses the Department's Serving Communities Strategic Goal of protecting lives, resources, and property by making information available to communities to use in developing volcano hazard mitigation, preparedness, and avoidance plans. As described in the OMB PART review, the VHP role is clearly defined and unique from other Federal, State, local, or private entities. The VHP 5-Year Plan has been reviewed, approved by the bureau, and will be released in FY 2006.

Within the last 10,000 years, 169 volcanic centers within the United States have erupted or exhibited sufficient hydrothermal activity or seismic unrest to indicate that they are capable of erupting in the future. To reduce societal exposure to the threats posed by these volcanoes, VHP conducts a range of on-going activities that may be broadly divided into volcano-hazard-assessment and volcano-monitoring components. Process-oriented research is conducted under both components to steadily improve accuracy of hazard assessments and accuracy of interpretations and forecasts of volcanic activity. Both components provide training and technical assistance to inform decisionmakers on managing risk from natural hazards.

Volcano hazard assessments are research efforts conducted to inform decisions on management of risk from natural hazards. Each assessment involves field work, laboratory analysis, and data analysis by research scientists, and typically requires 3 to 5 years to complete. The long-term goals are to provide hazard assessments for all dangerous volcanoes

and to establish response plans for all communities that they threaten. These goals are tracked by performance measures for (1) number of counties or comparable jurisdictions that have adopted emergency response plans, (2) percent of 70 volcanoes for which hazard assessments are published, (3) number of formal workshops or training provided to customers, and (4) number of systematic analyses and investigations (risk/hazard assessments) delivered to customers. Process-oriented research conducted in support of the hazard assessment includes studies on controls of explosive volcanism and dynamics of volcanic debris flows.

Use of Cost and Performance Information

Gathering ABC information at the task level is new for FY 2006. After tracking this information several years, VHP will be able to analyze trends in program funding, expenditures, and scientific emphases with links to Departmental goals and priorities. Broad breakdown of activities and costs linked to ABC codes are:

Estimated Funding ($ million)			
Activity	ABC Code	FY 2006	FY 2007
Volcano Monitoring	J7	12.0	12.0
Eruption Response	Z3	3.8	4.0
Hazard Assessment	N7	4.8	4.6
Training/Assistance	Z3	0.3	0.3
Program Planning	04	0.8	0.8

Monitoring volcanoes involves (1) collection, management, and distribution of data to inform decisionmakers on managing risk from natural hazards, and (2) technical assistance to decisionmakers on managing risk from natural hazards. Volcano monitoring is a continuing activity that includes detection of earthquakes and explosions, ground deformation, temperature change, and volcanic gas emissions. Sophisticated instruments are required, including arrays of sensitive seismometers, geodetic instruments and microphones, ground-based and airborne gas and thermal sensors, and satellite-based sensors. The long term goal is to monitor all U.S. volcanoes at levels commensurate with the threat each poses to lives, property, and enterprise. Fully deployed, such a monitoring network would constitute a National Volcano Early Warning System (NVEWS), which would acquire, process, interpret, and report data from all potentially hazardous U.S. volcanoes 24x7 in real time to optimize detection and characterization of early signs of unrest so that emergency officials and the public can effectively plan and implement mitigation strategies. Monitoring activities include maintenance of the existing network, expansion of the network to include previously unmonitored volcanoes, improvements in the monitoring of under-monitored volcanoes, and response to volcanic unrest and eruptions. The VHP monitoring network is maintained and operated by 5 volcano observatories (Alaska, Cascade, Hawaiian, Long Valley, and Yellowstone) and their partners, the Universities of Alaska, Washington, Utah, and Hawaii, and the Alaska Division of Geophysical and Geological Surveys. Collaboration with NOAA, the FAA, and the Air Force Weather Agency provides early warning and situational awareness of volcanic ash threats to jet aircraft. The Volcano Disaster Assistance Program, a partnership of the VHP and the USAID Office of Foreign Disaster Assistance, provides emergency response support and training to developing nations faced with volcanic hazards. The long term goal of the monitoring component is tracked by performance measures for (1) percent of 70 potentially active volcanoes monitored (2) number of volcanoes for which information supports public safety decisions and (3) number of sites (mobile or fixed) monitored for ground deformation to identify volcanic activity. Process-oriented research conducted in support of monitoring includes studies on the origin of long-period earthquakes and tremor associated with volcanic activity, on the contribution of hydrothermal fluids to ground deformation in calderas, on the causes and precursors of hydrothermal explosions at Yellowstone caldera, and on the dimensions and characteristics of the magmatic plumbing system of volcanoes.

Base funding for the VHP was increased $3,242,000 in FY 2006. FAA funds provided annually to the VHP for volcano monitoring in Alaska were reduced from $4,000,000 in FY 2005 to $3,000,000 in FY 2006. Approximately $700,000 was made available to the VHP in FY 2006 by

the USAID Office of Foreign Disaster Assistance in support of the Volcano Disaster Assistance Program.

The VHP has made steady annual progress on both monitoring and hazard-assessment efforts. Utilizing supplemental funds provided by the FAA, the volcano monitoring network has been expanded on average each year to include two previously unmonitored volcanoes. At the end of FY 2005, 51 volcanoes were monitored by the VHP. On average, one to two hazard assessments have been released to customers each year, and there has been steady progress on development of community response plans in the Cascades. The VHP estimates that 256 counties or comparable jurisdictions are threatened by volcano hazards. At the end of FY 2005, 170 had adopted or were served by emergency management organizations that had adopted response plans based on USGS volcano hazard assessments.

"I'm pleased to hear that the USGS Volcano Hazards Program is planning to install some seismic monitoring equipment on Pagan Volcano in the Northern Mariana Islands. During 2005, diligent USGS monitoring and interpretation of eruptive activity at the Anatahan Volcano in the Marianas proved instrumental to AFWA's mission of providing volcanic-ash advisories and situational awareness to DoD aviation. For example, your short-term forecasts of eruptive ash cloud height potential furnished us this past June were used by the USS Nimitz (CVN-68) Carrier Strike Group to help efficiently plan and complete a critical training exercise in the Marianas region. I look forward to continuing our close partnership in providing volcanic-hazard information in support of US Forces."

Charles R. Holliday
Chief, Satellite Applications Branch
Air Force Weather Agency
Januarv 2006

The VHP has been challenged by elevated volcanic activity for the last two years. The prolonged eruptions of Mount St. Helens (MSH) and Anatahan volcanoes were particularly draining on VHP resources, and impacted the ability of the program to meet its performance objectives in FY 2005. Significant new eruptions in FY 2006 or intensification of the eruption of MSH can be expected to result in redirection of VHP resources that will further impact program performance objectives.

FY 2007 Program Performance Estimates

Volcano-Monitoring Activities:

Eruption Response — The VHP will focus resources on eruption response as required in FY 2007. However, the level of this activity cannot be anticipated at this time and could change with little warning in the event of increased volcanic activity.

Networks Maintained — The VHP will endeavor to maintain one overall monitoring network functioning at the current level or better.

Volcanoes for which Information Supports Public Safety — The VHP will expand its monitoring capability to include Pagan volcano in the Marianas with the deployment of a satellite-telemetered monitoring network on the island. As a result, the VHP projects an increase in two performance measures. The number of volcanoes for which information supports public safety decisions will increase by 1, from cumulative 51 to 52. The percent of potentially volcanoes monitored (based on 70) will increase from 72.9 percent to 74.3 percent.

Improvement of Monitoring — The VHP will continue improvements initiated in FY 2006 to monitoring networks at Mt. Rainier, Mt. Hood, and Three Sisters in the Cascades, and at Augustine Volcano in Alaska. These improvements and the expansion of the monitoring

network to include Pagan volcano will be reflected in the performance measure tracking number of sites monitored for ground deformation.

Sites Monitored for Ground Deformation — The VHP plans to utilize at least 16 additional telemetered GPS and tiltmeter stations in FY 2007 for monitoring volcanoes. New stations to detect deformation will be added in the Marianas by the USGS, and will be added in the Cascades in collaboration with the *EarthScope* Program of NSF. It is anticipated that automation of the production of InSAR interferograms in FY 2006 will facilitate expanded use of InSAR in FY 2007.

Hazard-Assessment Activities:

Risk/Hazard Assessments Delivered to Customers — The VHP plans to deliver the hazard assessment of Pagan volcano in the Marianas and Yellowstone caldera in FY 2007. Based on a target of 70 volcanoes, this represents an increase of 2.8 percent to a total of 69.9 percent. In addition, progress will be made on the hazard assessments of Veniaminoff volcano in Alaska.

Formal Workshops or Training Provided to Customers — The VHP will provide at least four workshops or training sessions to customers in FY 2007.

Counties or Comparable Jurisdictions that have Adopted Improved Building Codes, Land-Use Plans, Emergency Response Plans, or Other Hazard Mitigation Measures — Based on completion of the Yellowstone hazard assessment in FY 2007, which will form the basis for a new response plan, the VHP plans to increase by 10 the number of counties or comparable jurisdictions that have adopted or would benefit directly from response plans for volcano hazards.

FY 2006 Planned Program Performance

Volcano-Monitoring Activities:

Eruption Response — The VHP will continue to concentrate CVO's resources on monitoring of the on-going eruption of MSH. Consequently, it is difficult to project with certainty the level of improvements that can be effected to monitoring networks for other Cascade volcanoes in FY 2006 and 2007. The VHP is now concentrating AVO's resources on monitoring the eruption of Augustine Volcano in the Cook Inlet. If the eruption of Augustine Volcano is prolonged or the eruption of MSH intensifies, redirection of VHP resources in response will significantly impact many other program activities.

Networks Maintained — The VHP will endeavor to maintain one overall monitoring network functioning at the current level or better. However, a $1 million reduction in funds from the FAA in FY 2006 for volcano monitoring in Alaska will be accommodated in part by slowing of the maintenance schedule for instruments in place in the western Aleutians.

Volcanoes for which Information Supports Public Safety — The VHP will not expand its monitoring capability to any currently unmonitored volcanoes. The revised FY 2006 plan is a reduction of 2 newly monitored volcanoes relative to previous plans for FY 2006. Suspension in expansion of the network in Alaska is planned to partially accommodate the $1 million reduction in funds provided by the FAA in FY 2006 for volcano monitoring in Alaska. A planned FY 2006 expansion of monitoring in the Marianas will be delayed until early FY 2007 by the necessity to

avoid field work during typhoon season; however, equipment will be acquired and shipped to Saipan in FY 2006.

Improvement of Monitoring — An increase of $3,242,000 in base funding in FY 2006 allows improved monitoring of volcanoes currently in eruption or showing signs of possible imminent volcanic activity in the Cascades and the Marianas. FY 2006 objectives are (1) rebuilding the network damaged by the eruption of Anatahan in FY 2005 and (2) initiation of improvement of monitoring networks at Mt. Rainier, Mt. Hood, and Three Sisters with installation of additional seismometers and GPS units. In addition, monitoring improvements were rapidly implemented at the end of 2005 at Augustine Volcano in Alaska unrest appeared to be moving steadily toward eruption.

Sites Monitored for Ground Deformation — The VHP plans to utilize 10 new telemetered GPS and tiltmeter stations in FY 2006, collaborating on installation with the University of Hawaii and with the *EarthScope* Program of NSF as opportunities arise. In addition, campaign-style GPS and high-precision leveling surveys will be performed in the Cascades and Yellowstone. An attempt will be made to automate production of InSAR interferograms, which are being using extensively to track volcano deformation on a time scale of months to years, but which currently require laborious manipulation by skilled scientists to produce. If successful, this will greatly expand the utility of InSAR as a monitoring tool.

Hazard-Assessment Activities:

Risk/Hazard Assessments Delivered to Customers — The VHP plans to deliver the volcano hazard assessments for Korovin, Tanaga and Pavlov volcanoes in Alaska in FY 2006. Based on a target of 70 volcanoes, this represents an increase of 1.4 percent to a total of 64.3 percent. In addition, progress will be made toward the completion of hazard assessments for Yellowstone caldera, Veniaminoff volcano in Alaska, and Pagan volcano in the Marianas.

Formal Workshops or Training Provided to Customers — The VHP will provide at least four workshops or training sessions to customers in FY 2006 on various volcano related topics. At least one of these workshops will be held with academic partners and Federal, State and Local emergency managers to develop implementation plans for the National Volcano Early Warning System (NVEWS).

Counties or Comparable Jurisdictions that have Adopted Improved Building Codes, Land-Use Plans, Emergency Response Plans or Other Hazard Mitigation Measures — The number of counties or comparable jurisdictions that have adopted or would benefit directly from response plans for volcano hazards will be increased by 20 in FY 2006 with completion the Central Cascades volcano response plan. In addition, VHP will complete two important inter-agency operational plans for volcanic-ash hazards to aviation: a National Plan, which is being developed through the Office of the Federal Coordinator of Meteorology, and a Marianas Plan.

FY 2005 Program Performance Accomplishments

The VHP met or exceeded all performance goals with one exception. The program failed to meet a target of 180 communities adopting volcano hazard emergency response plans as a result of the eruption of MSH in FY 2005, which dominated activities of staff at CVO, delaying completion of the Central Cascades volcano response plan. At the end of FY 2005, the number

of communities adopting or benefiting directly from volcano hazards response plans remained at 170 out of a possible 256.

The accomplishments listed below demonstrate the utility of USGS products that are counted under the output measures of: hazard network maintained, risk/hazard assessments completed, workshops or training provided to customers, number of sites monitored, and amount of information provided to the public to help mitigate risk.

Another Year of Elevated Volcanic Activity — FY 2005 was the second year in a row of elevated volcanic activity in the United States. During the year, the VHP responded to 12 months of continuous eruption at Kilauea in Hawaii and MSH in Washington, 9 months of continuous eruption at Anatahan volcano in CNMI, and sporadic eruptions of Mount Veniaminoff and Cleveland volcanoes in Alaska. Monitoring of Mount Spurr continued through FY 2005 in response to increased earthquake activity and continued melting of the summit glacier, and developments at Chiginagak volcano were carefully tracked as melting of the summit glacier produced a summit lake, which breached in July 2005, causing a 1-to 2-meter flood of acidic water that devastated a local sport fishery at Mother Goose Lake. Additionally, ground deformation and earthquake activity were carefully monitored at Mauna Loa volcano in Hawaii, and at Three Sisters volcanic center in Oregon.

Response to the 2004 Eruption of Mount St. Helens (MSH) — The CVO continued to closely monitor the eruption of MSH, immediately notifying the FAA, NOAA, and the Washington Emergency Management Directorate of events at the volcano that could pose a threat to aircraft or to people and property on the ground. The eruption has continued unabated since the first venting of steam and ash on October 1, 2004, and by December 2005, it had formed a new lava dome that was almost the size of the lava dome produced by more than 16 dome-building eruptions between 1980 and 1986. In response to the eruption, CVO collaborated with the University of Washington's Pacific Northwest Seismograph Network, the University of Oregon, the *EarthScope* Program of the NSF and NASA.

Eruption Response in the Commonwealth of the Northern Marianas (CNMI) — The third historical eruption of Anatahan volcano began on January 6, 2005 and continued until September 3, 2005, erupting more than one million cubic meters of ash. Clouds of volcanic ash and VOG (volcanic smog) blanketed large areas of the western Pacific. During the eruption, the USGS produced over 240 daily updates incorporating information from our monitoring partners, Air Force Weather Agency, Washington Volcanic Ash Advisory Center, and Guam meteorological watch, and the CNMI Emergency Management Office (EMO). Events were closely tracked because of the danger posed to jet aircraft and U.S. military operations in the western Pacific.

Expanded Volcano Monitoring and Progress on Hazard Assessments in Alaska — With supplementary funding of $4 million provided by the FAA, the AVO continued to expand its seismic monitoring network according to plan and on schedule. AVO expanded its network to include 2 previously unmonitored volcanoes with the addition of telemetered seismometers on Little Sitkin and Semisopochnoi volcanoes in the Aleutians.

Continuing Unrest at Mauna Loa Volcano — Close monitoring of Mauna Loa has continued since inflation was noted in the spring of 2002. The observed swelling of the volcano is consistent with addition of magma beneath the southern portion of Mauna Loa's summit caldera. With the collaboration of Stanford University, a "network inversion" filter was developed to rapidly estimate increases in this volume of magma based on continuous GPS

data. The data indicate that an injection of 30 million cubic meters of magma per year is responsible for the inflation. To improve monitoring of the deformation, HVO helped install 11 continuous GPS receivers on Mauna Loa in early 2005 funded by the National Science Foundation through the Pacific Geophysical Facility. HVO also added another tiltmeter on the northeast rift zone and installed another Web cam to bring real-time views of the summit caldera of Mauna Loa back to HVO. The camera was installed with a wireless hub in order to facilitate the installation of gas sensors in FY 2006.

Assessment of Relative Threat Posed by the Nation's 169 Geologically Active Volcanoes — The VHP published *An Assessment of Volcanic Threat and Monitoring Capabilities in the United States: Framework for a National Volcano Early Warning System (NVEWS) (http://pubs.usgs.gov/of/2005/1164/*). The study ranks 169 potentially active U.S. volcanoes in terms of threat to human lives, property, and aviation safety, and identifies volcanoes where monitoring networks are inadequate for the threats posed. In addition to the currently or recently erupting volcanoes, MSH, Kilauea, and Anatahan, and volcanoes exhibiting strong unrest (Mauna Loa and Mt. Spurr) highest priority targets for improved monitoring are:

- Thirteen very high-threat volcanoes with inadequate monitoring. Nine are in the Cascade Range of the Western United States, and four are in Alaskan including Augustine Volcano
- Nineteen volcanoes in Alaska and the Mariana Islands that pose high threat to aviation but have no real-time ground-based monitoring to detect precursory unrest or the onset of an eruption.

An additional 21 under-monitored volcanoes in Washington, Oregon, California, Hawaii, Alaska, the CNMI, and Wyoming comprise a second tier of NVEWS targets.

Progress on Inter-Agency Operational Plans — The VHP made significant progress on two important inter-agency operational plans for volcanic-ash hazards to aviation: (1) an overall plan at the National level and (2) a specific plan for the Marianas region of the Pacific. These plans will provide operational guidance by documenting the required procedures, and information products of the government agencies responsible for ensuring safety of flight operations when volcanic ash has been erupted into the atmosphere. For the National Plan, the VHP is working with FAA, NOAA, and the U.S. Air Force through the Office of the Federal Coordinator of Meteorology; timeline for completion of the plan is FY 2006. Development of the Marianas Plan was launched at a workshop convened by the USGS in Saipan on May 18–19, 2005, and involved the FAA, USGS, units of the National Weather Service, NOAA's Washington Volcanic Ash Advisory Center, the Air Force Weather Agency, and CNMI's EMO.

Performance Overview

Measure	2005 Plan	2005 Actual	Change from 2005 Plan	2006 Enacted	2006 Change from 2005 Actual	2007 Request	2007 Change from 2006
Use Rate: Volcanoes: X% of communities using DOI science on hazard mitigation, preparedness, and avoidance for each hazard management activity **(NK)**	70.3%	66.4%	-3.9%	74.2%	+7.8%	78.1%	+3.9%
Adequacy: X% of sampled stakeholders reporting adequacy of science base to inform decision-making for each hazard management activity **(SP)**	≥80%	99%	NA	≥80%	NA	≥90%	0
# of systematic analyses & investigations delivered to customers (risk/hazard assessments)	1	1	0	3	+2	2	-1
# of formal workshops or training provided to customers (instances/issues/events)	4	5	+1	4	-1	4	0
# of sites (mobile or fixed) monitored for ground deformation to identify volcanic activity	86	88	+2	98	+10	114	+16
# of volcanoes for which information supports public safety decisions **(PART)**	+2 (cum 51)	+2 (cum 51)	0	0 (cum 51)	0	+1 (cum 52)	+1
X% of potentially active volcanoes monitored (x number of 70) **(PART)**	72%	72.9%	+0.9%	72.9%	0	74.3%	+1.4%
X% of potentially hazardous volcanoes with published hazard assessments **(PART)**	62.8%	62.8%	0	64.3%	+1.428%	65.7%	+1.428%
# of counties, or comparable jurisdictions, that have adopted improved building codes, land-use plans, emergency response plans, or other hazard mitigation measures based on USGS volcano hazards information **(PART)**	180	170	-10	190	+20	200	+10

Activity: Geologic Hazards, Resources, and Processes

Subactivity: Geologic Hazard Assessments
Program Component: Landslide Hazards

Program	2005 Actual	2006 Enacted	2007 Fixed Cost & Related Changes [a/]	2007 Program Changes	2007 Budget Request	Change from 2006
Landslide Hazards Program	3,043	3,042	+42	200	3,284	+242
Total Requirements $000	**3,043**	**3,042**	**+42**	**200**	**3,284**	**+242**
FTE	***20***	***20***	***-1***	***+1***	***20***	***0***

[a/] Fixed cost increases for this activity total $62 of which $42 will be budgeted and $20 will be absorbed. FTE changes result from rebalance and renew skills mix to gain functional and position flexibilities identified through an extensive workforce planning effort (page H-2).

Summary of FY 2007 Program Changes for Landslide Hazards Program

Request Component	Amount	FTE
Program Changes		
• Multi-Hazards Initiative	+200	+1
TOTAL	**+200**	**+1**

Justification of FY 2007 Program Changes

The 2007 budget request for the Landslide Hazards Program is $3,284,000 and 20 FTE, which is a program change of +$200,000 and +1 FTE.

- **Integrated Multi-Hazards Demonstration Project (+$200,000 and 1 FTE) —** The Integrated Multi-Hazards Demonstration Project in Southern California, part of a multi-year initiative, will focus on integrating information and products about multiple hazards to improve the usefulness of this information in reducing loss of life and property from natural hazards, which supports the end outcome goal of "Protect lives, resources, and property" under the mission goal of Serving Communities. The development of integrated databases and the enhancement of IT systems to track multiple hazards will facilitate more rapid communication and response to the user community, regardless of the timeframe of a natural disaster.

The LHP role in the Multi-Hazards Demonstration Project will be to implement a system for issuing watches and warnings of flash floods and debris flows in previously burned areas in Southern California in a joint effort with the NOAA. This information will be entered into interactive GIS databases with other hazards information to provide immediate and comprehensive response to decisionmakers and the public. The requested funds of $200,000

will be enhanced by $100,000 redirected from lower priority work. The increased funding to LHP will enhance several important performance measures already in place. Training and technical assistance will be given to National Weather Service meteorologists in Southern California, so they may understand how to incorporate debris flow advisories into flash flood warnings. Additional landslide hazard assessments for newly burned areas will be carried out, and the rain gauge network required for the successful implementation of the debris flow warning system in Southern California will become more robust.

The LHP role in the Multi-Hazards Demonstration Project will be to implement a system for issuing watches and warnings of flash floods and debris flows in previously burned areas in Southern California in a joint effort with NOAA. The NOAA/USGS Debris-Flow Warning System was initiated as a pilot project in FY 2006 through a Memorandum of Agreement.

Program Performance Change — Though the program contributed to the strategic goals of advancing knowledge through scientific leadership and inform decisions through the applications of science, there are no performance measures specifically linked to this program change.

Program Overview

The LHP gathers information, conducts research, responds to landslide disasters, and produces scientific reports and other products that can be used by a broadly based user community, including Federal, State, and local governments and the private sector. LHP investigations focus on research to better understand, assess, and monitor the causes and mechanisms of ground failure. Its main goal is to reduce losses from landslides through improved understanding of landslide hazards and application of new strategies for hazard mitigation.

As described in the OMB PART review, the Geologic Hazard Assessments Subactivity role is clearly defined and unique from other Federal, State, local, or private entities. The LHP was reviewed in FY 2003 as part of the Geologic Hazard Assessments Program for the FY 2005 Budget using the PART, was found to be "moderately effective."

This program supports the Department's Serving Communities strategic goal to protect lives, resources, and property by making information available to communities to use in developing landslide hazard mitigation, preparedness, and avoidance plans. Three intermediate outcome measures in support of the intermediate outcome of providing information to assist communities in managing risks from natural hazards—the use rate of products, response to inquires, and adequacy of information—are tracked. Output measures for which targets are established in support of achieving the intermediate outcome goal include the delivery of risk assessments to customers and the presentation of formal workshops or training to customers.

Use of Cost and Performance Information

Gathering ABC information at the task level is new in the Landslide Hazards Program for FY 2006. After several years of tracking this valuable detailed information, LHP will be better placed to track and analyze important trends in program funding and expenditures, as well as scientific emphases within each program and links to Departmental goals and priorities.

Landslide-hazard assessments provide the scientific basis for land-use, emergency management, and loss reduction measures. For example, studies of landslide susceptibility and hazards are providing much needed information to reduce landslide losses in parts of the country that have significant landslide problems including, but not limited to: California, the

Pacific Northwest, and the Blue Ridge of the Eastern United States. The USGS cooperates with local partners and the FEMA in Seattle, Washington and Southern California.

Landslide hazard 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 into processes and forecasting methodologies is conducted on the types of landslides that produce 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 sites along coastal bluffs between Everett and Seattle, WA. This work is in cooperation with the Washington Department of Transportation, the Burlington Northern Santa Fe Railway, its private geotechnical consultant, and a private telecommunications company. These experimental sites will provide continuous rainfall, soil-moisture, and pore-pressure data needed to correctly understand the mechanisms of landslide occurrence on the bluffs. 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 will be useful in reducing hazards in landslide-prone areas of transportation corridors.

USGS scientists respond to landslide emergencies and disasters nationwide. Federal, State, and local agencies are assisted through landslide site evaluations and recommendations of strategies for reducing on-going and future damages from landslides. When there is sufficient information or knowledge of a particular area, such as in Southern California, LHP provides information on potential hazards. Specifically, if rainfall intensity-duration thresholds for landslide activity have been developed for an area or if landslide-hazard maps have been produced, LHP can issue an advisory. LHP works in conjunction with the NWS to issue advisories and press releases regarding the potential for landslide activity. These advisories are provided relatively infrequently.

For foreign disasters, the USGS works with the Agency for International Development's Office of Foreign Disaster Assistance (USAID/OFDA) in responding to appeals for technical assistance from affected countries.

The USGS provides timely information through the National Landslide Information Center (NLIC). The Center communicates with the public and media about on-going emergency responses and provides information to the external user-community through fact sheets, books, reports, and press releases, consistent with the Department's Serving Communities strategic goal to protect lives, resources, and property by providing information to assist communities in managing risks from natural hazards. The NLIC maintains several databases: the Landslide Bibliography (more than 15,000 entries), the International Landslide Experts Roster of about 2,000 entries, and Major Landslide Events of the United States (part of the USGS National Atlas). The NLIC also has real-time measurements from on-going landslide monitoring projects available for viewing via the Internet. These measurements are used to forecast landslide movement or changes in an individual landslide's behavior.

Monitoring can detect early indications of rapid catastrophic movement. Up-to-the-minute or real-time monitoring provides immediate notification of landslide activity, potentially saving lives and property. Continuous information from real-time monitoring also provides a better understanding of landslide behavior for scientists, engineers, and public officials. The USGS conducts these efforts in cooperation with other Federal, State, and local agencies, including BLM; NPS; Federal Highway Administration; California, Washington, Oregon, and Colorado

State Departments of Transportation; Colorado Geological Survey; Colorado School of Mines; Oregon Department of Geology and Mineral Industries, and private companies.

FY 2007 Program Performance Estimates

Landslide-Hazard Assessment Activities:

Risk/Hazard Assessments Delivered to Customers — The LHP plans to deliver a hazard/risk assessment for Punta Gorda region, Ventura County, California and a LiDAR landslide Map for Kitsap County, Washington in FY 2007.

Formal Workshops of Training Provided to Customers — The LHP will provide at least 1 workshop to communities in Ventura County, California or Kitsap County, Washington in FY 2007.

Counties or Comparable Jurisdictions that have Adopted Improved Land-Use Plans, Emergency Response Plans or Other Hazard Mitigations Measures — Four local government agencies in Washington, Oregon, and Southern California, a National Park, BLM district or other public lands jursidiction will incorporate LHP produced information into their plans, ordinances and other hazard mitigation measures in FY 2007.

Landslide Monitoring Activities:

Areas for which Models Exist that are Used to Interpret Monitoring Data — LHP will continue to develop rainfall thresholds for Western Oregon in FY 2007.

Landslide Hazards Emergency Response — LHP will continue to respond to landslide emergencies in the United States and internationally and monitor these landslides where necessary. Landslide emergencies will continue to be posted through the Department's Common Alert Protocol to reach the largest audience.

Landslide Information Dissemination Activities:

National Landslide Information Center — LHP will continue to respond to inquiries from the public, educators, and public officials on hazard mitigation, preparedness and avoidance strategies for landslide hazards**.**

Publications for Users of Hazard Information — LHP will continue to educate land-use planners and planning officials using the USGS/American Planning report, "Landslide Hazards and Planning." The USGS will also publish a handbook for non-scientists on landslide hazards through the auspices of the International Landslide Consortium.

FY 2007 Plan Compared to FY 2006 Plan

For End Outcome Goal 4.1 — Serving Communities: Protect Lives, Resources, and Property:

In cooperation with NOAA, the USGS has developed and is operating a prototype flash flood and debris-flow warning system for wildfire burned areas in Southern California. In FY 2007, the USGS will progress from the FY 2005–06 prototype or "pilot" warning system to full implementation of the warning system for burned areas in this geographic area. In addition, the

information collected in order to implement the warning system will be folded into the integrated risk hazard assessment developed by the hazard initiative.

FY 2006 Planned Program Performance

The accomplishments and outcomes listed below demonstrate the utility of USGS products that are counted under the output measures established for this program element.

New Program Efforts — LHP supports a number of important projects that assist in the implementation of the National Landslide Hazard Mitigation Strategy. In 2006, the LHP initiated a new Memorandum of Agreement (MOA) with the NOAA/NWS to implement a debris flow warning system pilot in parts of Southern California that have experienced wildfires. If successful, this pilot will eventually be expanded to other high priority areas across the Nation, as the budget allows. The LHP is also supporting a cooperative project with the Oregon Department of Geology and Mineral Industries and the Oregon Department of Transportation that will lead to the understanding of landslide susceptibility in Western Oregon and the reduction of losses from landslides which have historically been very high. LHP has become part of a governmentwide Common Alert Protocol (CAP) that will provide immediate information to Federal and State emergency managers and responders.

Risk/Hazard Assessments Delivered to Customers — At the request of the EPA and in cooperation with Colorado State University, LHP scientists will perform an assessment of debris-flow hazards in 2006 in the event of a large-scale moderate to severe wildfire in the Colorado Rocky Mountains. The assessment will identify the probability of debris flow as a function of burned area, basin morphology, and material properties. The model will employ a design storm event. The assessment will be used by EPA and others to identify potential environmental impacts of post-fire debris-flow activity on municipal water supplies.

Workshops or Training Sessions — A workshop and training session for local planners and emergency managers in Seattle will be held in 2006 at the conclusion of the major part of the research that has been conducted by LHP in the Puget Sound region. The workshop will concentrate on how best to use the new landslide hazard maps and other products developed during the project by LHP scientists to reduce loses from landslides in the region.

LHP scientists and managers will participate in an Oregon Department of Geology and Mineral Industries (DOGAMI) sponsored workshop on landslide hazards which will highlight the cooperative work being pursued by both DOGAMI and USGS.

Responses to Public Inquiries — The NLIC expects to respond to all 1,600 inquiries received from the public, educators, and public officials regarding hazard mitigation, preparedness, and avoidance strategies for landslide hazards.

Locations Using Geophysical Models — LHP will continue to maintain the rain-gage network established in areas burned by the fall of 2003 wildfires in Southern California. Additional networks will be established as new fires occur in the region. This monitoring and the accompanying research to understand the physical processes that control post-fire runoff and erosions events will eventually lead to a model that can be used to identify and quantify potential hazards posed by debris flows generated from burned watersheds.

FY 2005 Program Performance Accomplishments

The accomplishments listed below demonstrate the utility of USGS products that are counted under the output measures of hazard network maintained, risk/hazard assessments completed, hazards mitigation measures adopted, and workshops or training provided to customers.

> "This is an example of sound intergovernmental collaboration that will save lives."
> Vice Admiral Conrad C. Lautenbacher, Jr., U.S. Navy (Ret.)
> Undersecretary of Commerce for Oceans and Atmosphere and NOAA Administrator
> October 2005

NOAA/USGS Warning System for Post Wildfire Flash Floods and Debris Flows from Recently Burned Basins in Southern California — Fires in 2005 throughout the western United States have impacted hundreds of thousands of acres of public land and made it susceptible to increased runoff and debris-flow activity. Science-based information on post wildfire debris-flow hazards is critically needed by Federal, State, and local agencies to issue warnings and to mitigate the impacts of post-fire hazards on people, their property, and natural resources. In order to reduce these impacts, NOAA/USGS designed a prototype flash flood and debris flow warning system for recently burned basins in Southern California by linking the existing NWS Flash Flood Monitoring and Prediction system with rainfall intensity-duration thresholds for burned areas developed by the USGS. Such a system was implemented in the October 2005, and is being used to issue Outlooks, Watches, and Warnings that are disseminated to emergency-management personnel and the public. The operational plan for this system, as well as an evaluation of the resources and scientific advancements necessary to expand the system to other areas are included in USGS Circular 1283, entitled *NOAA-USGS Debris-Flow Warning system—Final Report.*

Development of the prototype warning system is part of the Post-wildfire Debris Flow Hazards Project supported by the LHP and the National Cooperative Geologic Mapping Program. Personnel from the California Water Science Center and Cascades Volcano Observatory also contributed to the development and implementation of the system.

Guidebook for Land-Use Planners — A major accomplishment of the LHP in partnership with the American Planning Association (APA) is the completion of a practical guidebook on how to incorporate landslide hazards into the land-use planning process. The guidebook entitled *Landslide Hazards and Planning*, discusses the physical characteristics of landslides, planning and zoning tools that can be utilized to reduce potential damage, and numerous case studies of communities that have experienced and recovered from landslides. The report has been made available to the 38,000 members of APA and others through its Planning Advisory Service. Land-use planners have a pivotal role in reducing landslide hazards because they influence how land is used and developed, how buildings and other structures are sited, and where communities build their roads, parks, schools, and other public amenities. The destructiveness of landslides was experienced in Southern California during the 2005 winter after numerous storms pounded the area.

Risk/Hazard Assessments Delivered to Customers — The LHP completed many of its products for Puget Sound area in 2005. The maps and reports include a LiDAR based landslide map of Seattle, a landslide hazard map for Seattle, results of hydrologic monitoring of unstable coastal bluffs near Edmonds and Everett, Washington, a landslide early warning system for these bluffs, evaluation of rainfall thresholds and estimated probabilities of landslides when the thresholds are exceeded, and protocols for issuing landslide warnings based on LHP-developed rainfall thresholds. These products have been shared with the City of Seattle in a formal

ceremony with the Mayor of Seattle and other communities in the Puget Sound area through training and personal contacts.

Severe storms pounded most of Southern California in January and February 2005, triggering thousands of landslides over an extensive area. In response to this widespread activity, the LHP conducted rapid assessments:

- A site-specific assessment of landslide hazards at La Conchita, where sliding killed 10 people. This report is being used by local officials in Ventura County,
- A preliminary aerial reconnaissance overview of the extent of landsliding, conducted in part with the California Geological Survey. These observations are available at: *http://pubs.usgs.gov/of/2005/1067* and *http://landslides.usgs.gov/recent/socal_reconn/index.php*.

"They have assisted us with addressing one of the more complex and controversial issues we face in providing assistance to the affected communities. FEMA greatly appreciates their efforts."

John Christensen, FEMA
May 10, 2005

Response to Severe Rain Storms in Southern California — The USGS provided general advisories of potential landslide activity for Southern California early January 2005 following intense rainfall. The Director of the USGS has been delegated the responsibility to issue warnings for an earthquake, volcanic eruption, landslide, or other geologic catastrophe (1974 Disaster Relief Act 41 U.S.C. 5201 et seq.). The LHP mounted a major response to the severe rainstorms in Southern California that caused fatalities and extensive damage from landslides during the winter of 2005. Scientists from LHP issued landslide hazard advisories to State agencies in California and Federal agencies such as the NWS, Department land management bureaus, and the Department of Homeland Security, as well as issuing notification to the public through the NWS all-hazard radio and news releases. The NLIC in Golden, Colorado, operated around the clock to answer public officials, the public, and media inquiries. LHP also conducted ground and air reconnaissance of the locations that experienced major landslides and served as technical advisor at FEMA's California, Disaster Field Office for 2 months.

Landslide Monitoring — The Landslide Hazard Program provided technology transfer to other agencies, such as assistance to: (1) BLM in constructing a remote monitoring system for the Bluegill landslide in Idaho, (2) Florida Water Conservancy District, La Plata County, the City of Durango, and the BLM for monitoring of a landslide complex directly downstream from Lemon Reservoir, southwest Colorado, (3) California Department of Transportation for monitoring of U.S. Highway 50 landslides, (4) Burlington Northern Santa Fe Railway and Washington DOT for potential landslides impacting the rail system, and (5) two networks consisting of 20 rain gages each in the Grand Prix/Old and Piru Fires of 2003 in Southern California.

Workshops or Training Sessions — USGS landslide specialists taught two, one-week courses in Honolulu, Hawaii to more than 50 participants from the State, private consultants, University of Hawaii faculty, and private land holders such as Kamehameha Schools. The State of Hawaii is applying methods taught to their public officials in the course, entitled *Rock-fall Susceptibility and Hazard Assessment*, to identify areas where rock-fall mitigation is needed on State-held lands.

Responses to Public Inquiries — The NLIC and project scientists responded to 5,200 inquiries received from the public, educators, and officials regarding hazard mitigation,

preparedness, and avoidance strategies for landslide hazards. The number of inquiries during 2005 was exceptionally large as a result of the exceptional number of natural disasters, including widespread winter flooding in Southern California, Southeastern Utah, and other parts of the United States.

Performance Overview

Measure	2005 Plan	2005 Actual	Change from 2005 Plan	2006 Enacted	2006 Change from 2005 Actual	2007 Request	2007 Change from 2006
Use Rate: Landslides X% of communities using DOI science on hazard mitigation, preparedness and avoidance for each hazard management activity **(SP)**	3.9%	3.9%	0	4.4%	+0.5%	4.9%	+0.5%
Use Rate: Landslide Hazards: # of responses to inquiries from the public, educators, and public officials to the National Landslide Information Center on hazard mitigation, preparedness and avoidance strategies for landslide hazards **(BUR)**	1,600	5,200	+3,600	1,600	-3,600	1,600	0
# of systematic analyses & investigations delivered to customers (risk/hazard assessments)	1	1	0	1	0	1	0
# of formal workshops or training provided to customers (instances/issues/events)	1	3	+2	1	-2	1	0
# of areas or locations for which models exist that are used to interpret monitoring data **(PART)**	4 1/3	4 1/3	0	4 2/3	+1/3	5	+1/3
# of counties, or comparable jurisdictions, that have adopted improved building codes, land-use plans, emergency response plans, or other hazard mitigation measures based on USGS landslide hazards information **(PART)** (Baseline is 1,800 counties and parks with moderate to high landslide susceptibility in the U.S. (FY99-FY03, 60 adopted measure)	71	71	0	80	+9	89	+9

Activity: Geologic Hazards, Resources, and Processes

Subactivity: Geologic Hazard Assessments
Program Component: Global Seismographic Network

Program	2005 Actual	2006 Enacted	2007 Fixed Cost & Related Changes [a/]	2007 Program Changes	2007 Budget Request	Change from 2006
Global Seismographic Network Program	7,469	3,914	+35	0	3,949	+35
Total Requirements $000	**7,469**	**3,914**	**+35**	**0**	**3,949**	**+35**
FTE	***5***	***5***	***0***	***0***	***5***	***0***

[a/] Fixed cost increases for this activity total $50 of which $35 will be budgeted and $15 will be absorbed.

Program Overview

The 2007 budget request for the Global Seismographic Network Program is $3,949,000 and 5 FTE. The USGS proposes no program changes for this program.

The Global Seismographic Network (GSN) Program is a global monitoring network providing high-quality seismic data to support earthquake disaster management, hazards assessments, national security (through nuclear test treaty monitoring), 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 the NSF, implemented by 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.

Initiated in 1986, the GSN currently consists of 138 stations, installed over two decades by USGS and IGPP. Funds for the purchase and installation of new sites are provided by NSF to IRIS. The USGS is responsible for maintenance and operation, data collection, and quality control of two-thirds of the GSN stations, and IRIS supports the University of California to operate and maintain the other one third. Maintenance is accomplished in cooperation with many international partners who, in most cases, provide facilities to shelter the instruments and personnel to oversee the security and operation of each station. USGS tasks include training station operators; troubleshooting problems; providing major repairs; conducting routine service visits to network stations; providing direct financial aid in support of station operations at those sites lacking a host organization, and ensuring data quality and completeness.

As part of GSN activities, the USGS and IRIS also evaluate, develop, and advance 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 signals of interest may be detected. The planned lifetime of the completed network is 30 years. However, with proper maintenance and upgrades of data system platform, the GSN can produce data indefinitely, with expanded capabilities.

Under a Memorandum of Understanding between the USGS and NSF, the GSN Program is overseen by a "Standing Committee" consisting of external stakeholders and one USGS representative. The GSN Standing Committee typically meets twice a year.

As described in OMB PART review, the USGS role is clearly defined and unique from other Federal, State, local, or private entities. The GSN Program was reviewed in FY 2003 as part of the Geologic Hazard Programs for the FY 2005 Budget using the PART. It was found to be "moderately effective." GSN-specific performance measures were established as part of that process.

Data and products derived from this program have multiple and diverse uses. First, the program supports the Department's Serving Communities strategic goal, to protect lives, resources, and property by making information available to communities for use in developing hazard mitigation, preparedness, and avoidance plans. The information provided to end users supports the intermediate outcome goal of providing information to assist communities in managing risks from natural hazards.

Use of Cost and Performance Information

Work continues with partners to share communications costs, including NOAA, NSF, the U.S. Air Force and Comprehensive Test Ban Treaty Organization (CTBTO). In some cases, the GSN has worked with local organizations to capitalize the communications while the host institution has agreed to pay the on-going costs (e.g., KEV).

In order to reduce travel costs, installation and (or) maintenance visits are conducted in regional "campaigns". For example, trips to a station in Greenland and two stations in Norway were combined into a single trip.

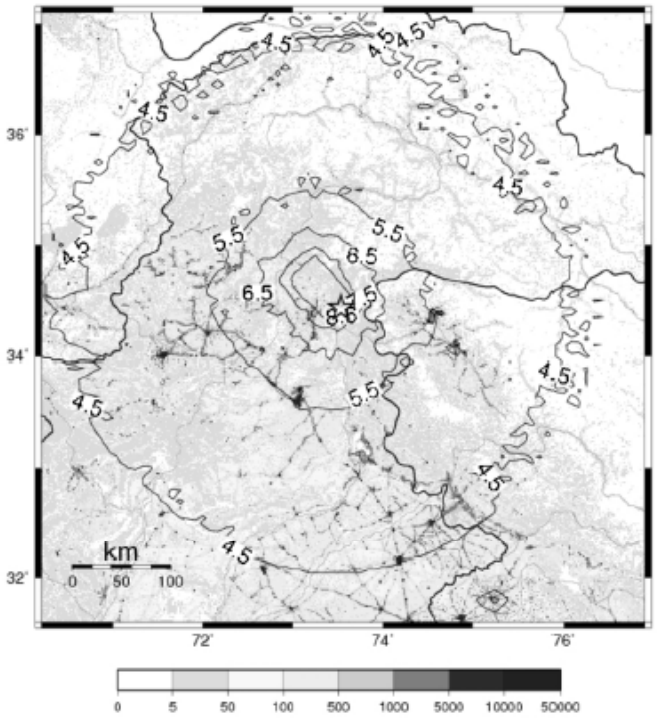
For example, GSN stations provide near-real-time data to NOAA's Tsunami Warning Centers, supporting tsunami monitoring in the Pacific Rim and disaster alerting in Alaska, Hawaii, Washing-ton, Oregon, California, and U.S. territories in the Pacific. Automated alerts, generated from GSN stations in the region of the December 26, 2004, great earthquake off northern Sumatra, were transmitted by the Pacific Tsunami Warning Center within minutes of the quake. For the Pacific Ocean basin, NOAA relies on GSN real-time data to trigger analysis of the ocean-bottom sensors that detect tsunami waves.

Principal end-users of GSN data include the USGS NEIC in Golden, CO, and a broad range of government agencies and academic researchers both domestic and international. These include the Comprehensive Test Ban Treaty Organization (CTBTO) and the Air Force Technical Applications Center (AFTAC), in their respective nuclear monitoring missions, as well as the NOAA Tsunami Warning Centers in Hawaii and Alaska. Copies of all the data from USGS GSN stations are sent to the IRIS Data Management Center (DMC) in Seattle, WA. The DMC is the distribution point for GSN data to users (such as scientists, engineers, and government agencies) worldwide, responding to over ten thousand requests for GSN data annually. In addition, data from most GSN stations are currently available within hours of large earthquakes to the worldwide user community via the USGS Live Internet Seismic Server (LISS).

GSN real-time data are transmitted continuously to the NEIC where they are used, with other data, to determine the locations, depths, magnitudes, and other parameters of earthquakes worldwide. The high quality of GSN data allows them to be used for the rapid determination of the geometric orientation of the fault that caused the earthquake, and provide an estimate of the length of the fault that ruptured during the earthquake.

The rapid availability of earthquake information is critical for first responders and government officials responsible for assessing an earthquake disaster. In the case of significant domestic earthquakes, the USGS and partners provide information to Federal and State emergency management and public safety agencies, operators of transportation facilities, public utilities, and national news media. In the case of potentially damaging events outside of the United States, information from the NEIC is immediately sent to the Department of State, embassies and consulates in the affected region, the Office of Foreign Disaster Assistance, the Red Cross, and the United Nations, as well as national and international news media.

PAGER for Pakistan Quake of Oct. 8, 2005



A new USGS product that relies on GSN data is the Prompt Assessment of Global Earthquakes for Response (PAGER) system. PAGER rapidly estimates the impact on humans from significant earthquakes worldwide by combining maps of shaking intensity with population density and infrastructure fragility. The above figure displays an example of PAGER map output for the October 8, 2005 Pakistan earthquake. The contours on this map show which areas suffered the most intense shaking on top of a global population map. PAGER indicates that 525,000 people were exposed to "violent" shaking during the earthquake. The PAGER results were generated within hours of the event and transmitted to the State Department's Office of Foreign Disaster Assistance (OFDA) and other Government agencies. PAGER relies on real-time data from the Global Seismographic Network.

Data from the GSN are used extensively in basic and applied research on earthquakes, Earth structure, and other geophysical problems. GSN data are also used in studies conducted and supported by USGS and other agencies like NSF, DOE, and the U.S. Air Force. Some of this research and data support national security through the seismic monitoring of nuclear explosions and the improved calibration of nuclear explosion monitoring networks.

Given the high rate of significant earthquakes around the world, the GSN is an important tool in earthquake-related education and outreach. The USGS has worked with IRIS to develop educational museum displays based on data from the GSN. These displays explain the basic concepts of seismology and earthquake occurrence and have proven to be quite popular with the public. Displays are in place at the Smithsonian Institution in Washington, D.C., the American Museum of Natural History in New York, the Carnegie Museum in Pittsburgh, USGS Headquarters, the New Mexico Museum of Natural History in Albuquerque, and the Franklin Institute's traveling "Powers of Nature" exhibit.

FY 2007 Program Performance Estimates

In FY 2007, following the expected completion of the telemetry upgrade, the installation of the 9-station Caribbean GSN affiliate network and the 4 GSN stations, and the upgrades/installations in the United States that contribute to the ANSS Backbone network, the program will focus almost entirely on network operations. Most resources will be devoted to the

operation and maintenance of stations to meet performance targets, and the quality control of GSN data.

During 2007, the GSN is expected to begin the initial deployment of the new data acquisition systems, replacing hardware which, in some cases, are 20 years old. The new systems will improve the reliability of the network, eliminating several of the weaknesses in the older systems, i.e., magnetic tapes, spinning disks, and high power consumption. As part of efforts to enhance the GSN, the USGS will also focus its efforts in instrumentation (both extending the lifespan of the current sensors as well as exploring the options for new sensors) and in efforts to expand the range of geophysical sensors deployed at GSN sites.

Three factors will lead to an expected decrease in the performance of the network in FY 2007: (1) Expected increases in fixed costs (mostly due to a federally negotiated increase in the main GSN support contracts), will likely decrease contractor support that will, in turn, result in less frequent visits to stations for scheduled and unscheduled maintenance. This will result in an expected lower performance on the metric for data availability. (2) It is expected that aging equipment will degrade station performance at some sites. Because of the increased fixed costs noted above, funds are not available to increase stocks of replacements sensors and other critical parts. (3) Anticipated lower data availability will result in lower cost efficiency. This is reflected in an increase in the performance metric for the cost per volume of input data from GSN sensors.

With the installation of GSN station at Tarawa and Kanton, Kiribati; Tenerife, Canary Islands; and Baja California, Mexico in FY 2006, the USGS will largely have completed its component of the GSN. Focus will turn in FY 2007 toward the challenges of operating and maintaining this modern digital network. Many GSN sites, such as this one in Raoul, are remote, making it a challenge to maintain reliable operations.

Program managers are seeking ways of reducing dependence on contract-supported station maintenance, but there are no significant changes expected in this budget year.

The percent of data availability for real-time data from the GSN reflects a decrease of 3 percent in 2007 due to aging equipment for which recapitalization funds are not provided and a decreased frequency of station maintenance visits.

GSN data processing and notification costs per unit volume of input data from sensors in monitoring networks (in costs per gigabyte) reflects an decrease of 0.09 in 2007 due to an increase in the number of stations contributing to the network, including the final stations installed in the new Caribbean network.

The number of earthquake monitoring GSN stations that have telemetry (to increase reporting speed from 1 hour to 20 minutes) reflects an increase of 4 percent in 2007, reflecting the inclusion of new, real-time stations to be installed in the Caribbean Network. The estimated decrease in data availability reflects the balance between new stations contributing data to the

system and old stations cannot be maintained for high uptime because of increased contract costs and aging equipment.

FY 2006 Planned Program Performance

Completion of USGS Station Installations — Siting, permitting, and installation of four GSN stations will continue through FY 2006 because of extended negotiations with host countries.

New Caribbean Station Installation — Nine new, GSN-affiliate stations will be installed in the Caribbean region, in the following countries: Antigua (or Barbuda), Barbados, Cuba, Dominican Republic, Jamaica, Honduras, Panama, Trinidad, Turks and Caicos and Grenada. This element is on-track for completion by end of September, 2006. Seismic station equipment purchased in 2005 has been delivered and equipment configuration and system integration is in process, while station operator training is planned for July. Once agreements are in place, USGS will send field engineers to the various countries to begin site preparation and vault construction. This work is independent of instrument configuration and station operator training, and can begin as soon as a site is identified and permits are in place.

Following initial efforts in the fourth quarter of 2005 to prepare implementation plans and fact sheets, and to inform U.S. State Department and various embassies on USGS plans, USGS seismologists traveled in the first quarter of FY 2006 to Antigua, Barbados, and Grenada, to identify future station sites and meet with host country officials to expedite permitting. All three Nations have agreed to move aggressively in signing agreements (delegated to USGS by the State Department). Visits were made to Turks and Caicos, Jamaica, and Dominican Republic for similar activities.

GSN Telemetry Upgrade — The USGS will expand and improve telemetry links to GSN stations in FY 2006. The long-term goal is to establish real-time links at a minimum of 95 percent of GSN stations. The President's tsunami action plan calls for upgrades to 39 GSN stations. Ten of these stations currently have no telemetry connection; the remainder have telemetry but it is not sufficient to provide reliable continuous waveform data. USGS is contracting with the University of California San Diego (UCSD) to upgrade the Institute for Geophysics and Planetary Physics (IGPP) stations that are regularly operated and maintained by UCSD. The USGS is working with NOAA and CTBTO to establish communications or add bandwidth to improve telemetry at several USGS-operated stations. Only a handful of GSN stations will require visits by USGS field engineers to upgrade. This element is on track for completion by end of September 2006.

As part of the modernization of the GSN, the USGS and IGPP will be involved in the testing and final selection of a new generation of data acquisition systems. This effort is underway; initial procurement of these new systems is expected in Spring of 2006.

FY 2005 Program Performance Accomplishments

The accomplishments summarized below pertain to USGS products that are counted under the performance measures of "hazard network maintained" and "% data availability for real-time data," and the output efficiency measure of "data processing and notification costs per unit volume of input data from earthquake sensors in monitoring networks."

The December 2004, Sumatra-Andaman earthquake was the largest event since the 1964 Good Friday Alaskan earthquake and the largest event since the advent of digital seismology. As a result, this catastrophic event provided the first major test of the design of the GSN and highlighted the critical contribution of GSN data to the USGS and NOAA for earthquake monitoring and hazard warning and notification. Within 21 minutes after the rupture started, vibrations from the earthquake were being recorded at every GSN station around the world. Of the 85 stations operated by the USGS, 75 (88 percent) of them were operational at the time of the earthquake. At 8 of those sites, the ground motions from the earthquake exceeded the recording capacity of the primary sensor, but the waveforms were recorded on secondary sensors (the secondary sensors were deployed precisely for this reason). The open data policy of the GSN made it possible for researchers to access the data quickly to study the earthquake and its rupture process in detail and GSN recordings of the Sumatra earthquake have been extensively used in scientific studies of the event. As an example of the importance of GSN data to current research, over 16 major journal articles have been published on the December 26, 2004, Sumatra-Andaman Islands earthquake and tsunami in the scant 10 months since the event occurred, many of them based on GSN data. Over the coming years, GSN recordings of the Sumatra earthquake will help scientists understand the physics of earthquake rupture and dynamics of subduction zones—studies that will have a direct bearing on the assessment of hazards associated with the Cascadia subduction zone in the Pacific Northwest.

In response to the December 2004, Sumatra earthquake and resulting Indian Ocean tsunami, the USGS carried out a wide range of activities in 2005 to aid recovery in the region and reduce the impact of future tsunami events in the United States and around the globe. In FY 2005, the Administration committed $37.5 million in FY 2005–06 for NOAA and USGS in an initiative to improve tsunami detection and warning systems. For FY 2005, USGS received $8.1 million in an Emergency Supplemental Appropriation, and $5.4 million was requested in the FY 2006 President's budget. Of the FY 2005 funds to USGS, $4.15 million are for improvements to the GSN; these support both NOAA's tsunami warning responsibility and the USGS responsibility for earthquake notification and hazard reduction. Of the FY 2006 increase to USGS, $0.6 million was to maintain the higher performance level of the GSN.

To improve the rapidity of global earthquake reporting, the USGS has made substantial progress in expanding the number of GSN stations that deliver real-time data to NEIC with over 89 percent of stations now sending continuous data to NEIC. USGS is partnering with UCSD, NOAA, and CTBTO to add telemetry links or expand bandwidth to improve communications at GSN sites. During FY 2005, a proposal was solicited from UCSD and preliminary conversations with NOAA and CTBTO personnel took place.

To improve the detection and rapid assessment of earthquakes in the Caribbean and Atlanta, the USGS purchased equipment for nine new seismic stations to be deployed in the Caribbean through the GSN. Working with collaborators in the region, site selection is underway and agreements are being negotiated with host countries. These new stations will provide data through NEIC to the NOAA tsunami warning centers.

During FY 2005, the USGS worked actively with the State Department toward obtaining agreements for installing two new GSN stations on Kanton and Tarawa Atolls in Kiribati, in the Central Pacific Ocean region, and with Spain for permits for one station in the Canary Islands in the Central Atlantic. This work is funded using NSF funds provided by IRIS. New real-time telemetry links for stations in northern Finland and Tuvalu (Central Pacific) were established (with IRIS funding) and in southern Greenland and in the Solomon Islands (via cooperation with

the CTBTO). The USGS conducted a training course for 10 GSN station operations (an annual event in Albuquerque, NM), using IRIS/NSF and CTBTO funding.

With an eye toward the future development of the network, the USGS and IRIS supported by NSF, co-funded an international workshop on GSN in the context of the Global Earth Observation System of Systems (GEOSS). Although the primary focus of the GSN is on the collection of seismic data, the flexible data acquisition system provides a platform for expanded Earth observatories. In fact, many GSN stations are already equipped with auxiliary sensors such as GPS receivers and microbaraographs. Because the GSN already provides infrastructure, host-country involvement and on-site support, international agreement on data sharing, and in most places real-time communications, the GSN is ideally situated to serve as a global backbone for Earth Observation. Fifty people from 14 Nations participated in this workshop. The GSN will be represented by the Federation of Digital Seismographic Networks in the on-going discussions.

The USGS GSN data availability for May 2004 through April 2005 was 90.5 percent, essentially unchanged from the previous year. This success is attributable to the high percentage of real-time telemetry (so problems can be recognized and fixed more quickly), more spare parts, and the diligence and efficiency of USGS employees and contractors. The cost of most spare parts was covered by NSF funds through IRIS, while the cost of most of the newest telemetry links was provided by both IRIS and the CTBTO through a cooperative agreement.

Performance Overview

Measure	2005 Plan	2005 Actual	Change from 2005 Plan	2006 Enacted	2006 Change from 2005 Actual	2007 Request	2007 Change from 2006
% of earthquake monitoring GSN stations that have telemetry (to increase reporting speed from one hour to 20 min.)	80%	86%	+6%	89%	+3%	93%	+4%
X% data availability for real-time data from the GSN **(PART)**	90%	89%	-1%	90%	+1%	87%	-3%
Data processing and notification costs per unit volume of input data from sensors in monitoring networks (in cost per gigabyte) (**PART**)*	0.99 $k/GB	0.79 $k/GB	-0.20	1.42 $k/GB	+0.63	1.33 $k/GB	-0.09

*GSN data processing and notification costs were rebaselined for 2006, so they are calculated now on only the USGS-operated stations of the network. Thus the apparent increase in costs in 2006 does not reflect a significant decrease.

This page intentionally left blank.

Activity: Geologic Hazards, Resources, and Processes

Subactivity: Geologic Hazard Assessments
Program Component: Geomagnetism

Program	2005 Actual	2006 Enacted	2007 Fixed Cost & Related Changes [a/]	2007 Program Changes	2007 Budget Request	Change from 2006
Geomagnetism Program	1,989	1,995	+35	0	2,030	+35
Total Requirements $000	**1,989**	**1,995**	**+35**	**0**	**2,030**	**+35**
FTE	***14***	***14***	***0***	***0***	***14***	***0***

[a/] Fixed cost increases for this activity total $50 of which $35 will be budgeted and $15 will be absorbed.

Program Overview

The 2007 budget request for the Geomagnetism Program is $2,030,000 and 14 FTE. The USGS proposes no program changes for this program.

The mission of the USGS Geomagnetism Program is to monitor the Earth's magnetic field through an array of ground-based magnetic observatories; to provide high temporal resolution records of magnetic field variations covering long timescales; to disseminate magnetic data to various governmental, academic, and private institutions; and to conduct research into the nature of geomagnetic variations for purposes of scientific understanding and hazard mitigation. The program consists of three main elements: (1) Geomagnetic Observatory Operations, (2) Data Transportation, Management, Processing and Dissemination, and (3) Scientific Research. Short-term variations, in particular those occurring during geomagnetic storms, are hazardous to satellites and electrical power distribution systems and make radio communications, navigation, and geophysical surveys difficult. During magnetic storms, astronauts and high-flying aircraft pilots can be exposed to dangerous levels of radiation. The program's magnetometer data are used for diagnosis of near-Earth space-weather conditions by both the NOAA Space Environment Center and the U.S. Air Force, and the program is an integral part of the National Space Weather Program as detailed in its strategic plan.

It is estimated that the annual economic impact of magnetic storms runs into the hundreds of millions of dollars, not to mention the potential impact upon national security. Long-term, secular variation of the field is caused by convection in the Earth's core, resulting in a slow drift in the global-scale structure of the magnetic field. Because many navigational systems use the magnetic field direction as a means of orientation, it is essential to track these long-term changes. Moreover, drilling programs undertaken within the oil industry rely on magnetic orientation, and these can be degraded during magnetic storms, particularly at high latitude. Finally, many historical property boundaries are based on magnetic orientation, and knowledge of the magnetic field is needed to reconstruct or re-establish these boundaries.

This program addresses the Department's Serving Communities strategic goal to protect lives, resources, and property by making information available to communities to use in developing

hazard mitigation, preparedness, and avoidance plans. Two measures are tracked in support of the intermediate outcome of providing information to assist communities in managing risks from natural hazards: (1) use rate of products and (2) adequacy of information. Output measures for which targets are established in support of achieving the intermediate outcome goal include the maintenance of one hazard monitoring network and the presentation of formal workshops or training to customers.

As described in the OMB PART review, the Geomagnetism Program role is clearly defined and unique from other Federal, State, local, or private entities. The Geomagnetism Program was reviewed in FY 2003 as part of the Geologic Hazard Programs for the FY 2005 Budget using the PART. It was found to be moderately effective. PART measures include the number of jurisdictions adopting improved plans, as well as cost per gigabyte of data from geophysical sensors per year.

The program activities support the USGS Geology Strategic Plan (2001–10) goals of conducting geologic hazards assessments for mitigation planning and providing short-term prediction of geologic disasters and rapidly characterizing their effects.

Geomagnetic Observatory Operations — The USGS Geomagnetism Program 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 stability. Each site is visited regularly by either program staff or contract employees to conduct calibrations of the instruments. Data are transmitted in real time to program headquarters in Golden, CO, via a set of satellite linkages. The program is currently working improve the basic infrastructure at each observatory and to improve the temporal resolution of the measurements, by increasing the sampling frequency from 1 minute to 1 second, and to improve data access by installing Internet links to each observatory. By necessity, the network and everything associated with handling the data are technologically elaborate. It consists of many finely tuned components, each of which need to be operated in careful synchronization.

Use of Cost and Performance Information

Cost/performance data are used to prioritize maintenance activities across the 14-observatory geomagnetic monitoring network.

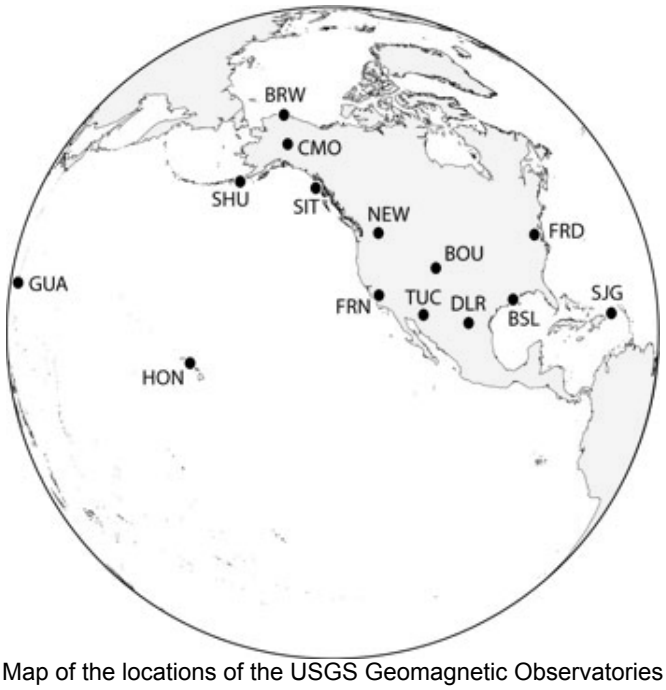
The Geomagnetism Program partners with NSF (through the *Earthscope* Program) and the Air Force (AFWA) to ensure adequate monitoring of the geomagnetic field.

All real-time data are used continuously by both NOAA and the US Air Force. Real-time data from Barrow, College, Honolulu, and San Juan are used by Kyoto University, Kyoto World Data Center, and the Japanese National Institute of Information and Communication Technology. Real-time data from Fredericksburg and Sitka are used by the GeoForshungsZentrum of Germany.

In FY 2006, program managers will analyze operational costs, facility needs, and customer data requirements across the observatory network, to seek cost efficiencies that may free funds for other critical program needs.

Data Processing, Management, and Dissemination — Once the data from the observatories are received in Golden, CO, they are subjected to an initial processing. They are then organized for immediate transmission to both NOAA's Space Environment Center in Boulder, CO, and the U.S. Air Force Weather Agency in Omaha, NE. For longer-term studies, the magnetic data are adjusted using the periodic calibration measurements made at each observatory, making them useful for statistical studies of rapid magnetic field variations and for the purpose of mapping the field on a global scale. These fully calibrated or "definitive" data are published yearly on a CD-ROM in cooperation with foreign national geomagnetism programs

working with *Intermagnet (http://www.intermagnet.org).* The USGS Geomagnetism Program also distributes data and maps and models of the magnetic field through its Web site *(http://geomag.usgs.gov),* which receives several hundred to a thousand visits from the public per day.



Map of the locations of the USGS Geomagnetic Observatories

Scientific and Applications Research — USGS Geomagnetism Program staff conduct geomagnetic research to achieve a better understanding of basic geomagnetic processes and their effects on physical and social environments. Recent projects have included the development of a statistical framework for characterizing the long-term secular variation of the magnetic field and studies of the dynamo generating the field within the Earth's core. The program has recently begun an analysis of the statistics of rapid magnetic field variations with the goal of characterizing them both spatially and temporally so that geomagnetic hazards can be mapped and so that risks can be quantified.

FY 2007 Program Performance Estimates

To address goals listed above in the Program Overview, the Geomagnetism Program is planning the following activities for FY 2007:

Geomagnetic Observatory Operations — In 2007, the new 1-second acquisition system will be tested, with the aim of preparing for fully operational 1-second acquisition at selected observatories in 2008. Program staff will concentrate on major upgrades at the Barrow Observatory, including repair or replacement of the primary sensor building, installation of the data-acquisition system, and installing Internet links. The Boulder Observatory will be prepared for use during the 2008 International Association of Geomagnetism and Aeronomy (IAGA) instrument workshop, including the installation of two new observation piers and simple shelters. Work will continue in developing calibration systems at Boulder. If *Earthscope* support is obtained, magnetotelluric operations at one or more observatories will commence. Finally, with support and collaboration, and as part of the International Polar Year, it is planned that full-fledged observatory operations will commence at the South Pole.

FY 2007 should see the benefit of these efforts, primarily through improved data quality and reduced operational expenses. With the installation of the new data acquisition system at all observatories by the end of 2007, continuous operations and software upgrades should make the network easier to manage. Work on the program's Web site should make dissemination of magnetometer data easier and result in improved profile for the program. Finally, involvement with *Earthscope* and International Polar Year (IPY) will increase the program's customer base.

Based on an internal review of the operational costs, facility needs, and user requirements for data at USGS geomagnetic observatories that will be completed in FY 2006, USGS will decide whether to close one or more of the observatories in order to make resources available for other observatories or other program needs. Currently, in terms of performance tracking, USGS has targeted the closure of one observatory at the beginning of FY 2007. This will lower the input data rate from the network and therefore increase average operational costs per unit of input data.

Photograph of the coil calibration facility at the College, Alaska, geomagnetic observatory. The program provides services to other governmental, academic, and private communities including: calibration services for declination-inclination magnetomers and transit magnetometers, compass-calibration test sets with certificates, advice on purchase of magnetic instruments and data-acquisition systems installation of magnetic instrumentation, decontamination of magnetic facilities and acquisition packages, compass rose surveys, and certified surveys conducted anywhere in the western hemisphere.

Data Processing, Management, and Dissemination — Capacities for managing and disseminating 1-second data should be complete in 2007 and made operational in 2008. Management of magnetotelluric and South Pole data will commence.

Scientific and Applications Research — Work will continue on developing a geomagnetic hazard map in 2007, primarily through statistical analysis of observatory data. Simple but operationally useful measures of magnetic activity will be developed for possible display on the program Web site.

FY 2006 Planned Program Performance

Geomagnetic Observatory Operations — In 2006, program staff will replace all buildings at the Stennis and Del Rio observatories, and major repairs will be made to buildings on the Fredericksburg observatory. Major upgrades will be made to the electrical power systems at the Fredericksburg and Sitka observatories. The data acquisition system will be installed at the Del Rio, Sitka, Stennis, and Tucson observatories. Internet access will be installed at the Del Rio, Stennis, and Tucson observatories. If *Earthscope* support is obtained, magnetotelluric operations will be installed at the Boulder observatory. Finally, as part of the International Polar Year, it is planned that preliminary observatory operations will commence at the South Pole, primarily through the installation and operation of an absolute intensity magnetometer.

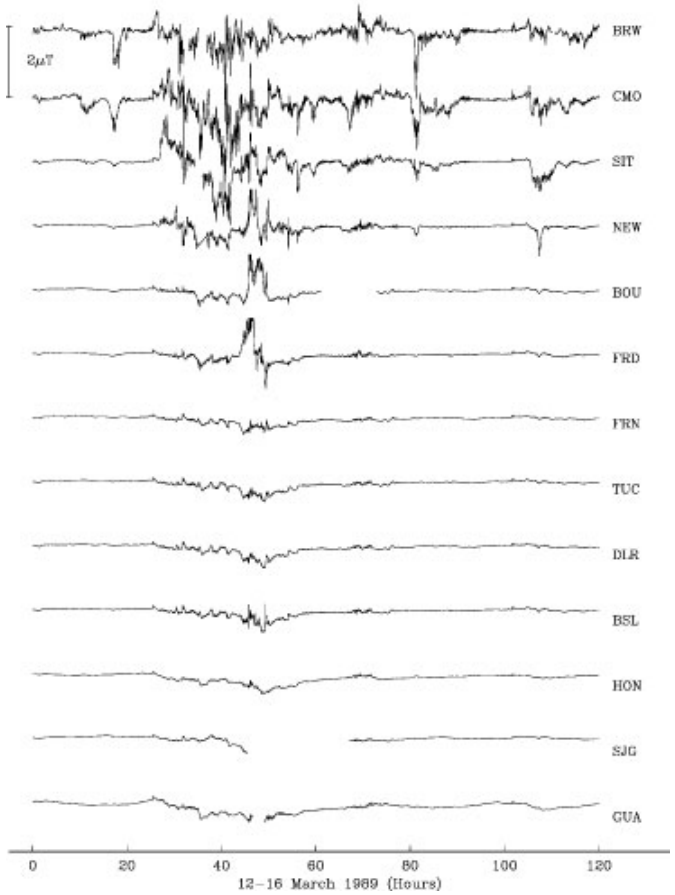
Data Processing, Management, and Dissemination — Capacities for managing and disseminating 1-second data will be initiated. Management of magnetotelluric data from Boulder will commence.

Scientific and Applications Research — Work will continue on developing a geomagnetic hazard map, primarily through statistical analysis of observatory data, and it expected that two papers will be submitted for publication on the subject. A review article on the many uses of magnetic observatory data will be completed.

Performance Measures — The Geomagnetism Program expects improved cost performance when the new data-acquisition system becomes fully operational. This is especially true as the temporal cadence of data acquisition is improved from the current one minute standard to one second. The usage of the calibration system should make systems more reliable and reduce the burden of data processing.

- One formal workshop will be held by USGS in FY 2006: A product development meeting of the USGS, U.S. Air Force, and NOAA.
- USGS will attend other related meetings: The annual meeting of the National Space Weather Program Council, in Silver Spring, MD. The USGS represents the Department of the Interior in the National Space Weather Program, which coordinates Federal space weather monitoring and research activities across multiple agencies.
- The IAGA operations meeting in Belsk, Poland.

Also in FY 2006, program managers will analyze operational costs, facility needs, and customer data requirements across the observatory network, to seek cost efficiencies that may free funds for other critical program needs.



Magnetic Storm Data from March, 1989. The stacked waveform plot shows horizontal-field intensity (H) as measured by USGS observatory magnetometers during the 'great storm' of March 1989. This storm induced large quasi-direct currents in power grids, causing systemwide power blackouts in Quebec and numerous power-equipment problems in the northeastern United States. The same storm also caused radio-communication blackouts, and, because of an expansion of the ionosphere, increased the atmospheric drag on satellites, thereby altering their orbits.

Program managers expect level performance in FY 2006. However, as observatories are upgraded from 1-minute to 1-second sampling frequency, there will be a marked jump in the cost efficiency of observatory operations (i.e., lowered cost per unit volume of input data from geomagnetic sensors). In addition, if USGS is successful in partnering with NSF to build a new geomagnetic observatory at the South Pole, this will increase the input data rate from the network and therefore decrease average operational costs per unit of input data.

FY 2005 Program Performance Accomplishments

The accomplishments and outcomes listed below demonstrate the utility of USGS products that are counted under the output measures for number of workshops or training provided, number of data collections, and numbers of locations adopting hazard mitigation measures.

Improved Monitoring of the Earth's Magnetic Field — As part of an on-going effort to expand and upgrade observatory operations, the Geomagnetism group staff deployed a new data collection and transmission system at two observatories. When made fully operational, this system will enhance the temporal resolution of the data and will take full advantage of the Internet-based Earthworm data-transportation system developed by USGS seismologists. Program staff continued work on a coil-calibration facility at Boulder, CO, intended to allow magnetometer systems to be fully tested and calibrated prior to deployment. Staff have developed an Oracle database to better manage the program's data, which is being integrated into data collection, management, and dissemination operations. During 2005 program staff submitted for publication four encyclopedia articles on the Earth's magnetic field and the USGS Geomagnetism Program. The program currently has a post-doctoral fellow working with staff on the statistical summary of magnetic-field activity for eventual production of a geomagnetic-hazard map.

Geomagnetism Web Site Upgraded — The program has a new Web site, providing more information to the public about operations, data, and services, along with educational and scientific material. The program now has a formal memorandum of agreement with the U.S. Air Force concerning the near-real-time delivery of magnetometer data, and several agreements have been put into place concerning operations and different legal issues at the individual observatories.

Transition to Higher-Frequency Observations — The new data-acquisition system is being modified to produce one-second average data, and when the system is made operational the program's data will be of significantly higher temporal resolution than the current one-minute data. In order to improve the fidelity of acquisition systems, a coil-calibration facility is being installed at the Boulder observatory site, and when this is completed, staff will be able to carefully calibrate their magnetometers. An Oracle database is being developed that will help staff manage the program's voluminous data, serve as an interface between the data-transportation and processing systems, and facilitate the dissemination of data through the program's Web site and other specialized delivery tools. All these developments will improve the quality of service to the scientific community and, ultimately, expand the program's customer base.

Expanded Research — Research is being pursued on magnetometer-calibration theory, data-processing theory, and the analysis of magnetic observatory data. The calibration and processing projects are directly related to the program's on-going development of a coil-calibration system and the need for enhanced processing of observatory data, both of which are needed to improve the data quality in order to satisfy the ever-more-stringent needs of the user community. The data-analysis project, sometimes broadly described as a geomagnetic-hazard map, consists of a statistical analysis of the spatial and temporal characteristics of rapid magnetic-field variations, particularly those occurring during magnetic storms. Some of this analysis is concentrated on indices—generic measures of magnetic-field activity widely used within the scientific community—while other parts of the analysis are concentrated on variation in the magnetic-field vector itself. Since the data-analysis project is of fundamental relevance to a broad range of subjects within geomagnetism, both applied and

academic, the project will help program staff to interface with a broad base of existing and potential customers.

Performance Overview

The table below summarizes data for the Geomagnetism Program, including measures shared among the USGS programs in Earthquake Hazards, Volcano Hazards, Landslide Hazards, and the Global Seismographic Network.

Measure	2005 Plan	2005 Actual	Change from 2005 Plan	2006 Enacted	2006 Change from 2005 Actual	2007 Request	2007 Change from 2006
# of formal workshops or training provided to customers (instances/issues/events)	1	2	+1	1	-1	0	-1

This page intentionally left blank.

Activity: Geologic Hazards, Resources, and Processes

Subactivity: Geologic Landscape and Coastal Assessments
Program Component: Earth Surface Dynamics

Program	2005 Actual	2006 Enacted	2007 Fixed Cost & Related Changes [a/]	2007 Program Changes	2007 Budget Request	Change from 2006
Earth Surface Dynamics Program	13,634	13,354	+159	-247	13,266	-88
Total Requirements $000	**13,634**	**13,354**	**+159**	**-247**	**13,266**	**-88**
FTE	***82***	***82***	***-2***	***0***	***80***	***-2***

[a/] Fixed cost increases for this activity total $228 of which $159 will be budgeted and $69 will be absorbed. FTE changes result from rebalance and renew skills mix to gain functional and position flexibilities identified through an extensive workforce planning effort (page H-2).

Summary of FY 2007 Program Changes for Earth Surface Dynamics Program

Request Component	Amount	FTE
Program Changes		
• Global Dust Study	-247	0
TOTAL	**-247**	**0**

Justification of 2007 Program Changes

The 2007 budget request for the Earth Surface Dynamics Program is $13,266,000 and 80 FTE, which is a program change of -$247,000 and 0 FTE. The reduction will end a portion of an unrequested earmarked project. It does not address the highest priority science needs in Earth Surface Dynamics research. This will keep the core program intact while allowing the USGS to make the best use of resources and ensure that the higher priority work in hazards mitigation and earth observation is funded.

- **Global Dust Study (-$247,000 and 0 FTE) —** The proposed funding decrease in the Global Dust Study would reduce the current scope of the project and discontinue additional analyses of dust composition and its impacts. Additional planned studies which include microbiological, mineralogical and geochemical studies of major dust source areas in Africa and Asia and investigations of pathways of dust and included organic contaminants to organisms in impacted ecosystems (e.g., coral reefs) would be eliminated or reduced.

Program Performance Change — Though the program contributes to the strategic goals of advancing knowledge through scientific leadership and inform decisions through the

applications of science, there are no performance measures specifically linked to this program change.

Program Overview

Use of Cost and Performance Information

Gathering ABC information at the task level is new for FY 2006. After several years of tracking this valuable detailed information, ESDP will be better placed to track and analyze important trends in program funding and expenditures, as well as scientific emphases within each program and links to the Department's goals and priorities.

This program supports the Department's Serving Communities strategic goal to advance knowledge through scientific leadership and inform decisions through the application of science. The goal of the ESDP is to be the primary provider of scientific information on past, present, and future climates and their effects on Earth and human systems to fulfill the mission of the USGS. Understanding of Earth surface processes and climate change impacts is used to provide perspectives for policymakers and support for land and resource managers. Program goals are achieved via a series of projects in the following main groups that:

- Document the nature of climatic and environmental change and variability on timescales ranging from years to millennia,
- Develop fundamental understanding of interactions between climate, Earth surface processes, and marine and terrestrial ecosystems on timescales ranging from years to millennia,
- Seek to understand impacts of climate change and variability on landscapes and marine and terrestrial systems,
- Model and anticipate the effects of climate change and variability on natural and human systems,
- Provide information on the relative sensitivity, adaptability, and vulnerability of ecosystems, resources, and regions to climatic change and variability to support land and resource management and policy decisions, and
- Enhance the quality and relevance of program activities through collaboration with national and international scientific entities.

ESDP-funded projects support the goals of the U.S. Climate Change Science Program (CCSP) to (1) improve knowledge of the Earth's past and present climate and environment, including its natural variability, (2) improve quantification of the forces bringing about changes in the Earth's climate and related systems, (3) reduce uncertainty in projections of how the Earth's climate and environmental systems may change in the future, (4) understand the sensitivity and adaptability of different natural and managed ecosystems and human systems to climate and related global changes, and (5) explore the uses and identify the limits of evolving knowledge to manage risks and opportunities related to climate variability and change.

Results of scientific activities supported by ESDP are communicated to customers in academia, resource management agencies, and the general public through project reports and peer-reviewed scientific papers, Web sites, databases, and meetings with stakeholders. Metrics of program success include the number of reports and publications, number of people accessing Web sites, and the frequency of meetings with stakeholders.

The USGS Earth Surface Dynamics Program (ESDP) supports research in three principal Earth processes study areas: Global Change and impacts of climate change and variability, Great Lakes geologic mapping, and Priority Ecosystems Studies.

Global Change — (Estimates for FY 2005, $10.4 million; FY 2006, $10.5 million, FY 2007, $10.5 million). The ESDP supports multidisciplinary studies of past environmental and climatic changes (climate and environmental history), process studies that explore the sensitivity of the Earth-surface and associated ecosystems to climate change and variability, and forecasting of potential future changes and their effects on landscapes, land use, and ecosystems (particularly on public lands). The combination of these studies provides integrated long-term perspectives on the effects of climatic changes and variability and on the interactions through time among climatic, geologic, biologic, and human systems on regional and landscape scales. These studies provide information to allow policymakers and land and resource managers to gauge the relative sensitivity of particular ecosystems, resources, and regions to climatic change and variability. Understanding the nature and magnitude of past climate and environmental changes is necessary to provide a baseline against which to identify the effects of humans as agents of environmental change and to provide a long-term perspective on climate variability that can be used in developing plans for ecosystem restoration.

Central Great Lakes Geologic Mapping Coalition Project — (Estimates for FY 2005, $0.5 million; FY 2006, $0.5 million; FY 2007, $0.5 million). This project contributes to ESDP goals of understanding the interrelationships among Earth surface processes, ecological systems, and human activities by documenting, analyzing, and modeling geological and hydrological processes involved in environmental change; as well as providing information on the nature and extent of past climate changes (especially the extent of Pleistocene ice advances in the Midwest).

Priority Ecosystems Studies — (Estimates for FY 2005, $2.7 million; FY 2006, $2.5 million; FY 2007, $2.5 million). Through PES, ESDP supports interdisciplinary studies of ecosystems, including studies of the Everglades, San Francisco Bay Delta, Chesapeake Bay, Platte River, and the Mojave Desert to evaluate land-use changes, ecosystem histories, indexes of ecosystem sensitivity to change, and vulnerability to potential stressors in order to devise restoration and adaptive management strategies for land use managers.

End outcome measures for which targets are set relate to the soundness of methodology, accuracy, and reliability of the science, and the accessibility to and satisfaction with products and services. In support of the intermediate outcome to improve the information base, information management, and technical assistance, intermediate outcome measures regarding the content and expanse of the knowledge base and the quality of studies are tracked. Outputs associated with these intermediate outcome measures include the maintenance and update of three long-term data collections, the completion of systematic analyses or investigations for customers, and formal workshops or training provided to customers.

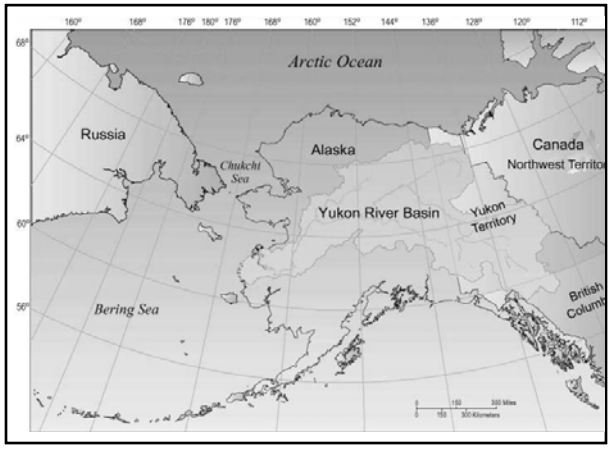
FY 2007 Program Performance Estimates

Specific FY 2007 science priorities for Earth Surface Dynamics include:

- Cryospheric studies in Alaska's North Slope that will help determine the impacts of climate change on current and near-term permafrost stability. This work is being conducted in cooperation with the BLM.

- The role of climate change in influencing the carbon budget, hydrologic cycle, and related ecological response within the Yukon Basin of Alaska and adjacent parts of Canada. This work will benefit resource management decisionmakers in the NPS, FWS, U.S. Forest Service, the Canadian Government, the State of Alaska, and native Alaskan consortiums.
- The continued investigation of the geohistorical record in the arid southwest, Pacific Northwest, and intermountain regions of Colorado, Utah, and California will help facilitate better understand long term climate change and variability and its influence on the evolution of various ecosystems over time. This collection of work is highly coordinated with land and resource managers from across the State and Federal government agencies in order to provide them with a concise understanding of past, present, and future drivers of landscape and resource changes so that they may develop more efficient and cost-effective resource management plans.
- Work will continue on developing a better understanding of the causes of global dust development and transport, and the potential consequences of dust to human and ecological health.
- Work is beginning on the study of abrupt climate change events, their mechanisms and their impact on the Earth and its inhabitants. This work will ultimately provide significant knowledge to managers responsible for developing adaptation or coping strategies aimed at the mitigation of climate-related natural hazards, such as floods, strong storms, drought, and sea-level rise.

Systematic analyses, formal workshops, and number of gigabytes collected remain constant in FY 2007. In order to provide a stronger linkage, and increased performance and efficiencies in implementing program goals, ESDP will be implementing the following changes in FY 2007, as described below.



Aerosols and Climate: Integrating Remote-Sensing with In Situ Observations — The USGS component of this global change community-wide effort includes research and model improvements regarding aerosol–climate interactions. By augmenting global observations with a mix of intensive in situ field observations from ground, ship, and aircraft, together with laboratory and controlled condition characterization of aerosols and their properties, data analysis and modeling, ESDP will be able to make great strides in addressing the role aerosols play in changing the Earth's radiation budget, hydrologic cycle, and resultant landscape and ecological responses.

Implementation of new and more efficient science and monitoring activities as well as new performance standards require a change in the allocation of resources between specific science projects studying global dust issues. The program will begin development of a new global dust science plan that will guide ESDP in the development of new aerosol-specific performance measures, and the resultant reallocation of fiscal and human capital resources for FY 2007.

Terrestrial and Freshwater Interactions with a Changing Climate in the Yukon River Basin — Climate change is a global phenomenon, but the magnitude of change and the significance of the effects on Federal systems will vary across the globe. Arctic and sub arctic regions are considered to be particularly sensitive to the effects of climate warming. Permafrost thawing, and the resulting enhancement of both water infiltration and the decomposition of large stores of frozen organic material, will radically affect northern ecosystems of the Arctic region and the rate at which carbon is exported from those landscapes to the atmosphere, rivers, and the Arctic Ocean. In particular, this potential permafrost could significantly increase the rate of warming globally. These conditions make arctic and sub arctic ecosystems important areas for deciphering the potential effects of global warming on natural resources. The USGS and the U.S. Forest Service (USFS) are leading a developing consortium of U.S. and Canadian Federal agencies, university scientists, and tribal organizations in implementing a prototype environmental monitoring and research strategy in the Yukon River Basin. The collaboration will link air, water, soil, and forest information across the Yukon River Basin to track and understand regional changes in carbon flux and storage. International collaboration with Canadian partners in the Yukon River headwaters will be critical to the success of the project. For FY 2007, ESDP plans to reallocate $600,000 for the program to the development of a Yukon Basin pilot study for a 2-year proof-of-concept study.

Global Change —In FY 2007, global change activities will focus on the terrestrial and freshwater interactions with a changing climate in the Yukon River Basin. The USGS and the USFS are leading a consortium of U.S. and Canadian Federal agencies, university scientists, and Tribal organizations in implementing a prototype environmental monitoring and research strategy in the Yukon River Basin. The collaboration will link air, water, soil, and forest information across the basin to track and understand regional changes in carbon flux and storage.

Great Lakes — In FY 2007 the USGS and the State geological surveys of Illinois, Indiana, Michigan, and Ohio will continue a partnership to produce three-dimensional geologic maps of the extensive glacial deposits that blanket the upper Midwest. These maps provide a foundation for making economic and environmental decisions related to ground water balances, land, and other natural resources in the Great Lakes. By pooling their expertise and resources, the five geological surveys can address these issues more effectively than could any one survey working alone.

Priority Ecosystems Studies — In FY 2007, the ESDP will continue to provide support for PES studies which are described in more detail in the Science on the Landscape section (page F - 30). Through PES, ESDP supports interdisciplinary studies of ecosystems, including studies of the Everglades, San Francisco Bay Delta, Chesapeake Bay, Platte River, and the Mojave Desert to evaluate land-use changes, ecosystem histories, indexes of ecosystem sensitivity to change, and vulnerability to potential stressors in order to devise restoration and adaptive management strategies for land use managers.

FY 2006 Planned Program Performance

The program accomplishments described below are examples that demonstrate the utility of scientific publications, reports, and other products that are counted under the output measures "systematic analyses and investigations delivered to customers" and "number of long-term data collections maintained."

Satellite Image Atlas of the World — In FY 2006, the program plans to complete the 11 volumes of the Satellite Image Atlas of the World (USGS Professional Paper 1386). This is the culmination of a long-term international project to use Landsat Multispectral Scanner (MSS) images acquired in the mid-1970s to establish a baseline for the areal distribution of the Earth's glaciers. More than 70 U.S. and foreign scientists, from 25 countries, representing 45 different institutions, have collaborated in the preparation of 10 geographic-area chapters and an introductory chapter on State of the Earth's Cryosphere at the Beginning of the 21st Century: Glaciers, Snow Cover, Floating Ice, and Permafrost, the latter with a 1:50,000,000-scale map of the Earth's Dynamic Cryosphere.

Long-term Data Collection Efforts — The ESDP will continue to measure active layer and deep borehole temperatures in 2006 to monitor changes in Alaskan permafrost and collect and analyze meteorological and wind erosion data from USGS monitoring stations in the Southwest. The program also supports long term paleoenvironmental data sets including the Packrat Midden database on past vegetation composition.

Formal Workshops or Training Provided to Customers — The ESD program will provide at least 6 workshops or training sessions to customers in FY 2006, three of which include:

- Global Change: A workshop on global change priorities and their coordination between ESD, the Department, and other partners will be held in Reston, Virginia in March.
- Global Dust: An internal USGS workshop coordinating global dust research efforts and strategies is in the planning stages. The time and place have not yet been established.
- Yukon Basin: A workshop coordinating the efforts of a Yukon Basin initiative is planned for spring. This collaborative effort will link air, water, and soil and forest information across the Yukon River Basin. A consortium of scientists and stakeholders from USGS, Interior, FWS, NPS, NFS, and the State of Alaska are expected to participate.

Systematic Analyses and Investigations Delivered to Customers — The ESD program will deliver 6 systematic analyses. These will be included in the final volumes of Profession Paper 1386, *The Satellite Image Atlas of the World*.

Databases Maintained (gigabytes annual and cumulative) — The ESD Program will accumulate 2.8 gigabytes for a cumulative total of 13.8 gigabytes.

The Earth Surface Dynamics Program has completed a new 5-Year Plan covering the period FY 2006–11 in FY 2005. This plan will be revised to reflect comments received during in the external review of the program to be conducted by the American Association for the Advancement of Science (AAAS) in FY 2006.

FY 2005 Program Performance

The accomplishments and outcomes listed below demonstrate the utility of USGS products that are counted under the output measures for number of systematic analyses and investigations delivered to customers; number of workshops or training provided, and number of data collections.

The ESDP continues to collect long-term data sets and undertake systematic analyses that address the Department's strategic goals, especially to advance knowledge through scientific leadership and inform decisions through the application of science.

Highlights of program accomplishments in FY 2005 that have been reported to customers include:

- On-going studies of the history, timing, and extent of hypoxic events in the Gulf of Mexico that show increased use of fertilizer has amplified an otherwise naturally occurring process.
- Completed studies of changes in glacier margins in the Antarctic Peninsula over the past 60 years show that the boundary between advancing and retreating glaciers has moved progressively southward over the period of study, suggesting that warmer temperatures are in large part responsible for changes in the ice margin.
- Studies of never-grazed grasslands in Canyonlands National Park in comparison to areas that were grazed until 1974 show that the historically grazed areas have a reduced content of surface silt-sized particles and soil carbon and nitrogen, as a result of wind erosion, even after 30 years of recovery. This suggests that livestock grazing and resulting nutrient loss by wind erosion of soils has long lasting effects on the soil fertility of native grasslands in this area, and should be considered in management decisions related to the long-term sustainability of grazing in arid environments.

Performance Overview

Measure	2005 Plan	2005 Actual	Change from 2005 Plan	2006 Enacted	2006 Change from 2005 Actual	2007 Request	2007 Change from 2006
# annual gigabytes collected	2.8	2.8	0	2.8	0	2.8	0
# cumulative gigabytes managed	11.0	11.0	0	13.8	+2.8	16.6	+2.8
# systematic analyses delivered to customers	5	6	+1	6	0	6	0
# formal workshops and training provided to customers	6	6	0	6	0	6	0

This page intentionally left blank.

Activity: Geologic Hazards, Resources, and Processes

Subactivity: Geologic Landscape and Coastal Assessments
Program Component: National Cooperative Geologic Mapping

Program	2005 Actual	2006 Enacted	2007 Fixed Cost & Related Changes [a/]	2007 Program Changes	2007 Budget Request	Change from 2006
National Cooperative Geologic Mapping Program	25,162	25,113	+334	0	25,447	+334
Total Requirements $000	**25,162**	**25,113**	**+334**	**0**	**25,447**	**+334**
FTE	***144***	***144***	***-4***	***0***	***140***	***-4***

[a/] Fixed cost increases for this activity total $477 of which $334 will be budgeted and $143 will be absorbed. FTE changes result from rebalance and renew skills mix to gain functional and position flexibilities identified through an extensive workforce planning effort (page H-2).

Program Overview

The 2007 budget request for the National Cooperative Geologic Mapping Program is $25,447,000 and 140 FTE. The USGS proposes no program changes for this program. The National Cooperative Geologic Mapping Program (NCGMP) was created following the passage of the National Geologic Mapping Act of 1992, which was reauthorized in 1997 and 1999 (P.L. 105–36 and P.L. 106–148). In FY 2006, Congress is due to reauthorize the Act for the third time. The NCGMP is the primary source of multiple-purpose geologic maps that depict the distribution of the Nation's sediment and rocks and the resources they provide. Geologic maps are vital for exploring, developing, and preserving mineral, energy, and water resources; evaluating and planning for land management and environmental protection; reducing losses from natural hazards, including earthquakes, volcanoes, landslides, and other ground failures; mitigating effects of coastal and stream erosion; siting of critical facilities; and planning for basic Earth science research. The NCGMP represents more than a decade 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. Each of these partners has a unique role, yet all work cooperatively to leverage financial resources and to determine the areas of highest priority for new geologic mapping.

This program supports the Department's Serving Communities strategic goal to advance knowledge through scientific leadership and inform decisions through the application of science. End outcome measures for which targets are established relate to the soundness of methodology, accuracy, and reliability of the science, and to the accessibility and satisfaction with information products and services. In support of the intermediate outcome to improve the information base, information management, and technical assistance, intermediate outcome measures regarding the content and expanse of the knowledge base and the quality of studies are tracked. Outputs associated with these intermediate outcome measures include the maintenance and updating of a long-term data collection, the completion of systematic analyses or investigations for customers, and formal workshops or training provided to customers.

The mission of the NCGMP is to provide accurate geologic maps and three-dimensional frameworks that contribute to sustaining and improving the quality of life and economic vitality of the Nation and mitigating geologic hazardous events and conditions.

Program priorities are outlined in the National Geologic Mapping Reauthorization Act of 1999 (P.L. 106–148) and in the program's 5-Year Plan which, which will be finished early in FY 2006. The new NCGMP 5-Year Plan has three goals:

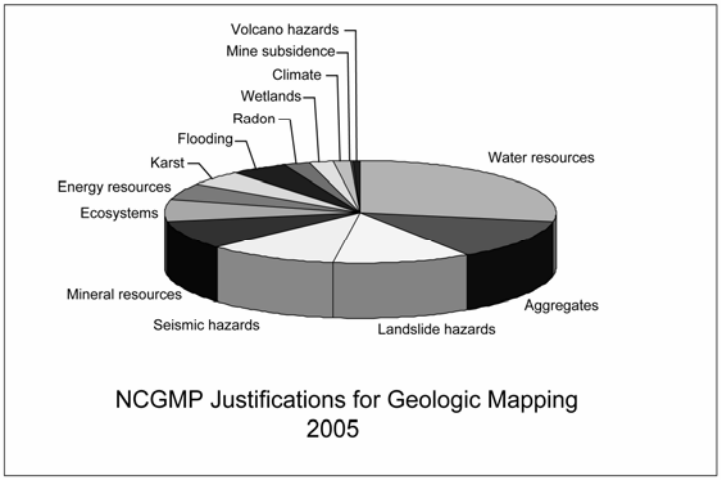
- Goal 1 — Produce high-quality, multi-purpose digital geologic maps and accompanying databases and reports to solve diverse land-use problems in high-priority areas. Develop three-dimensional geologic frameworks that extend into the subsurface for use in a variety of predictive models, such as ground-water flow, seismic shaking, landslide probabilities, landscape change, and ecosystem health. Measures under this goal deal with increasing regional geologic map coverage of the United States, promoting use of geologic maps by the NPS, water resource managers, and in the mitigation of natural hazards, as well as documenting the Systematic Analyses and Investigations delivered to customers.

Use of Cost and Performance Information

Gathering ABC information at the task level is new in the NCGMP for FY 2006. After several years of tracking this valuable detailed information, NCGMP will be better placed to track and analyze important trends in program funding and expenditures, as well as scientific emphases within each program and links to the Department's goals and priorities.

- Goal 2 — Make geologic map information more accessible to the public by providing geologic maps, reports, and databases in a variety of digital formats. Preserve and make accessible the extensive USGS paleontologic collections and accompanying databases. Measures under this goal document the maps/reports that are made accessible on the Internet through the National Geologic Map Database (http://ngmdb.usgs.gov), and the information provided to our customers through formal workshops and training.
- Goal 3 — Ensure that the NCGMP will have the capabilities/workforce to meet the future needs of the Nation. Measures include documenting how students trained through the EDMAP component of the program use their mapping experience to further their geoscience education and careers.

Over the past few years, geologists within the NCGMP have been working to advance and improve the production of geologic maps through the use of new field mapping techniques that streamline the process from data collection to map production. NCGMP has established ambitious targets to make the process even more efficient and will continue to collect quantitative data on the success of these improvements.



NCGMP Justifications for Geologic Mapping
2005

The NCGMP priorities are reviewed annually by a Congressionally mandated Federal Advisory Committee, which includes representatives from DOE, USDA, EPA, Office of Science and

Technology Policy (OSTP), State geological surveys, academia, and the private sector. In addition, State Mapping Advisory Committees in 47 States meet each year to prioritize local geologic mapping needs and assist USGS managers in modifying and prioritizing long-range plans. These priorities are based upon customer needs for the maps. In 1987, geologic maps had five primary applications: oil and gas, metals, industrial minerals, ground water, and coal, listed in decreasing order. By 2005, the number of justifications increased and broadened dramatically, as can be seen above the accompanying figure above. Progress and status reports on the NCGMP are prepared for the Secretary of the Interior to deliver to the Committee on Resources of the House of Representatives and the Committee on Energy and Natural Resources of the Senate.

In FY 2005, OMB undertook an analysis of NCGMP using PART. The program received a rating of Moderately Effective, and established several new long term measures that are directly linked to other programs or agencies. Specifically, NCGMP intends to measure how geologic maps are used by resource managers in the NPS, water managers across the Nation, and by communities to mitigate against natural hazards, such as landslides, earthquakes and volcanic eruptions. The measure involving water managers, is directly linked to a PART measure established in FY 2004 by the USGS Ground-Water Resources Program.

The NCGMP carries out the Mapping Act through three main program components: FEDMAP, STATEMAP, and EDMAP. Each year, panels that include scientists from Federal and State governments and academia critically review all work plans that are submitted to the three components.

FEDMAP

(Estimates for FY 2005, $17.31 million; FY 2006, $17.55 million; FY 2007, $17.56 million)

The FEDMAP component currently supports, totally or in part, 29 regional geologic mapping and synthesis projects that cross jurisdictional boundaries and (or) involve work on Federal lands. These projects are located primarily within three regional teams of the USGS: Western Earth Surface Processes Team, Central Earth Surface Processes Team, and Eastern Earth Surface Processes Team. However, NCGMP also funds interdisciplinary projects with the Mineral Resources Program, Earthquake Hazards Program, Landslide Hazards Program, and the Ground Water Resources Program. Most of these projects have a lifespan of approximately 5 years. In FY 2006, studies are being undertaken in 31 States. The program also partially supports a number of geochronology and other common-use laboratories in the Geologic Discipline and the National Geologic Map Database Project, which represents a major cooperative effort with the Association of American State Geologists to serve information about all geologic maps produced in the United States. New and on-going geologic mapping work plans are evaluated annually by a FEDMAP Review Panel, which includes representatives from State geological surveys, NPS, FWS, USGS Water Resources Discipline (WRD), and USGS scientists with diverse scientific backgrounds.

"The Illinois State Geologic Survey strongly supports the USGS' National Geological Map Database Program. The capabilities it provides to find nearly 100,000 geologic maps, data, and related products from hundreds of publishers, view hundreds of maps online, and identify where mapping is on-going are critical to those evaluating groundwater contamination potential, earth hazards, and water and mineral resource availability. The data base is particularly helpful for those unfamiliar with research in a particular area or for those beginning a research on mapping project. The NGMDB provides a central location for mapping information".

William Shilts, Illinois State Geologist,
July 14, 2005.

The National Geologic Map Database project is an on-going effort with State geological surveys, universities, the Canadian Geological Survey, and the Consejo de Recursos Minerales, Mexico, to present all geologic mapping data from North America on one Web site and with a common set of map standards. Additionally, users can access information on current geologic mapping activities and the proper use of geologic names. The project's Web site serves more than 40,000 users per month. In FY 2005, thousands of new bibliographic map records were added to the map catalog, and the recently implemented online image library, which serves digital geologic maps, was expanded.

Through a Science in the Parks effort, the NCGMP is the principal USGS partner coordinating and prioritizing geologic mapping studies with the NPS. This decade-long effort is now an integral component of the FEDMAP program, and the NCGMP is committed to working with NPS well into the future. Projects are developed and selected jointly by the NPS and the USGS to merge the earth science information needs of individual parks with the geologic mapping mission of the USGS. The resulting geologic data are made available in digital, as well as standard, formats that are needed for NPS land-use management, educational outreach, inventory, and monitoring of natural resources. NCGMP-funded projects also work with other Federal land management agencies (e.g., FWS, BLM and the U.S. Forest Service).

> "The BLM uses geologic maps on a frequent basis. We need up-to-date maps in order to delineate mineral resources; determine mineral potential; site roads, water wells and dams; determine the distribution of threatened of endangered plant species endemic to certain geologic formations and determine potential vegetative communities. We use geologic maps and reports produced by the USGS."
>
> Becky J. Hammond
> Bureau of Land Management
> August 25, 2005

STATEMAP

(Estimates for FY 2005, $7.29 million; FY 2006, $7.25 million; FY 2007, $7.32 million)

The STATEMAP component supports geologic mapping studies by State geological surveys through a competitive grant program that matches every Federal dollar with a State dollar. Mapping priorities are determined with the help of State Mapping Advisory Committees in each State, which 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.

EDMAP

(Estimates for FY 2005, $0.57 million; FY 2006, $0.56 million: FY 2007, $0.57 million)

The EDMAP component supports the training of a new generation of geologic mappers in universities and colleges through a competitive matching-fund grant program. In FY 2005, the NCGMP continued a career study of EDMAP students that was begun in 2004. Students are sent a questionnaire three years after completion of their EDMAP experience. So far, the results clearly demonstrate that EDMAP students (1) fall well above the national average for pursuing advanced academic degrees in the geoscience field, (2) easily obtain geoscience positions due to the knowledge gained through the EDMAP experience, and (3) frequently use the geologic mapping skills gained through the EDMAP. In fact, several past EDMAP students, now teachers/professors, are applying for EDMAP grants for their students.

FY 2007 Program Performance Estimates

Important projects that will be completed in FY 2007 and whose accomplishments will satisfy program GPRA requirements include (1) ground water resources of the Sante Fe, NM area, (2) geologic mapping in Big Bend National Park, (3) karst hazards and geologic mapping in the Shenandoah Valley of Virginia, (4) understanding of subsurface geologic and hydrologic frameworks of the North Carolina Coastal Plain, and (5) geologic mapping related to seismic and landslide hazards in the Portland Hills of Oregon. NCGMP anticipates that approximately 47 State geologic surveys and 40 universities will receive financial support from the program through our grant programs. These projects will produce over 400 new geologic maps and train approximately 60 students.

FY 2006 Planned Program Performance

In FY 2006, there are several planned accomplishments that will be used to satisfy the NCGMP GPRA Performance Measures. These activities will demonstrate the utility of USGS products.

Data Collection and Analysis — Nine systematic analyses will be delivered to NCGMP customers. These include the numerous products that have resulted from the six multi-year FEDMAP projects that will be ending in FY 2006 (1) Atlantic estuaries, (2) focus on quaternary stratigraphy in the Los Angeles region, (3) geologic mapping in support of land, resources, and hazards issues in Alaska, (4) improving the geohydrologic framework of the Edwards and Trinity aquifers, south-central Texas, (5) surficial geologic mapping in the Southwest, and (6) three-dimensional geologic maps and visualization.

The NCGMP will provide 10 formal workshops or training to its customers and will continue to maintain 1 long-term data collection: the National Geologic Mapping Database (NGMDB). In FY 2005, 110 gigabytes of information were added to the NGMDB, which at the end of the fiscal year contained 950 gigabytes of information. In FY 2006, approximately 200 gigabytes will be added to the database.

With the budget change for the NCGMP in FY 2006, the program has had to reduce the funding money distributed to every FEDMAP, STATEMAP, and EDMAP project. This will continue to reduce their ability to begin new geologic mapping efforts, to acquire essential additional information for on-going mapping projects, and to publish completed investigations.

New PART Measures — In FY 2006 NCGMP will establish baselines for new PART measures that link to work done with major program partners—primarily the NPS, the Ground-Water Resources Program, and communities that are trying to mitigate against natural hazards.

Preservation of Geological and Geophysical Data and Samples — The Energy Policy Act of 2005, Section 351, calls for the NCGMP Federal Advisory Committee to write a report to Congress that addresses the need to preserve geological and geophysical data, samples, and core. This committee will also assess the needs of other Department's land management agencies in preservation issues through a survey questionnaire. In addition, the program will begin the process of consolidating and preservation paleontologic data and specimens at risk.

100th Anniversary of the 1906 San Francisco Earthquake — NCGMP will produce a number of important products summarizing major advancements in the understanding the tectonic history of the greater San Francisco region.

Missouri River Geologic Framework — This new project will focus on understanding the geology, hydrology, and ecology of the lower Missouri River from South Dakota to Iowa through cooperative studies with WRD and Biological Research Division. This area is part of the Missouri National Recreational River, which is managed by the NPS and who will use information provided by this project to manage the region and determine areas of additional land acquisition. In addition, Native American Tribes along the river, FWS, BLM, U.S. Army Corps of Engineers, and State and local agencies need this information to address ecologic, hydrologic, and habitat issues that have arisen from conflicting land-use demands.

Geology of Parks and Federal Lands of the Southwest — A new project, "Geology of parks and Federal lands of the Southwest," will conduct geologic mapping efforts in Death Valley National Park, Glen Canyon National Recreation Area, Grand Canyon National Park, Havasu National Wildlife Refuge, Kaibab National Forest, Kaibab-Paiute Indian Reservation, Lake Mead National Recreation Area, Mesa Verde National Park, Mojave National Preserve, Navajo Nation, Parashant National Monument, Pipe Spring National Monument, Vermilion Cliffs National Monument, and Wupatki National Monument.

Geologic Mapping and Hydrogeology of Crystalline Rocks — This new project will take knowledge gained about aquifer characteristics in bedrock from other regions of the Eastern United States and will modify and apply this understanding to parts of Connecticut, Massachusetts, New Hampshire, and New York that are experiencing rapid urban growth and resulting increased demand for potable ground water.

FY 2005 Program Performance Accomplishments

The accomplishments and outcomes listed below demonstrate the utility of USGS products that are counted under GPRA performance measures for (1) long-term data collections maintained/updated, (2) systematic analyses delivered to customers, (3) formal workshops or training provided, and (4) number of square miles of land that are geologically mapped each year. The first five accomplishments listed below represent the five systematic analyses that were used by NCGMP for FY 2005 GPRA results. NCGMP defines systematic analyses as the entire output of a project during its lifespan, which is summarized when the project ends.

Bedrock Regional Aquifer Systematics Study (BRASS) — Through close cooperation with the WRD, this project has improved understanding of the distribution and behavior of ground water in regions of the Eastern United States that are underlain by bedrock, with a focus on the Appalachians. The flow, storage, and chemical interaction of ground water in fractured-bedrock aquifers have been poorly known before this project. By coordinating geologic mapping and hydrologic investigations, the influence of different bedrock lithologies and structures on ground-water behavior and chemistry was documented, and conceptual models were developed. These models can then be extrapolated to larger areas to provide regional hydrogeologic frameworks.

Because of rapid urban development along the Eastern Seaboard, ground-water resources are threatened as never before by over consumption and the possibility of contamination. Planning agencies, which are faced with uncertainties about sustainable water supplies in regions underlain by bedrock, are actively seeking answers to water-supply questions. Debates have begun in many regions concerning the amount of new development that can be sustained by existing water supplies, and exactly how much ground water is available.

The BRASS project has obtained critical information from a number of cooperative studies in these diverse hydrogeologic environments. In New Hampshire, mapping of the crystalline bedrock, combined with water well-yield data, provided more accurate predictions of water-well yields and demonstrated that fractures in the rock can control directional trends in well yield. In Massachusetts, the interaction between crystalline-bedrock ductile and brittle structures has been shown to control the geometry of zones of contribution to municipal water-supply wells. In Virginia, mean well yield is influenced by crystalline rock type (i.e., where diabase bodies form barriers to regional ground-water flow).

National Park Service Support (NPS) — Because the NPS employs few geologists, it relies heavily on USGS for basic geologic research and geologic inventories (including geologic maps). The complexity of the two organizations requires a systematic effort by both to link NPS research needs with USGS research projects and to disseminate the research results widely and effectively. The Geologic Resources Division of the NPS coordinates park efforts and works with USGS projects to facilitate interagency coordination and information distribution.

The "Geology of National Parks" project has produced (1) geologic maps and reports, (2) research on the effects of coastal processes and climate change on fragile resources, such as wetlands and glaciers, and (3) interpretive products. Each project task has addressed a specific NPS request for assistance. For most tasks, NPS has provided either funding or "in kind" services. Geologic data have been provided in digital and standard formats to optimize use for resource management and inventories and for public outreach. Project geologists worked directly with NPS staff to increase awareness of potential links between USGS research and land and near-shore management issues and to encourage communication of geologic information to the millions of annual visitors to the Nation's parks.

This project has worked with the following park units: Delaware Water Gap National Recreation Area, Death Valley National Park, Devils Tower National Monument, Dinosaur National Monument, Golden Gate National Recreation Area, Grand Canyon National Park, Hawaii Volcanoes National Park, Joshua Tree National Park, Kaibab National Forest, Lake Mead National Recreation Area, Lassen Volcanic National Park, Mojave National Preserve, Mount Rainier National Park, Pipe Spring National Monument, Point Reyes National Seashore, Wrangell-St. Elias National Park and Preserve, and Yellowstone National Park.

Southern California Areal Mapping Project (SCAMP) — Through cooperation with the California Geological Survey, USDA, BLM, U.S. Marine Corps, and the San Bernardino Valley Municipal Water District, SCAMP has provided a geologic foundation for Southern California that has been used and will continue to be used to facilitate decision-making and land-use management related to a broad range of societal applications. The nearly 20 million people that live in Southern California all face a variety of challenges posed by the geologic setting they inhabit. These challenges include (1) earthquake hazards created by numerous active faults of the complex San Andreas Fault system, (2) ground-water availability and quality in a semi-arid setting where ground-water basins have complex geologic controls, and (3) mineral and energy resource utilization in a region where multiple land uses are in competition.

This project's objective has been to determine the geologic architecture and history of Southern California. The main effort has been the development of extensive digital geologic-map databases that describe the geologic setting and geologic history of Southern California. Incorporated into each database are value-added interdisciplinary data that include isotope geology and geochronology, regional geophysics and geochemistry, drill records, engineering properties, paleontology, geomorphology, and pedology.

The geologic-map databases typically are developed at 1:24,000 - scale and then synthesized into 30' x 60' quadrangles. Nearly 100 geologic maps have been published by this project.

Kentucky — This multi-year effort, conducted by the Kentucky Geological Survey through a series of STATEMAP projects, was based on a State mandate to convert all the State's 1:24,000 - scale geologic maps to digital form by the year 2005. This has now been completed. Through a previous cooperative effort with the USGS, Kentucky was in a unique position of having total geologic map coverage of the State at 1:24,000 scale. The next phase is to create a seamless spatial database of these maps and supporting data.

Kentucky's geologic maps have been and will continue to be used by land-use and transportation planners and disaster and emergency service personnel for making land-use decisions where seismic hazards, land development, natural resource use, and land conservation may be in conflict. For example, for two new planned interstate highways, geologic maps will be used to assist in route placement to avoid sensitive karst areas and liquefaction prone sections, to locate needed aggregate resources, and to educate the public.

Wisconsin — This 5-year effort, conducted by the Wisconsin Geological and Natural History Survey through STATEMAP projects, has focused on geologic mapping of the Quaternary deposits in the Fox River lowland. This glacial lake basin (Glacial Lake Oshkosh) is in a rapidly urbanizing region, and information about near-surface aquifers and aggregate resources was needed for the State's comprehensive planning initiatives. This lowland includes parts of 14 counties, and plans were developed to produce geologic maps at 1:24,000 scale of the entire region over a 6-year period. These maps will next be combined into three 1:100,000-scale geologic maps that will be part of a publication that explains the distribution of surficial materials, the subsurface stratigraphy, and the geological history of the region. In addition, there will be a scientific publication with a detailed description about various aspects of Lake Oshkosh.

Geologic Map and Report Production in FY 2005 — The NCGMP, through the USGS and its partners in 47 State geological surveys, published hundreds of peer-reviewed geologic maps and reports in high priority areas as determined by State Mapping Advisory Committees, Interior, and other Federal land management agencies, the Federal Advisory Committee, and customer forums. All geologic maps have multiple uses; however, the most important current uses deal with preserving the quality and quantity of ground-water resources and assisting in the understanding of and prediction of natural hazards, such as landslides, earthquakes, floods, and volcanoes.

New Geologic Map of North America — This map, which is the result of a cooperative effort by the USGS, Geological Society of America (GSA), Geological Survey of Canada (GSC), and the Woods Hole Oceanographic Institution (WHOI), also includes detailed features of the seafloor, including spreading centers, seamount chains, and subduction zones. An employee of USGS was one of two compilers for the on-land geology for this monumental effort that has occurred over the last twenty years. The USGS is now working on a digital version of the map. The USGS Central Region Earth Surface Processes Team Web site has an expanded description of the map at *http://esp.cr.usgs.gov/info/gmna/*.

In 2005, 124 projects were carried out in 47 States through the STATEMAP component of the program. More than 470 geologic maps, as pre-publication drafts, were delivered.

In 2005, 58 students working on 36 projects from 30 universities learned and applied geologic mapping techniques in 26 States through support by EDMAP. All of these student activities were coordinated with projects within the USGS and (or) State geological surveys. The students delivered 106 geologic maps that they used for various university projects, theses, and dissertations. Each year, the program reaches out to new geoscience departments to participate in the EDMAP component of the program. In 2005, five universities that had not previously participated applied for EDMAP grants. Also, to increase diversity in the program and geosciences as a whole, representatives of the program discussed future opportunities with Historical Black Colleges and Hispanic dominated programs. The program expects EDMAP proposals from these institutions in upcoming years.

Performance Overview

Measure	2005 Plan	2005 Actual	Change from 2005 Plan	2006 Enacted	2006 Change from 2005 Actual	2007 Request	2007 Change from 2006
Content and expanse of knowledge base: X% of surface area with temporal and spatial monitoring, research, and assessment/data coverage to meet land use planning and monitoring requirements **(SP)**	53%	53%	0	55%	+2%	57.5%	+2.5%
X% of geologic investigations in National Park Service (NPS) units that are cited for use by the NPS within three years of delivery **(PART)**	Baseline	80%	0	80%	0	80%	0
X% of EDMAP students that work on subsequent geoscience degrees or obtain a job in a geoscience field **(PART)**	95%	94%	0	95%	+1	95%	0
X% of U.S. with geologic maps that are being integrated into ground-water availability status and trends to support resource management decisions **(PART)**	5%	5%	0	6%	+1%	8%	+2%
# of counties or comparable jurisdictions that have adopted hazard mitigation measures based in part on geologic mapping and research **(PART)**	10	10	0	12	+2	14	+2
# of annual gigabytes collected	200	110	-90	200	+90	200	0
# of cumulative gigabytes managed	1,040	950	-90	1,150	+200	1,350	+200
# of systematic analyses and investigations delivered to customers	5	5	0	9	+4	9	0
# of formal workshops or training provided to customers (instances/issues/events)	10	10	0	10	0	10	0
# of hours for fieldwork, compilation, and publication of a typical geologic map **(PART Eff)**	3,070	3,070	0	2,980	-90	2,890	-90
# of State Geological Surveys that add geologic map information to the NGMDB **(PART)**	48	48	0	49	+1	50	+1
# of EDMAP students trained each year **(PART)**	60	62	+2	60	-2	60	0

This page intentionally left blank.

Activity: Geologic Hazards, Resources, and Processes

Subactivity: Geologic Landscape and Coastal Assessments
Program Component: Coastal and Marine Geology

Program	2005 Actual	2006 Enacted	2007 Fixed Cost & Related Changes [a/]	2007 Program Changes	2007 Budget Request	Change from 2006
Coastal and Marine Geology Program	37,457	39,285	+499	-391	39,393	+108
Total Requirements $000	**37,457**	**39,285**	**+499**	**-391**	**39,393**	**+108**
FTE	***236***	***239***	***-7***	***0***	***232***	***-7***

[a/] Fixed cost increases for this activity total $713 of which $499 will be budgeted and $214 will be absorbed. FTE changes result from rebalance and renew skills mix to gain functional and position flexibilities identified through an extensive workforce planning effort (page H-2).

Summary of FY 2007 Program Changes for Coastal and Marine Geology Program

Request Component	Amount	FTE
Program Changes	0	0
• Multi-Hazards Initiative	+200	0
• Florida Shelf Research	-591	0
TOTAL	**-391**	**0**

Justification of 2007 Program Changes

The 2007 budget request for the Coastal and Marine Geology Program is $39,393,000 and 232 FTE, which is a net program change of -$391,000 and 0 FTE.

- **Integrated Multi-Hazards Demonstration Project (+$200,000 and 0 FTE) —** The Integrated Multi-Hazards Demonstration Project in Southern California, part of a multi-year initiative, will focus on integrating information and products about multiple hazards to improve the usefulness of this information in reducing loss of life and property from natural hazards, which supports the end outcome goal of "Protect lives, resources, and property" under the mission goal of Serving Communities. The development of integrated databases and the enhancement of IT systems to track multiple hazards will facilitate more rapid communication and response to the user community, regardless of the timeframe of a natural disaster.

  With $200,000 of requested funds and $200,000 from cost savings, CMG will develop models and tools to assess coastal vulnerability to extreme storm events, in partnership with the State of California and the U.S. Army Corps of Engineers. CMG will continue collaborative activities with the National Tsunami Hazard Mitigation Program and the University of Southern California to advance tsunami modeling and inundation mapping.

- **Florida Shelf Research (-$591,000 and 0 FTE) —** The requested decrease of $591,000 will eliminate efforts funded in FY 2006 by Congressional earmark to support geological and environmental characterization of the inner shelf region of Florida. Efforts will be ended with the State of Florida and the University of South Florida (USF) to provide environmental characterization for the management of submerged resources; to develop collaborative mapping programs, including inventory, synthesis, and management of existing data and new data collection. The USGS will also not continue participation in the Gulf of Mexico Alliance action plan.

Program Performance Change Table

Total Performance Change		*+2 systematic analyses & investigations delivered to customers*			
	A	*B*	*C*	*D= B+C*	*E*
	Overall Performance Changes from 2006 to 2007				
Measure	**2006 Enacted Performance**	**2007 Base Performance Level**	**2007 Impact of Program Change on Performance**	**2007 Budget Request Performance**	**Out-year Impact of 2007 Program Change on Performance**
systematic analyses & investigations delivered to customers	**8**	**8**	**+1**	**9**	**+1**

Column B: The performance level expected to be achieved absent the program change (i.e., at the 2006 request level plus/minus funded fixed cost/related changes); this would reflect, for example, the impact of prior year funding changes, management efficiencies, absorption of fixed costs, and trend impacts.

Column E: The out-year impact is the change in performance level expected in 2008 and Beyond of ONLY the requested program budget change; it does not include the impact of receiving these funds again in a subsequent outyear.

Program Overview

The USGS Coastal and Marine Geology Program (CMGP) maintains and applies capabilities in marine geology, geophysics, geochemistry and oceanography to provide information and research products on geologic conditions and processes critical to the management of the Nation's coastal and marine environments. The CMGP addresses a broad suite of national issues in the thematic areas of natural hazards, environmental quality and human health, and natural resources requiring credible and objective scientific data, information, and understanding. As the primary Federal marine geologic research, information and knowledge provider the CMGP develops, maintains, and delivers information, technologies and products that provide Federal, State, and local agencies and the public the authoritative, scientific basis for regulating, managing, and protecting the Nation's coastal and marine resources and communities.

Program objectives spanning the thematic program components include:

- Characterization of geological setting, processes, and change at regional or system scales as required to provide the framework understanding for management and policy in response to a broad range of issues — Framework development and synthesis of geologic information and understanding is the foundation for, and an integral part of, USGS research activities to understand and model the physical processes that control the status, function, and evolution of coastal and marine systems and the resulting

environmental, hazard, and resource implications for human and environmental health, economic growth, public safety, and resource use, protection, and management.

- Development of regional and national hazard, resource and environmental assessments of coastal and marine condition, change and vulnerability to human and natural processes—Regional geological framework development and topical research on geological processes provides the foundation for development of assessment products.
- Development of broadly applicable models of coastal and marine evolution and change—Geologic framework development and process understanding provides the basis for development and evaluation of hindcast and forecast models. Model application to specific issues and settings, expanding the range of relevant applications, is supported by regional information development and targeted process studies.

Overall direction of CMGP activities is established by a 5-Year Plan. The plan reflects internal and external inputs such as the USGS and Department's strategic plans and periodic reviews of the program and program elements by the National Academy of Sciences (NAS). The CMGP is also broadly directed by the objectives of the National Coastal Program Plan (2003) submitted to Congress by the USGS. The overall goals of this program are to (1) provide the scientific information, knowledge, and tools required to ensure that land and resource use decisions, management practices, and future development in the coastal zone and adjacent watersheds can be evaluated with a complete understanding of the effects on coastal ecosystems and communities and (2) provide a full assessment of the vulnerability of coastal and marine ecosystems and communities to natural and human-driven changes.

CMGP program objectives and activities support the Department's Serving Communities strategic goal to advance knowledge through scientific leadership and inform decisions through application of science. GPRA targets for project and program outputs, including analyses, models, information resources, and workshops to transfer information and capabilities are established as part of the program planning process and performance is evaluated quarterly and annually. End outcome measures for which targets are set relate to the soundness of methodology, accuracy, and reliability of the science and to the accessibility and satisfaction with products and services. In support of the intermediate outcome to improve the information base, information management, and technical assistance, measures regarding the content and expanse of the knowledge base and the quality of studies are tracked. Outputs associated with these intermediate outcome measures include the maintenance and update of long-term data collections, the completion of systematic analyses or investigations for customers, and formal workshops or training provided to customers.

In pursuit of these goals the CMGP develops and implements national, regional, and topical studies that advance knowledge relevant to national issues. Program activities are developed in response to long-term program objectives, partner needs, and potential to leverage USGS resources with partner resources to effectively meet shared objectives. Leveraging or cost-sharing provides partners access to unique USGS capabilities while enhancing the cost-effectiveness of USGS mission activities. Historically partners provide 7 to 10 percent of funding for program activities, with significant in-kind contributions additionally provided through collaborative studies developed to respond to critical needs identified by stakeholders, ensuring that study products have immediate application while advancing long-term program objectives. Regional studies are designed to provide essential framework information to Federal, State, and local managers with respect to specific issues/topics as well as providing broadly applicable information products. Topical studies, often implemented within regional efforts, are designed to develop fundamental information that has broad applicability. Synthesis of regional and topical

studies provides the basis for national assessments and products. Project work plans submitted to the CMGP are reviewed annually by internal and external scientists and managers knowledgeable in the relevant area of proposed and on-going work. Reviewers provide guidance that informs program and project directions and implementation.

The CMGP supports research projects implemented primarily by the Coastal and Marine Geology centers in Woods Hole, MA; St. Petersburg, FL; and Menlo Park and Santa Cruz, CA. Additional resources are provided to other USGS science centers and external cooperators (academic, State) to ensure needed capabilities are effectively provided.

Use of Cost and Performance Information

Gathering ABC information at the task level is new in the Coastal and Marine Geology Program for FY 2006. After several years of tracking this valuable detailed information, USGS will be better placed to track and analyze important trends in Program funding and expenditures, as well as scientific emphases within each Program and links to Department's goals and priorities.

FY 2007 Program Performance Estimates

The 2007 budget request for the Coastal and Marine Geology Program is $39,393,000 and 232 FTE, which is a program changes of -$391,000 and 0 FTE. Planned accomplishments and outcomes are consistent with targets under the Department's Serving Communities strategic goal to advance knowledge through scientific leadership and inform decisions through the application of science. GPRA targets for "analyses delivered" will include products resulting from base budget increases in FY 2006 (Tsunami Hazards) and FY 2007 (Integrated Multi-Hazards Demonstration Project in Southern California). These expanded activities will support both the USGS Hazards Initiative and the Administration's Tsunami Risk Reduction plan.

In FY 2006 the CMGP is scheduled to be evaluated by OMB through PART review. The CMGP will work closely with bureau leadership and OMB to develop more effective measures of program performance that more accurately reflect the application and impact of CMGP products and the effectiveness of CMGP operations.

Program performance in FY 2007 will reflect funding changes as requested in FY 2007 and as provided in FY 2006. FY 2007 budget increases in support of the USGS Integrated Multi-Hazards Demonstration Project in Southern California will result in delivery of one additional hazard assessment. FY 2006 budget increases for tsunami hazard investigations will also contribute to development of additional analyses related to Tsunami Source Assessment. Initial products are expected in FY 2007 from the Puget Sound Ecosystem Study with enhanced funding provided in FY 2006.

North-Central Gulf of Mexico Studies: Science for Ecosystem Restoration and Increased Disaster Resilience in the Aftermath of Hurricanes Katrina and Rita — In FY 2007 CMGP will apply resources made available from studies nearing or reaching completion to address Administration, bureau, and program priorities. In FY 2006 a comprehensive USGS planning effort will identify critical efforts needed to provide the science base for restoration and recovery of the Gulf of Mexico region in the aftermath of Hurricanes Katrina and Rita. The CMGP will, in FY 2007, redirect funds in response to collaborative science planning, engaging other Federal, State, and academic partners, to address the system-scale response of the North-Central Gulf of Mexico coastal region to natural hazards and human impacts. Efforts will address immediate science and information needs for on-going restoration, long-term needs for regional restoration, and will represent the next stage in implementation of the ecosystem science goals of the

USGS National Coastal Program Plan. New performance goals, consistent with PART measures established in FY 2006, will be developed.

Initial efforts will rely on established and unique CMGP capabilities in geologic mapping, coastal characterization, and coastal response modeling. Prior to and subsequent to the landfall of hurricanes Katrina and Rita the USGS, in collaboration with NASA and the USACE, completed high resolution airborne LiDAR elevation mapping of the hurricane impacted regions. These data, and coastal response models developed as part of on-going program studies, will provide the basis for assessing impacts and evaluating coastal response. Data collection, analyses and modeling will proceed with the objective of improving assessments of future hazard vulnerability and assessments of restoration effectiveness for hazard mitigation.

The Tampa Bay Ecosystem Study will complete major data collection efforts in FY 2006. Resources from this study will be redirected to support multidisciplinary efforts in the North-Central Gulf of Mexico, including integrated data management and delivery enhancing information models developed within the Tampa Bay Study and across USGS programs.

Coastal and Ocean Mapping: Effective Deployment of Core CMGP Capabilities — The CMGP is the primary Federal provider of expertise and competencies required to map and interpret coastal and ocean geologic structure and change; providing essential information on the form, composition, and alteration of the physical environment required to assess hazard vulnerability, identify critical habitats, locate non-living resources, and manage coastal and marine living and non-living resources. Mapping is thus the basis for long-term CMGP efforts to describe, understand, and model coastal and ocean systems and mapping products have immediate application to a wide range of ocean and coastal resource management needs. The USGS will continue to lead efforts, begun in response to the Administration's Ocean Action Plan (OAP), to ensure that Federal and federally funded ocean and coastal mapping activities are coordinated, prioritized, and effective. Beginning in FY 2006 the CMGP will support interagency efforts through the Interagency Working Group on Ocean and Coastal Mapping (IWG-OCM) of the NSTC Joint Subcommittee on Ocean Science and Technology (JSOST) to meet these objectives set forth in the OAP. Initial efforts will include development of an inventory of all Federal and federally supported mapping programs and activities.

Efforts to ensure the more effective application of marine mapping data and information will continue. The USGS is working with the private sector and the American Geological Institute (AGI) to preserve existing offshore seismic data and to ensure that it is available to the research community. Existing data resources are irreplaceable, in danger of being lost, and will provide the basis for future investigations leading to, for example, improved understanding of hazard potential across the U.S. marine realm. USGS researchers are utilizing the expanded information resources provided by this collaborative effort to identify and map active and dormant faults offshore to evaluate both tsunami and earthquake hazards. This work will continue as part of USGS multiprogram efforts in support of the Energy Policy Act of 2005 leading to creation of a Preservation of Geological and Geophysical Data Program with funding provided in FY 2007 to the Energy Resources Program.

Environmental Quality and Human Health — These studies address topics such as pollution and waste disposal, characterization of coastal and offshore biological habitats, understanding of habitat loss, coral reef health, marine sanctuaries and reserves, and environmental change. Results from these efforts provide an understanding of geologic processes needed to predict natural and human-related variability and to evaluate the influence of human activities on coastal, estuarine, and offshore regions. Federal and State agencies and private groups

routinely use the regional broad-based and long-term science information produced by this USGS work to make land-management decisions.

National Coastal Efforts: Science for Sustaining and Restoring Coastal Resources — In accordance with the goals of the bureau National Coastal Program Plan, work is planned for several high priority areas around the Nation including the mid-Atlantic Coastal Plain, Chesapeake Bay, Northern Gulf of Mexico, Puget Sound, and Tampa Bay:

- In FY 2007, CMGP will provide support to Eastern Region priorities in the mid-Atlantic Coastal Plain by examining the flux of groundwater to the mid-Atlantic Coastal Plain. This effort will allow for informed decision-making that balances human use and ecosystem requirements by examining the role groundwater and associated nutrients play in coastal eutrophication in North Carolina estuarine systems. Continued efforts in the Chesapeake Bay will address the impact of sediment input and mobility associated with natural and human processes on water clarity and ecosystem health.
- In southern Louisiana, the USGS has engaged with partners (e.g., University of New Orleans (UNO), Louisiana Department of Natural Resources, and the U.S. Army Corps of Engineers (USACE) to write the Near-Term Louisiana Coastal Area (LCA) plan for restoration activities associated with wetlands and barrier island loss. CMGP efforts will address the nature and magnitude of subsidence and barrier island loss as critical inputs to assessing the viability and success of restoration projects.
- Continuing implementation of the USGS National Coastal Program Plan, the CMGP is partnering with other Federal, State, and regional agencies in Washington State as part of the Puget Sound Nearshore Ecosystem Restoration (PSNER) group to provide the knowledge and information required to rehabilitate Puget Sound ecosystem health and prevent additional damage as populations and human impacts in the basin continue to increase. Utilizing enhanced funding provided beginning in FY 2006, the CMGP supports research as part of a USGS multidisciplinary effort (FY 2005–10) designed to (1) evaluate the probable effects of the Elwha dam removal, planned for FY 2008, on nearshore habitats, (2) understand the physical and ecological interactions within the highly modified Skagit Delta, and (3) provide information on beach, cliff, and nearshore sediment dynamics as they relate to critical nearshore habitats.
- Tampa Bay is environmentally threatened by continued growth and development throughout the Bay watershed and by specific activities including construction of an underwater gas pipeline, construction and operation of a major desalinization plant, three expansions of port facilities, and dredging of Tampa Bay to support commercial vessel traffic. The USGS Tampa Bay effort to address these critical issues will continue through FY 2008. Major goals are to (1) assess the geological, ecological, and water quality history of the Bay, (2) develop monitoring programs to assess the current health of the bay, and (3) provide the scientific understanding and tools to evaluate future changes in the Bay ecosystem. The USGS is modeling the structural setting of the historic Bay to provide the basis for assessing change; identifying, quantifying, and modeling the impacts of urbanization on benthic habitat distribution, health, and restoration; and developing and maintaining a decision support system to facilitate science information exchange. With the completion of major data collection efforts, reduced funding will be provided in FY 2007 to synthesize previously developed information and to develop a Tampa Bay Integrated Coastal Model (TBICM) to provide tools to assess the impacts of development and structural changes on water quality, habitat, ecological health, and public safety. Funding in FY 2008 will be provided for final syntheses and product development.

Coral Ecosystem Research — The USGS, as the Department's science agency, is uniquely suited to undertake coordinated multidisciplinary research on coral reef issues. Two Executive Orders (EO 13089 and 13158) established a Coral Reef Task Force and a resulting plan to conserve coral reefs. All Federal agencies are required to protect coral reefs and associated habitat. NOAA and the Department have identified coordinated action as essential to meet the Nation's coral reef conservation needs.

Responding to needs identified by the U.S. Commission on Ocean Policy and the Coral Reef Task Force, a bureau plan for coral ecosystem research will be completed in FY 2005, with final review in FY 2006, and will guide bureau research over the next 5 years. The plan identifies four major areas where USGS research can have an impact: land-based pollution, global climate change, ecological integrity, and remote and deep coral ecosystems. CMGP will focus on (1) identifying the sources, transport pathways and biologic and physiologic impacts of land-based pollution on U.S. coral reefs with the objective of providing the science base for management of watershed and land use activities (mitigation) and developing protocols for monitoring land-use impacts on coral reefs, and (2) building models to integrate remote sensing data with experimental results of reef response to various stressors including global climate change. The expected output will be tools for assessing coral reef response to environmental change for application by the primary Department stewards of the Nation's coral reef resources, NPS, FWS, and MMS, for parks, refuges, and outer continental shelf (OCS) lands under their respective jurisdictions.

Benthic Habitat Characterization — Improved understanding of seabed character and processes has immediate application to fisheries management, designation of Marine Protected Areas (MPA), assessment of mineral resources, and use of the seabed for pipelines, cables, wind farms, and waste disposal. In particular, geologic and seabed mapping data developed by the CMGP support efforts to characterize benthic habitats (seafloor and lake bottom areas) and link geology and geologic processes to the distribution, abundance, and diversity of marine habitats. Production of interpretive maps, developed in collaboration with NOAA, NPS, and academic partners, showing the distribution of seabed materials, seabed dynamics, and biologic habitats supports effective management of the Nation's marine lands for diverse uses.

This work is addressing areas identified as high priority by the NPS, MMS, National Marine Fisheries Service (NMFS), National Marine Sanctuaries (NMS), and coastal States including the Santa Barbara Channel (California) and the Gulf of Maine region managed jointly by the United States and Canada. The New England Fishery Management Council and NMFS use results to manage the fisheries and habitats of the region and USGS scientists serve as technical advisors to the Council's Habitat Committee. In FY 2007 USGS scientists will continue to work with Federal partners to provide baseline resource characterization in priority locales, while pursuing research aimed at better understanding the physical requirements for healthy and sustainable resources.

Contaminated Sediments in California's Urban Ocean — The CMGP is working with the EPA and local agencies to design the most effective remediation plan to mitigate the effects of DDT-contaminated sediment on the Palos Verdes shelf. Large cooperatively developed databases of oceanographic observations are being used to characterize near-bed conditions and processes in order to model the erosion, transport, and fate of shelf sediments, including both DDT-affected sediments and clean capping material. The CMGP is continuing active participation in the multi-agency Bight '03 effort to develop sediment and contaminant budgets for the greater Los Angeles area. Samples are analyzed for major oxides and chromium, sulfur,

carbon and clay mineralogy. In addition, the spatial distribution of microorganisms in the region offshore of Southern California impacted by the Orange County Sewage outfall will be determined and compared to baseline conditions from sampling in the 1960s. In an effort to better understand the processes by which contaminant are mobilized and transported the CMGP will also participate in a field program coordinated by the Southern California Coastal Ocean Observing System (SCCOOS) to study cross-shelf transport of sediments and pollutants in Orange County.

Natural Hazards and Public Safety — These studies provide geologic information for (1) understanding and predicting coastal erosion, sea-level rise, and storm impacts, (2) identifying and evaluating offshore earthquake and tsunami hazard potential, and (3) evaluating submarine and coastal landslide hazards. As the population growth along the Nation's coasts continues, accurate scientific understanding of the dynamics of coastal systems is needed to address issues relating to public safety, recreational and commercial use, and resource management. CMGP supported efforts, focusing on geologic hazards in coastal and marine regions, will be integrated into broader bureau efforts to provide enhanced multi-hazard information across the suite of hazards and locales impacted.

Coastal and Marine Catastrophic Hazards: Earthquakes, Tsunami, Coastal and Marine Landslides — In FY 2006 the CMGP initiated a coordinated effort to effectively address these related hazards consistent with the developing multi-hazard initiative of the USGS. This effort builds on prior hazard-specific studies supported by the CMGP through FY 2005. Within this framework the CMGP will provide the marine geologic and geophysical expertise required to supplement broader USGS and other agency efforts that do not cover the unique (process and operational) aspects of hazards in coastal and marine realms. Application of these competencies is an essential element of a coordinated effort to understand hazards and to develop scientifically sound assessments of the likelihood of loss of life, infrastructure, and property from catastrophic geologic events associated with coastal and marine geologic processes.

This effort builds on prior CMGP research efforts and demonstrated experience interacting with groups tasked with making formal hazard assessments and providing products needed in a timely manner. Current efforts are collaborative with the Southern California Earthquake Center (SCEC), Working Group on California Earthquake Probabilities (WGCEP), the National Tsunami Hazard Mitigation Program (NTHMP), FEMA, NOAA and USGS Earthquake and Landslide Hazard Programs. Planned activities for FY 2007 will provide:

- Timely information on the location, geometry, extent, and slip history of offshore faults that threaten major metropolitan areas along the West Coast. This work will be substantially enabled by analysis and interpretation of the seismic-reflection data library expanded through acquisition of existing private-sector data in collaboration with industry and the American Geophysical Institute. Analyses will result in improved modeling of potential fault motions and resulting earthquake and tsunami hazards; providing the basis for improved forecasts of earthquake and tsunami probabilities in the coastal and marine realm.
- Geological characterization and geotechnical models related to landslide, debris flow, and liquefaction potential in coastal and marine sedimentary deposits. Research will address objectives to understand the influence of (1) landscape form, (2) material properties and structural discontinuities, and (3) tectonics, seismicity, and uplift patterns on landslides along the Pacific Coast. Advanced non-invasive methods developed by

the CMGP will be applied to characterize ground motion amplification and ground-failure potential in the urban and nearshore areas of California, Oregon, and Washington.

- Improved assessments of tsunami source potential for the development of improved tsunami warning systems for the Pacific, Atlantic, and Caribbean regions of the United States. Existing data will be analyzed to identify potential for tsunami generation by offshore landslides. Research on tsunami deposits will lead to improved methodologies for estimating tsunami inundation recurrence and magnitude. Numerical modeling will improve understanding of earthquake and landslide mechanics in support of improved tsunami source assessments.

Caribbean Tsunami Hazards — Increased funding provided to the CMGP in FY 2006 will support a multi-year effort to improve regional assessments of tsunami hazard potential in the Caribbean (Puerto Rico and Virgin Islands) by developing enhanced geological and geospatial information. The proposed 5-year effort will culminate in an improved hazard assessment for the region as a model for future regional tsunami hazard assessment efforts elsewhere. Activities will include (1) coordinated development of source potential information from marine geophysical studies, (2) modeling of tsunami propagation and runup, (3) interpretation of onshore tsunami deposits to characterize hazard potential, and (4) development of improved digital elevation models based on existing elevation data. The study is coordinated with broader hazard assessments (USGS Earthquake Hazards Program) and multi-agency tsunami hazard assessment programs (NOAA) and the University of Puerto Rico Seismic and Tsunami Hazards Center. Short-term objectives include provision of information for deployment of NOAA observational buoys as part of an enhanced tsunami warning system and development of improved inundation forecasts in the event of earthquakes from various sources.

National Coastal Change Hazards — The last national compilation of historical shoreline change was completed by the USGS more than 30 years ago. Since that time, methods of obtaining, analyzing, and displaying shoreline data have substantially improved, and over 30 years of coastal change has occurred. The primary objectives of this study are to (1) determine and quantify the relative vulnerabilities of U.S. coastlines to coastal change hazards, (2) improve understanding of the processes contributing to coastal change hazards, (3) enhance implementation of probabilistic assessments of hazards and vulnerability, and (4) enter into strategic partnerships to facilitate hazard data dissemination. The three themes being emphasized include (1) monitoring hazards using airborne sensors; e.g., LiDAR, (2) understanding processes, particularly those that facilitate assessment of long-term and storm-induced coastal change hazards, and (3) data integration and dissemination using database and GIS technology.

The baseline map information being produced provides an outstanding assessment of pre-storm condition throughout the country. Subsequent post-storm LiDAR missions (e.g., Hurricanes Charlie, Frances, Ivan and Jeanne in FY 2004, Hurricanes Dennis, Katrina, and Rita in FY 2005–06) allowed rapid quantification of storm-induced changes. Pre-storm data, including assessments of storm inundation potential, were made available to researchers, local users, and coastal zone managers prior to landfall. Continuing efforts to maintain up-to-date coastal map products and assess coastal change are being pursued with NASA, NOAA, and the USACE. These collaborative efforts ensure comprehensive data collection that effectively applies resources to meet multiple agency requirements and future work will address the development of products and tools that support the breadth of applications at all levels.

Regional Coastal Erosion Studies — Providing the regional understanding of geology and geologic processes required to manage shorelines subject to chronic erosion and catastrophic storm impacts is a long-term objective of the CMGP. Through such studies the CMGP provides the regional context for development of large-scale models of coastal change that support regional and smaller-scale decision-making by State and local coastal zone managers. The CMGP is currently completing two such studies in North and South Carolina and is planning a future enhanced study to build upon the information and understanding developed therein. As the existing regional studies come to completion the CMGP will work with stakeholders to identify optimum opportunities to advance broadly applicable knowledge of coastal change. The lessons learned through these targeted regional efforts have clarified the links among (1) observed historical patterns of coastal erosion, (2) the processes (storms, sediment transport, and inlet formation) that drive shoreline change and (3) the underlying controls exerted by the geologic setting and history of the study areas. In response to increasing costs and resource limitations the CMGP will only support one regional erosion study from FY 2007 forward.

North Carolina — Numerous hurricanes have impacted North Carolina in recent years, including Hurricane Isabel in September 2003 and Alex in August 2004, resulting in severe coastal and inland flooding, erosion of hundreds of kilometers of shoreline, damage or destruction of thousands of homes, and disruption of transportation arteries. These impacts to the coastal zone occur against a backdrop of continued sea-level rise, chronic erosion, and the likelihood that we are entering a period of higher hurricane risk. The North Carolina coast attracts significant tourism to its parks, beaches, and national seashores. Coastal development continues to increase throughout the region, tourism is a major economic factor, and the coastal ocean supports a local fishing industry; all of which are impacted by coastal change. The USGS, the North Carolina Geological Survey, East Carolina University, and other academic investigators are collaborating to map and understand the regional coastal system of northern North Carolina in an effort to relate the geologic history, setting and physical processes to coastal change. Among the issues being addressed are shoreline erosion, storm dynamics and coastal system response, location of sand resources for beach nourishment, records of climate and sea-level change, and habitat evolution across the nearshore, barrier islands, and estuaries.

In FY 2004, the project completed its 4-year effort to collect geophysical data for the inner continental shelf from Virginia to Cape Lookout, and the corresponding backbarrier estuarine system. Work in FY 2005 and FY 2006 will measure and model shoreline response to severe storms, thus providing information essential for utilizing and managing this extremely dynamic coastal system, and furnishing a sound scientific basis for policy and regulatory decisions. Findings from this study are being used by the NPS to assess the impacts of proposed coastal mitigation strategies and transportation corridor planning, by the FWS to evaluate the environmental consequences of inlet abandonment, and by the USACE and NC Department of Transportation to refine sand resource exploration strategies. The NPS, FWS, USACE, and several State agencies are presently debating a number of issues related to mitigation of coastal erosion and inlet dynamics in the study area. This project provides a critical foundation of objective information and scientific analyses that serves all stakeholders. The North Carolina study will focus on synthesis of geologic and process information developed within this project in FY 2007.

South Carolina — Much of the South Carolina coastline is heavily developed, supporting large populations and infrastructure, and robust commercial and tourism industries. The continued success of these coastal economies is closely related to the health of local shorelines, which

mitigate the potential for property loss and damage associated with coastal erosion and severe storm events. The USGS, the NOAA Sea Grant Consortium, the State of South Carolina, several university partners, and the USACE, Charleston District are cooperating to provide a sound scientific understanding of the factors that control coastal erosion, sediment availability and transport, habitat distribution, and vulnerability to coastal change along coastal South Carolina. The main objectives of the study are to (1) evaluate the role that the geologic framework plays in the evolution of the coastal system, (2) assess sediment distribution and the mechanisms and pathways by which sediment is transported, and (3) develop a conceptual sediment budget, based upon geologic mapping and observations of shoreline erosion/accretion rates, that will be tested and supplemented by quantitative measurements of the physical processes that drive inner-shelf circulation and sediment transport.

The South Carolina Coastal Erosion Study will be largely completed in FY 2006 with provision of map, interpretive, and research products that define the geologic setting and history, sediment availability, and processes that result in erosion and storm-driven change. All data and interpretations will be synthesized in conceptual models that combine the roles of oceanographic processes and antecedent geology in controlling coastal evolution and modern beach behavior. Modest efforts in FY 2007 will complete final products and provide the framework for future program planning of studies to advance understanding of the processes that control the evolution of sedimentary systems in the region and nationally.

Subsidence and Fault Activation in Louisiana — Nowhere are the impacts of natural and human-induced change on coastal resources more dramatically apparent than in coastal Louisiana. Loss and alteration of barrier islands, bays, and coastal marshes continue to impact public safety as well as the economic, cultural, and environmental health of the region. More than $150 billion worth of municipal and industrial infrastructure is at risk. Over 900,000 acres of wetlands and protective barrier islands have been lost since the 1930s, with land-loss rates as high as 25,600 acres per year as recently as the 1970s. Natural processes resulting in high rates of sea-level rise and subsidence are exacerbated by human alterations of the Mississippi River and subsidence associated with hydrocarbon and ground water withdrawal. Louisiana's low-lying coastal resources, infrastructure, and population centers are increasingly at risk to increased flooding, land-loss, and storm impacts. USGS programs are providing assessments of risk, documenting historic and on-going land-loss and subsidence and contributing to the Louisiana Comprehensive Area plan for restoration efforts in cooperation with the UNO, Louisiana State University, Tulane University, the Louisiana Department of Natural Resources and Federal partners, including the USACE.

A series of USGS studies in collaboration with the USACE and UNO have provided valuable insights into the processes driving subsidence and sea-level rise within the Mississippi River delta plain. Recent USGS investigations have focused on wetland subsidence and fault activation induced by oil and gas production. Wetlands subsidence is shown to be significantly accelerated in areas of persistent hydrocarbon production. The reductions in elevation are sufficient to cause dramatic changes in the affected wetland ecosystems.

The USGS and UNO are coordinating efforts to develop a comprehensive understanding of coastal vulnerability in this rapidly changing coastal setting to both human-induced and natural subsidence, including plans to place site-specific subsidence investigations into the broader regional context of sea-level rise and storm hazards. In FY 2006 and FY 2007, modeling efforts are being extended to incorporate the regional effects of natural consolidation and subsurface faulting on subsidence. State and Federal natural resource agencies responsible for flood control, wetland protection, and coastal restoration are using the study's products in their

planning and regulatory activities. Study products will aid in identification of critical areas at risk and in assessing the feasibility and effective life of restoration and mitigation efforts. Users will include Federal (FWS, USACE) and State (Louisiana Department of Natural Resources) agencies, as well as joint State/Federal entities developing restoration plans for coastal Louisiana.

California Urban Ocean Sediment Management — The CMGP is working with Federal, State and local partners that comprise the California Sediment Management Workgroup. This group is focused on studies of coastal change; which can result in substantial property loss for Federal, State, local and private landowners and economic losses for public and private sectors. Specific field investigations will target the Santa Barbara-Ventura coastline and the San Francisco Bight. Investigations will include high-resolution seafloor mapping, oceanographic instrument deployments, documentation of sediment flux, and sediment transport modeling. This work will help assess local sand availability as well as internal variability in the coastal environment, including beach, nearshore, and offshore variability in physical processes, sediment character, and transport. Information is being used for a variety of sediment management issues including design of erosion mitigation strategies, identification of sand resource potential for beach nourishment, storm hazard assessments, forecasting coastal change, and planning for maintenance (dredging and disposal) of navigational channels. Work is also underway to evaluate the transport and fate of fine sediments discharged into California coastal waters. Preliminary analyses show that a large gradient exists in the timing of fine sediment production from northern to Southern California and that urban areas have significantly altered sediment discharge.

Natural Resources — These studies provide information on the location, distribution, quantity, and quality of fresh water and mineral and energy resources in coastal and marine environments and the potential impacts of resource use and extraction. Increasing demands on ground- and surface-water resources require improved understanding of the interaction of hydrologic and geologic systems in coastal regions and the environmental impacts of resource use and modification. Understanding the distribution of sand and gravel resources is critical to assessing the resource potential and the impact on sedimentary systems and coastal habitats of resource development.

Ground-water Resources are critical to coastal communities and the health of coastal habitats. In the mid-Atlantic region, USGS scientists have been investigating delivery by direct ground-water discharge of excess nutrients from fertilizer and septic systems to coastal bays in the Delaware-Maryland-Virginia (Delmarva) Peninsula. Collaborators and stakeholders include EPA, Coastal Intensive Site Network (CISNet) consortium, NPS, State agencies, universities, marine laboratories, and citizens' groups. USGS investigators have shown that ground water may influence much larger areas of the coastal bay systems than previously thought. Study findings will inform future land and resource use decisions and nutrient management strategies in Delmarva watersheds. CMGP has expanded efforts from the Delmarva Peninsula to Pamlico Sound, NC; and to New England, including Cape Cod National Seashore, MA. Efforts in FY 2006 and FY 2007 will be carried out in Chincoteague Bay (Delmarva) and Florida. These sites were chosen to represent the variability of ground water discharge in settings typical of the Atlantic coast. Studies will yield information necessary to improve hydrologic models, quantify sustainable rates of ground water withdrawal, and determine the importance and biological impacts of nutrient fluxes from ground water into estuaries.

Sand Resources — Coastal erosion and land loss, resulting from complex natural processes (i.e., storms, sea-level rise, sediment starvation) and man-made alterations (i.e., dams,

dredging, coastal engineering structures), are pervasive along coastal regions. Beach nourishment is increasingly viewed for developed coasts as a cost-effective and environmentally sound method of mitigating coastal erosion, reducing storm and flooding risk, and restoring degraded coastal ecosystems. For beach nourishment to be viable, however, large volumes of high quality sand are necessary and must be located close to the intended project beaches. Offshore marine sand bodies are often the sole sand source alternative for beach nourishment.

Completed studies in Long Island and continuing regional studies in Louisiana, South Carolina, and North Carolina are providing regional-scale assessments of the availability of offshore sand and gravel resources suitable for beach nourishment. Historic data, combined with the results of regional studies, are leading to the development of a consistent national assessment of sand and gravel resources around the United States. USGS scientists will synthesize, disseminate, and map available coastal sediment and geologic framework data from the USGS and cooperating external organizations. Efforts in FY 2005 and FY 2006 focus on continued population of a unified relational database for sediments in partnership with MMS, NOAA, USACE, the Institute of Arctic and Alpine Research/Colorado University, the UNO, and several coastal States. FY 2006 and FY 2007 activities will emphasize identifying and characterizing potential Louisiana sand resources for barrier island restoration. The long-term goal (FY 2006 and beyond) of this project is to provide assessments of the character and distribution of sand and gravel resources potentially suitable for beach nourishment and coastal restoration.

Gas Hydrates — Since passage of the Methane Hydrate Research and Development Act of 2000, hydrates have been recognized increasingly as both a potential energy resource and a hazard to deep water drilling. The CMGP and the Energy Resources Program (ERP) of the USGS are working with the Department of Energy, NOAA, NSF, and the Naval Research Laboratory to fully implement a comprehensive gas hydrate research program in the United States. Samples collected during recent major field programs studying gas hydrates on the Mackenzie Delta, AK; (in cooperation with Japanese, German, Indian, and Canadian partners), in the Gulf of Mexico (in cooperation with French, Japanese, Russian, academic, and industrial partners), and off the Oregon coast (in cooperation with the Ocean Drilling Program) are being analyzed at several USGS labs to understand the physical and dynamic properties that control gas hydrate formation in both permafrost and continental margin settings. These studies are also leading to better strategies for studying these substances and modeling their behavior in natural settings. In FY 2006 and FY 2007, the USGS will continue working with the Joint Industry Program, headed by Chevron-Texaco and Maurer Technologies in Alaska and the Gulf of Mexico, to further gas hydrate studies. A new 5-Year Plan for USGS hydrate research has been prepared collaboratively by CMGP and ERP. In addition to specific energy resource-related efforts, the CMGP plans to expand its efforts in assessing the role of gas hydrates in sea-floor stability and climate change issues.

Technology and Information — These studies provide enabling technologies and base-line products characterizing the form and composition of the Nation's coasts and seafloor through systematic reconnaissance-level surveys and production of maps of the U.S. coast and offshore Exclusive Economic Zone (EEZ). These scientific maps and information are used for assessment and management of the sea floor and provide a foundation for investigations of environmental, hazard, and resource issues in coastal and offshore areas. The USGS also addresses the management and transfer of marine geologic information and products.

LiDAR (Light Detecting and Ranging) Mapping — The EAARL (Experimental Advanced Airborne Research LiDAR) is an airborne system developed by NASA and applied cooperatively with the USGS that provides unprecedented capabilities to survey coral reefs, nearshore

benthic habitats, coastal vegetation, and sandy beaches. EAARL is uniquely suited for mapping features where extreme variations in the laser backscatter complexity and signal strength are caused by different physical and optical characteristics. CMGP development of this capability has focused on developing algorithms and methodology to use this information for improving (1) fire fuel estimation, (2) discrimination between vegetation community classes, and (3) the combination of airborne bathymetric LiDAR measurement of water column thickness and turbidity with simultaneous hyperspectral scanning to improve the retrieval of benthic reflectance spectra and thereby improve the accuracy of fine scale shallow benthic habitat maps over coral reef and seagrass communities. Those algorithms were tested in FY 2005. Work with the NPS will continue on mapping coral rugosity (a measure of coral reef degradation) in Florida and the Caribbean. This technology provides an effective method of mapping relevant to a broad range of USGS and other Federal programs. Work in FY 2006 will focus on integrating remotely sensed LiDAR data into a model framework being constructed to extrapolate coral reef response to external stressors over a large geographic region. While focusing on coastal and marine applications, the CMGP will continue to work with other programs and other agencies to expand the range of applications for which these tools are optimally suitable. In FY 2007 the CMGP will focus on the development of map and digital products, based on existing data, to characterize NPS priority units and provide decision-support tools for NPS managers.

Coastal Modeling — The National Community Sediment Transport Model is being promoted by CMGP to further the understanding of sediment resources and the transport of sediments and associated contaminants. This will be an open-source numerical model for sediment transport in coastal regions developed in cooperation with other Federal agencies, academic institutions, and private industry where the development of the sediment transport model architecture and models will evolve into standards for use in applications by the broader community interested in coastal issues. On-going activities in this project include promoting, testing, selecting, developing, improving, and maintaining the community models; advancing instrumentation and data analysis techniques for making measurements to test and improve sediment-transport models; providing software analysis and visualization tools that support model applications; and applying sediment transport models to regional contaminant and erosion issues. The USGS is working with the Office of Naval Research (ONR), and scientists funded by the NSF to ensure that a coordinated effort increases model effectiveness in addressing needs across the entire spectrum of Federal agency needs. In FY 2006, and continuing through FY 2008, the USGS will collaboratively fund (with NSF and ONR) a coordinated effort to develop the National Community Sediment Transport Model through funding to academic/governmental/private sector partnership through the National Ocean Partnership Program. The CMGP internal research program will be fully integrated into this effort, thus leveraging USGS and partner resources towards the objectives of a common development plan.

The Coastal Evolution Model — A new modeling project initiated by CMGP in FY 2004 will develop a multiscale numerical modeling system for coastal evolution that incorporates physical processes and empirical knowledge. Model components will be calibrated and evaluated with data obtained from regional and other field investigations, coordinated with the above Community Sediment Transport Modeling System, and with program site-specific investigations. Objectives of this project are to (1) predict morphological change (profile and shoreline change), (2) quantify the linkages between antecedent geologic framework, inner shelf and nearshore morphology, watershed sediment delivery, and shoreline change over a continuum of socially relevant scales, (3) examine the relative contribution of cross-shore and alongshore sediment transport processes to morphological changes over a range of time and space scales, and (4) improve sediment transport parameterizations to be used for long-term morphologic modeling. FY 2006 and FY 2007 work will be undertaken in conjunction with ongoing CMGP

regional studies to further program objectives to link understanding of coastal geologic setting and processes with forecast models of coastal response.

Law of the Sea/Limits of the Outer Continental Shelf — Should the United States become a signatory to the United Nations Convention on the Law of the Sea (UNCLOS), the Nation will have a 10-year time window to develop and submit evidence for extending the limits of its continental shelf beyond 200 nautical miles. The criteria that a Nation can use in its submission requires an understanding of the geologic structure, history, and sedimentary extension of the continental shelf. The USGS has collected much of the existing regional data required to assess sediment thickness information and has undertaken two tasks toward determining the adequacy of these data. First, the USGS developed a GIS for eight continental margin regions and trust territories identified as locations where an extension might be proposed. This GIS contains navigation data that have been classified for navigational accuracy and suitability for assessing sediment thickness and is the first step in determining where additional data might be needed should the United States submit a claim. Second, the USGS compiled actual sediment thickness values in the Bering Sea region of Alaska. This is the first attempt to recompile sediment thickness information digitally and to identify potential gas hydrate resources in this priority area extending beyond the 200-nautical mile limit.

In 2004, Brazil became the second Nation, after Russia, to make a submission to the Commission on the Limits of the Continental Shelf for an extended continental shelf. USGS worked extensively with the Department of State in 2004 to develop technical evaluations of the submission and in FY 2005, provided technical evaluation of the Australian submission–the most comprehensive submission to date. In FY 2006 and FY 2007 the CMGP will continue to provide technical assessment of any claims submitted in support of Department of State needs. As the response to past submissions is made public, the USGS will assess potential United States submissions for expanded jurisdiction given the interpretations by the UNCLOS of other Nation's efforts. This will inform both technical and policy decisions as to the appropriate scope and content of potential submissions related to this issue.

Marine Realms Information Bank (MRIB) and Knowledge Management — The Internet offers quick and convenient service for those who need the best available scientific results as the basis of decisions about disaster response, waste disposal, beach nourishment, and other important issues. Unfortunately, the great volume of miscellaneous information on the Internet presents a daunting prospect to those who need to quickly find reliable scientific information about a particular issue and location. The MRIB is an online library of the USGS CMGP that organizes and provides links to high-quality scientific resources that are maintained online by the USGS, other agencies, and partners in academia and the private sector. Unlike most search engines, MRIB uses maps to allow search for information about particular places, and allows Internet users to browse for information in an organized set of categories that includes environmental issues, natural disasters, geological features, and research methods. MRIB is now being incorporated into a larger Coastal and Marine Knowledge Bank (CMKB) that provides an electronic organization, presentation, and interactive capability to utilize the Nation's CMGP knowledge assets (i.e., for data, derived products, knowledge, and also human intellectual resources). The CMKB will ensure that CMGP data and knowledge are available to a wide variety of users to address multiple, complex issues and archiving and serving this data should lead to new science by providing links to other system studies. A Monterey Bay Portal Demonstration Site (*http://marine.usgs.gov/cmkb/*) was created in FY 2004. In FY 2006 and FY 2007, a parallel site highlighting the results of regional and national hazards assessments will be created.

FY 2006 Planned Program Performance

For FY 2006 the CMGP is expected to meet or exceed all performance targets. Specific analyses delivered will be somewhat modified in response to the impacts of Hurricanes Katrina and Rita. The USGS maintains a substantial and productive program focused on coastal storm impacts. The magnitude of these hurricanes have resulted in both an increased demand for program products and a unique scientific opportunity to advance relevant program efforts with respect to catastrophic storm impacts. This will necessitate some redirection of program resources to ensure timely development and delivery of impact assessments and scientific interpretations that is expected to impact program performance positively.

The planned accomplishments listed below demonstrate the utility of scientific publications and other products counted under the output measures for "number of long-term databases maintained," "systematic analyses delivered to customers," and "number of formal workshops and training provided to customers."

The CMGP will continue to maintain and update the following long-term databases:

- Antarctic Data Library–currently 50 gigabytes, add 5 gigabytes/year, cost to maintain is around $50,000 per year, and
- Tampa Bay (*http://gulfsci.usgs.gov/tampabay/*) database enlarged to include Gulf of Mexico coastal data–currently 8 gigabytes, add 3 gigabytes/year, cost to maintain is around $30,000 per year.

The CMGP will deliver the following analyses in FY 2006. Products identified continue an effort by the CMGP to report substantial bodies of information and research results as programmatic accomplishments in lieu of individual published products.

- **Tsunami Hazards:** Publications will include multiple USGS-authored papers in a Special Issue on Tsunami Deposits, *Journal of Sedimentary Geology*; multiple USGS-authored publications developed in collaboration with NOAA, FEMA, and academic partners developing a probabilistic methodology for tsunami forecasting.
- **Earthquake Hazards:** A group of USGS-authored publications providing data and models in support of the Working Group on California Earthquake Probabilities (WGCEP) statewide earthquake forecast, and a group of USGS-authored publications summarizing coastal and marine earthquake hazard assessments for the Pacific Northwest.
- **Benthic/Fisheries Habitat:** A USGS/NOAA co-edited volume resulting from a USGS/NOAA sponsored workshop on "Benthic Habitats and the Effects of Fishing" published by the American Fisheries Society.
- **Mineral Resources:** A USGS Circular on the state of knowledge of marine mineral resources in the Exclusive Economic Zones of Pacific Islands, Database publication of Pacific Coast offshore surficial sediment data.
- **National Assessment of Coastal Change Hazards:** Historical Assessment of Shoreline Change and Coastal Land Loss for the U.S. Southeast Atlantic Coast, Coastal Classification Atlas products for portions of the Texas Coast, and Impact Assessments subsequent to 2005 Hurricanes.

- **South Carolina Regional Erosion Study:** Publication of data and interpretive products linking geologic framework/mapping (GPRA 2005) and oceanographic observations to provide conceptual models for evolution of South Carolina coastal region.
- **Gas Hydrates:** Publication of laboratory methodology developed with joint USGS/DOE funding, and data and interpretive products from field investigations of Gulf of Mexico hydrate sites.
- **Stakeholder Mapping:** Data and product release associated with cooperative mapping for resource managers at State and Federal levels, including New York, New Jersey, Massachusetts Bay, and Massachusetts Coastal Zone.

Planned workshop support includes:

- Annual stakeholder/investigator workshops for on-going studies in North Carolina, Puget Sound, and Tampa Bay,
- Technical Workshops on development of Coastal Evolution and Coastal Sediment Transport Models,
- Interagency Workshop on Gas Hydrate Research,
- Interagency Workshops on Coordination of Coastal and Marine Mapping, and
- USGS/Stakeholder Workshops related to Gulf of Mexico Science Planning addressing restoration and hurricane hazard needs.

The FY 2006 enacted budget included base increases for Puget Sound Ecosystem Studies and Tsunami Hazard Studies. These will begin to positively impact program performance measures in FY 2007, resulting in delivery of 1 additional analysis. The FY 2006 enacted budget additionally included a Congressional earmark for Florida Shelf Habitat Mapping. This is not maintained in the current budget request and will not affect program performance.

FY 2005 Program Performance Accomplishments

For FY 2005 the CMGP met or exceeded all performance targets. Planned delivery of "Historical Shoreline Changes and Associated Coastal Land Loss along the California Coast," under the National Assessments of Shoreline Change project was not achieved. New analyses suggest that methodologies developed for the low-lying small tidal range shoreline of the Gulf of Mexico need to be modified to ensure results are scientifically credible and accessible to the user community. An improved methodology has been developed and is under review prior to application and product completion. The CMGP met FY 2005 targets for analyses delivered with the production of Coastal Vulnerability Index (CVI) products for NPS in the Cape Hatteras National Seashore, Virgin Islands National Park, Golden Gate National Recreational Area, Point Reyes National Seashore, Dry Tortugas National Park, War in the Pacific National Historical Park, Gateway National Recreational Area, and the National Park of American Samoa. Results of the CVI studies have been delivered to NPS park Superintendents and managers through meetings and presentations.

The accomplishments and outcomes listed below demonstrate the utility of USGS products that are counted under output measures for a number of systematic analyses and investigations delivered to customers, number of workshops or training provided, and number of long-term data collections maintained. These accomplishments and outcomes support the Department's strategic goals and CMGP goals to document and assess both human activities and natural

processes on U.S. coastal lands and offshore and support the National Coastal Plan strategy to respond to critical regional needs while addressing national issues associated with coastal change. Highlights of program accomplishments and outcomes in FY 2005 include:

- **Tsunami Hazards: Indian Ocean Tsunami —** As members of international response teams, CMGP scientists provided scientific and technical expertise to support improvements in hazard mitigation and coastal planning relating to the Indian Ocean tsunami. This effort included developing tsunami models and related information on regional tsunami generation and propagation; providing critical geologic, sedimentologic, and mapping expertise; and collecting information on tsunami inundation, erosion and deposition, nearshore bathymetry, and coastal change impacts. USGS staff led or participated in International Survey Team expeditions to Sumatra (twice), Sri Lanka, and the Maldives. Geological information and interpretations resulting provide critical field validation for improved tsunami models, aid in reconstruction efforts and future response planning, define future vulnerability, and inform the public regarding tsunamis and their impacts.
- **Tsunami Hazards: United States —** Continuing basic research includes mapping tsunami, earthquake, and landslide hazards in the Caribbean, Alaska, and the Pacific Northwest. Work in the Caribbean was completed as a joint effort with the University of Madrid, the Spanish Royal Naval Observatory, and the University of Puerto Rico. The deployment of seismometers to image the fault structure of the ocean bottom will assist in calibrating the seismic network to better locate earthquakes in the Puerto Rico Trench and in planning an expanded Caribbean tsunami warning system. Collaboration with NOAA focused on efforts to develop shared priorities for tsunami source assessments and to develop forecast models as part of the Tsunami Resilient Community concept.
- **Central Gulf of Mexico: Hurricane Katrina Impacts —** Pre- and post-Hurricane landfall surveys, collaboratively with NASA and the USACE, provided accurate and rapid assessments of storm vulnerability (pre-storm) and impacts (post-storm). The USGS provided pre-storm elevation data sets ensuring that coastal condition, including alterations by recent prior hurricanes, were reflected in pre-storm impact and vulnerability assessments. Post-storm elevation, photographic, and ground surveys provided for rapid assessment of storm impacts. Data were processed and provided to local State and Federal emergency managers to target recovery efforts. Specific applications included assessments of levee damage in New Orleans, calculation of debris volumes in Alabama, and mapping of storm surge levels throughout the region. Initial analyses indicated that:

  - The central part of Dauphin Island, AL, in the eastern extent of hurricane force winds, was overtopped by storm surge and waves. Significant volumes of sand, and most structures, were removed from the island and swept into the Mississippi Sound.
  - Along the Mississippi mainland coast around Gulfport virtually all near-coastal structures were destroyed and debris swept as much as two miles inland.
  - The Chandeleur Islands, a 70-km long barrier chain in eastern Louisiana, were stripped of virtually all visible sand. Elevations rising as high as 10 to 12 feet above sea level were reduced to 1.5 to 3 feet throughout the chain and island area was decreased by over 85 percent.

  These data also provide the basis to evaluate program efforts to forecast and model coastal response to future extreme storm events.

- **Central Gulf of Mexico: Subsidence —** Regional subsidence is a primary driver for coastal land and wetland loss and increased hazard vulnerability in Louisiana. The CMGP published findings of studies on the linkage between subsidence, wetland loss, and fluid extraction (oil, natural gas, water) in the region. The report demonstrates that historical interior wetland loss south of Houma and west of Bayou Lafourche resulted from rapid subsidence, mostly between the late 1960s and the late 1970s and that wetland loss rate are substantially lower now than during the 1970s. The highest subsidence rates in Lafourche and Terrebonne Parishes coincide with oil and gas fields and reactivated faults, providing compelling evidence that the rapid historical delta plain subsidence was largely induced by oil and gas production. These findings, and their relevance to projections of future subsidence, are critical elements in providing the scientific basis for planning and evaluating planned regional restoration efforts to address wetland loss and hazard vulnerability.
- **Puget Sound —** In partnership with Federal agencies, the State of Washington, Indian Tribes, and regional organizations, the CMGP developed a Research Plan to support the Puget Sound Nearshore Ecosystem Restoration Project. Six research activities were identified in the Plan, including monitoring the effects of the Elwha Dam removal on nearshore habitats and providing data to assist in evaluating changes in Puget Sound coastal habitat.
- **Coral Reef Ecosystems —** Based on CMGP information, the GOM Fisheries Management Council voted designate 104 square miles of the Pulley Ridge a Coral Essential Fish Habitat, an action mandating a variety of protective regulations for the area.
- **Invasive Marine Species —** USGS and NOAA researchers have identified an aggressive colonial tunicate species infesting gravel habitats in the offshore Georges Bank fishing ground. Surveys in 2005 found the species to be rapidly spreading and currently infesting rich scallop and groundfish habitats in two areas of gravel seabed that total 88 square miles in size. The species has no known predators, is a threat to smother shellfish in aquaculture farms and fisheries habitats, and will be able to expand its habitat wherever it encounters suitable water and bottom conditions**.**

Performance Overview

Measure	2005 Plan	2005 Actual	Change from 2005 Plan	2006 Enacted	2006 Change from 2005 Actual	2007 Request	2007 Change from 2006
# of annual gigabytes collected	8	5	-3	8	+3	8	0
# of cumulative gigabytes managed	58	55	-3	63	+8	71	+8
# of systematic analyses and investigations delivered to customers	8	8	0	8	0	9	+1

Measure	2005 Plan	2005 Actual	Change from 2005 Plan	2006 Enacted	2006 Change from 2005 Actual	2007 Request	2007 Change from 2006
# of formal workshops or training provided to customers (instances/issues/events)	9	10	+1	10	0	10	0
# of conceptual or numerical models developed **(Puget Sound GD)**	0	0	0	0	0	0	0 Will produce 1 in FY 2008

Activity: Geologic Hazards, Resources, and Processes

Subactivity: Geologic Resource Assessments
Program Component: Mineral Resources

Program	2005 Actual	2006 Enacted	2007 Fixed Cost & Related Changes [a/]	2007 Program Changes	2007 Budget Request	Change from 2006
Mineral Resources Program	53,764	52,774	+954	-22,943	30,785	-21,989
Total Requirements $000	**53,764**	**52,774**	**+954**	**-22,943**	**30,785**	**-21,989**
FTE	***426***	***424***	***-12***	***-180***	***232***	***-192***

[a/] Fixed cost increases for this activity total $1,362 of which $954 will be budgeted and $408 will be absorbed. FTE change of -12 results from rebalance and renew of skills mix to gain functional and position flexibilities identified through an extensive workforce planning effort (page H-2).

Summary of FY 2007 Program Changes for Mineral Resources Program

Request Component	Amount	FTE
Program Changes		
• Research and Assessments	-18,443	-145
• Minerals Information	-4,500	-35
TOTAL	**-$22,943**	**-180**

Justification of FY 2007 Program Changes

The 2007 budget request for the Mineral Resources Program is $30,785,000 and 232 FTE, which is a program change of -$22,943,000 and -180 FTE.

- **Mineral Resources (-$22,943,000 and -180 FTE) —** MRP conducts basic research in ore deposits, geochemistry, and geophysics and applied research in national and international mineral assessments that benefit States, local governments, industry, and academia, in addition to many Federal programs. With current budget constraints, the Administration is focusing its efforts in mineral resource assessments and research to those efforts that support the needs of Federal land management programs and expects that universities or other entities will undertake assessments and research that support non-Federal needs. This funding level will keep the core Federal program intact, providing the information and analyses that address the Department's strategic plan goals concerning Resource Use.

The proposed reductions to the budget for MRP will result in a significantly scaled-back program that will conduct three site-specific mineral resource projects and mineral resource assessments for Federal land management agencies in the lower 48 States, provide regional-scale geologic data and mineral resource assessments in three areas of Alaska, complete collection of national-scale data characterizing earth materials, collect data only on domestic production and

utilization of 100 mineral commodities, and manage four national-scale long term databases. The proposed reductions will be addressed with the following specific actions:

- Termination of an international collaboration to provide a global assessment of potential for undiscovered mineral resources;
- Discontinuation of research on improving methods of mineral resource assessment and on enhancing applications of GIS to mineral resource assessments;
- Discontinuation of most research and data collection projects, including:
    - Research in the lower 48 States and Alaska on processes that form ore deposits,
    - Geo-environmental research aimed at understanding processes through which metals are dispersed through the environment (the basis for partnerships in watersheds challenged with abandoned mine sites),
    - Industrial minerals research,
    - Application of remotely sensed data to meet the needs of Interior bureaus, including remote characterization of mineral products released at abandoned mine sites and prioritization of specific remediation targets,
    - Research on the human health consequences of mineral materials, including dusts and toxins such as mercury and arsenic, and
    - A comprehensive soil geochemical survey of the United States,
- Elimination of support for at least 8 USGS geochemical and geophysical labs.
- Elimination of the collection of data on international production and utilization of 100 mineral commodities,
- Termination of research and analysis of minerals and materials life cycles, materials flows, and future uses of minerals and materials, and
- Elimination of the Mineral Resources External Research Program (MRERP), which makes grants to non-Federal entities to conduct research addressing MRP goals.

The proposed decrease would require that USGS eliminate at least 180 jobs held by employees at nine locations across the United States (Denver, CO; Flagstaff, AZ; Menlo Park, CA; Mounds View, MN; Reno, NV; Reston, VA; Spokane, WA; Seattle, WA; and Tucson, AZ).

The proposed decrease will eliminate 5 systematic analyses scheduled to be delivered to customers in FY 2007, and 14 more that are underway and scheduled through FY 2011. Three systematic analyses that are scheduled for delivery in FY 2007 will be delayed until at least FY 2008, 1 scheduled for 2008 will be delayed to 2010, and 1 scheduled for 2009 will also be delayed to 2010. Starting in 2007, MRP will be able to produce about 1 systematic analysis per year.

MRP's ability to provide formal workshops or training for customers will be reduced from 8 instances in FY 2006 to 3 in FY 2007 and beyond. The number of mineral commodity and related reports (including materials flow studies) produced annually will be reduced from 720 in FY 2006 to 700 in FY 2007 and beyond; the remaining reports will include no international production and consumption data.

Program Performance Change Table

Total Performance Change	-19 systematic analyses - 5 workshops -20 commodity reports Changes in average cost of systematic analyses				
	A	*B*	*C*	*D= B+C*	*E*
	Overall Performance Changes from 2006 to 2007				
Measure	**2006 Enacted Performance**	**2007 Base Performance Level**	**2007 Impact of Program Change on Performance**	**2007 Budget Request Performance**	**Out-year Impact of 2007 Program Change on Performance**
# of systematic analyses & investigations delivered to customers	**6**	**6**	**-5**	**1**	**-14 in the period 2008-2011**
# of cumulative gigabytes managed	**16.221**	**16.3**	**0**	**16.3**	**N/A**
# formal workshops or training provided to customers	**8**	**8**	**-5**	**3**	**0**
# of mineral commodity reports available for decisions	**720**	**720**	**-20**	**700**	**0**
Average cost of a systematic analysis or investigation	**$4.4M**	**$3.0M**	**+$9.4M***	**$12.4M***	**FY 2008 expected avg. cost = $3.5M**

Column B: The performance level expected to be achieved absent the program change (i.e., at the 2006 request level plus/minus funded fixed cost/related changes); this would reflect, for example, the impact of prior year funding changes, management efficiencies, absorption of fixed costs, and trend impacts.

Column E: The out-year impact is the change in performance level expected in 2008 and Beyond of ONLY the requested program budget change; it does not include the impact of receiving these funds again in a subsequent outyear.

- Includes sunk costs of projects terminated early as a result of funding change.

Program Overview

The United States is the world's largest user of mineral commodities. Processed materials of mineral origin accounted for more than $478 billion in the U.S. economy in 2005. This represents an increase of 14 percent in a year when the GDP increased by just under 8 percent. U.S. manufacturers and consumers of mineral products depended on other countries for 100 percent of 16 mineral commodities and for more than 50 percent of 42 mineral commodities that are critical to the U.S. economy. Current and reliable information about both domestic and international mineral resources and the consequences of their development informs decisions about supply and development of mineral commodities.

MRP is the sole USGS program addressing Department's Resource Use strategic goal of managing resources to enhance public benefit, promote responsible use, and ensure optimal value of non-energy minerals. To clearly measure USGS progress in providing information, three outcome measures (average square miles of the United States with non-energy mineral information available to support management decisions; customer satisfaction with information provided to support decisions in non-energy minerals; and percent of studies validated through appropriate peer review or independent review) were identified in partnership with Department and OMB and designed to roll up into the intermediate goal of increasing the information base,

improving information management, and providing technical assistance. MRP funds basic and applied research, within USGS and outside, that provides world-class earth science research and data used by policy and decisionmakers, land managers, other Federal and State agencies, the mineral resources industries, foreign governments, nongovernmental organizations, academia, other scientists, and the public.

Use of Cost and Performance Information

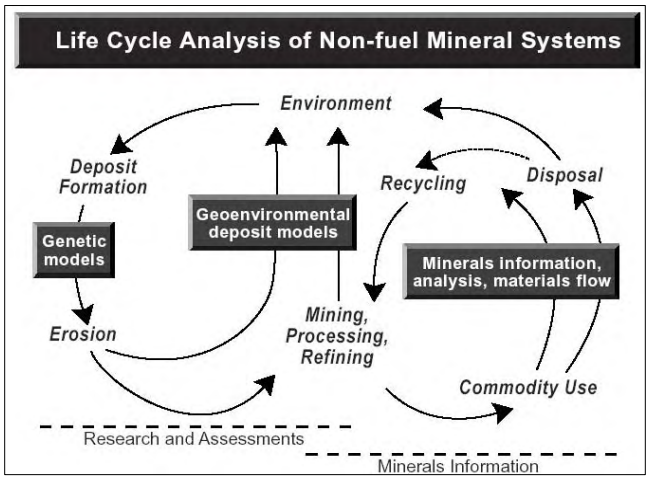
MRP was reviewed in FY 2003 for the FY 2005 budget using PART and was found to be moderately effective. The most recent OMB summary of MRP says that the program has achieved performance targets and made its information products and databases easier to use. Following OMB guidance, MRP continues to focus program activities to support long term land use and policy decisions and to make reports and data more accessible and user friendly.

USGS has ABC data for FY 2004 and FY 2005, but these two years of data demonstrate that more detail is required for decision-making. Beginning in FY 2006, data are collected for each task within a project. After several years of collecting at this level, MRP will be better able to track and analyze trends in program funding and expenditures, as well as links to the Department's goals and priorities.

ABC data for 2004 and 2005 demonstrate that over 88 percent of funds appropriated to MRP are allocated to project work that satisfies key performance measures: average U.S. square miles with non-energy minerals information, number of systematic analyses delivered to customers, and number of gigabytes of data managed.

Using PART, ABC, and other performance information, such as customer surveys and reviews by the National Research Council, the MRP continues to evolve towards a research- and information-based program that assists others in using the results of USGS research and data collection to meet the needs of land management agencies and a broad spectrum of professional and general users.

In its most recent review of the MRP (2003), the National Research Council identified four Federal roles in mineral science and engineering: an unbiased national source of science and information, basic research on mineral resources, advisory, and international (undertaking or supporting international activities that are in the national interest). MRP addresses these four roles through work in two functions: a research and assessment function that provides information for land planners and decisionmakers about where mineral commodities are known and suspected in the Earth's crust, and a minerals information function that collects, analyzes, and disseminates data that describe current production and consumption of about 100 mineral commodities, both domestically and internationally for approximately 180 countries. Together these activities provide information ranging from that required for land planning decisions on specific management units to that required for national and international economic decisions.



Life cycle analysis of non-fuel mineral systems (see figure) demonstrates the connections between various natural and anthropogenic processes through which minerals are made available to sustain developed societies. Each function meets the needs of different parts of the community of mineral resource information users, including Federal, State, and local land managers; Federal, State, and international departments and agencies concerned with materials availability, defense, security, the economy, trade, environmental management, human health and safety; private sector

companies concerned with materials availability, defense, security, the economy, trade, environmental management, human health and safety; academic institutions; policymakers in the U.S. Congress and State legislatures; and the general public.

Program funding is allocated for projects whose products support goals outlined in the current 5-Year Plan (*http://minerals.usgs.gov/plan/mrp-plan-2006-2010.pdf*); both project activities and funding are adjusted annually as required to accommodate increases or decreases in staffing, fixed costs, and overall availability of funds. Prioritization of specific projects is based on five characteristics. Projects that have been retained address these criteria:

- Deposit types that have highest likelihood of occurring on U.S. Federal lands,
- Commodities for which current and future supplies are not secure,
- Commodities for which increased demand is anticipated,
- Deposit types that have largest economic or environmental impact, and
- Work on lands where access is not an issue and cooperation from land owners or managers has been secured.

The Federal Land Policy and Management Act of 1976 requires USGS to "conduct mineral surveys of public lands to support the designation of Wilderness Areas . . . Prior to BLM making any recommendation for the designation of any area as wilderness, the Secretary of Interior shall cause minerals surveys to be conducted by USGS." In addition, USGS has significant responsibilities deriving from the Minerals Policy Act of 1970 and the National Materials and Minerals Policy, Research, and Development Act of 1980. The MRP responds to these and other economic and public policy needs of the Nation with both the research and data functions of the program. In addition to assessments of the potential for undiscovered mineral deposits, the MRP provides long-term national and regional data on mineral production, use, and recycling to land-management agencies, regulatory agencies, industry, academia, and the public. MRP statistics and information on the global supply of, demand for, and flow of minerals and materials essential to the U.S. economy, national security, and environmental protection are available on the Web *(http://minerals.usgs.gov/minerals/)*. Customer satisfaction surveys of use of data from the national mineral resource assessment, minerals databases, and geochemical data indicate a total satisfaction score of 86 percent.

FY 2007 Program Performance Estimates

The 2007 budget request for the Mineral Resources Program is $30,785,000 and 232 FTE, which is a program change of -$22,943,000 and -180 FTE. The two primary MRP components, Research and Assessments and Minerals Information, are addressed separately.

The 2007 budget request for MRP Research and Assessments function is $19,503,000, a net change of -$17,769,000 and -157 FTE. With funds proposed for FY 2007, this function will conduct the following activities addressing the Department's Resource Use goal for non-energy minerals:

- Continue three site-specific mineral resources projects in the lower 48 States (scheduled for completion on FY 2008 or later),
- Provide regional-scale geologic data and mineral resource assessments in three areas of Alaska, delivering one systematic analysis to customers,

- Complete collection of national-scale data characterizing earth materials, meeting the final goal for average square miles with baseline data available for decisions,
- Manage three national-scale long term databases (geochemistry, geophysics, and mineral deposits), contributing to the increased number of gigabytes of data managed,
- Provide three formal workshops or training to customers on topics such as understanding the utility of geoscience data for land planning.

Site-specific projects in the lower 48 are collaborative efforts began in FY 2003 in Big Bend National Park, on BLM lands on the western slope of Colorado, and in national forests in north-central Colorado. Each project is designed to address the land manager's need for specific information about mineral deposits (which may be sources of inorganic toxins in Big Bend National Park), processes by which they are formed (to minimize release of toxic metals from mineral-rich black shales in western Colorado), and potential for discovery of new deposits on or near Federal lands (necessary for planning, particularly in areas affected by urban-wildland interface issues, such as north-central Colorado).

Development and upgrading of national databases, and conversion of those databases to standard formats, is an ongoing effort and will continue in 2007; as data are available or new databases become standardized, they are placed online. This continuous updating allows users to gain direct access to live databases, instead of being limited to a one-time retrieval of data potentially months or years out of date. Evolving online data delivery tools provide information in digital format to any customer with Internet access; this has been of particular interest to land-management agencies and regional-planning groups. Some of the features of this unique online system include sophisticated data set search options, user viewing of data tables, and downloading of page-sized maps with user control of map data layers, legend, title, and other parameters. The system is available at *http://mrdata.usgs.gov/.*

Data and conclusions from USGS minerals research will continue to be available to users in easily accessible, accurate, and timely products in 2007. Information is disseminated through traditional paper products, in digital form, on the Internet *(http://minerals.usgs.gov/)*, through interagency collaborations, and in technical and non-technical public presentations. Other methods through which MRP projects provide timely results for all customers include development of new geophysical and geochemical techniques for mineral-resource studies and the application of mineral-resource expertise and techniques to other societally relevant issues such as mapping earthquake and volcanic hazards, location and evaluation of energy resources, characterization of hydrology, or location of buried ordnance.

The Mineral Resources Data System (MRDS) is a worldwide database of metallic and industrial mineral sites with related geologic, commodity, and deposit information. It currently contains information describing about 115,000 locations; new records are continually being added and existing records updated or upgraded. In 2007 no new records will be added; emphasis will be on updating and upgrading existing records. About 200 data fields are available for each location, permitting storage of such disparate information as location, geology, description of deposit, exploration and development, description of workings, commodities present, production, reserves and resources, and published and unpublished references. The data can be searched and sorted using any of these fields. The data are available on CD-ROM and as part of the MRP's data delivery Web site (see above).

The 2007 budget request for MRP Minerals Information function is $11,282,000, a net change of -$4,220,000 and -35 FTE. With funds proposed for FY 2007, this function will conduct the following activities addressing the Department's Resource Use goal for non-energy minerals:

- Collect, analyze, and disseminate timely information and data on domestic supply and availability for more than 100 mineral commodities, including fuel and fuel by-products, in the United States, delivering about 700 mineral commodity reports and
- Complete conversion of canvass forms to electronic format, maintain national long-term data sets for commodity data, contributing to the increased number of gigabytes of data managed.

Mineral materials are essential to the U.S. economy and national security. USGS information and data cover the extraction, production, and refining of mineral commodities and some of their products. The Department, DoD, CIA, Department of State, Federal Reserve, and private sector companies utilize USGS mineral-related policy analysis in their regional and global analyses. Information on strategic minerals is also provided to the DoD for managing the National Defense Stockpile.

USGS mineral commodity specialists provide production and capacity data for the U.S. nonfuel minerals industry to the Federal Reserve Board (FRB). The FRB uses data in USGS minerals information reports to calculate the indexes of industrial production, capacity, and capacity utilization, which are among the most widely followed monthly indicators of the U.S. economy. These capacity indexes and the rates of capacity utilization based upon them are published monthly in FRB's G.17 release, Industrial Production and Capacity Utilization. USGS scientists also provide assistance to FRB economists and policymakers in analyzing mineral industry indicators and trends.

FY 2006 Planned Program Performance

In FY 2006, MRP will deliver 6 systematic analyses to customers, add 234,391 square miles of baseline data coverage for the United States, make 720 mineral commodity reports available to decisionmakers, increase conversion of minerals information canvass forms to electronic formats from 80 to 88 percent, provide 8 formal workshops or training programs to customers, and award $1,000,000 in research grants through the MRERP.
Systematic analyses to be delivered will provide land managers, industry, and other research scientists with

- Enhanced understanding of regional-scale fluid movements responsible for forming the world-class Red Dog lead-zinc deposit in Alaska and associated petroleum systems,
- New interpretations of regional-scale crustal evolution through time in the Great Basin, including those responsible for formation of rich Carlin gold deposits in Nevada,
- Research on a variety of industrial minerals topics across the country, including limestone systems in the mid-continent, clay deposits in the eastern States, diatomite deposits in Nevada, and the potential for use of alluvial fans as sources of aggregates,
- Models for basin development in the Southwest, including enhanced understanding of circulation systems for ground water and mineralizing fluids, based on application of complex systems theory and advanced computing methods,

- Research in the Cascade Mountains of Washington and Oregon demonstrating how differences in evolution of volcanic systems that host rich copper porphyry systems and those that do not,
- New methods of analysis and interpretation in the field of low temperature aqueous geochemistry, essential contributions to understanding and remediating adverse effects of abandoned mine sites.

In addition, MRP will fund projects scheduled for completion in FY 2007 and beyond including:

- The U.S. portion of an international collaboration to conduct the first-ever global assessment of potential for undiscovered mineral resources,
- Research on mitigating uncertainty and risk in mineral resource assessment,
- Pilot studies for the first comprehensive North American soil geochemical survey,
- Applications of geographic information systems to mineral resource assessment, land use planning, and visualization of results of mineral resources research,
- Research on the characteristics of mineral dusts known or suspected to be disease-causing agents in humans,
- Studies of physical and chemical pathways by which earth materials become available to plants, animals, and humans,
- Development of geoenvironmental models of mineral deposits, an essential step towards predicting consequences of mining specific mineral deposits in specific climatic regimes,
- Research on the pathways and quantities of mineral materials that underpin the economies of developed and developing Nations,
- Field research to provide essential geologic, geochemical, geophysical, and mineral deposits data for the least-well understood areas of Alaska.

The MRERP has been increased from $250,000 to $1,000,000 in FY 2006. MRP anticipates making 10 to 20 awards to State, academic, and private sector institutions that have demonstrated the ability to conduct research addressing MRP's 5-Year Plan goals.

FY 2005 Program Performance

In FY 2005 MRP met or exceeded all performance measures, although most were within 5 percent of target. Measures are exceeded when projects have unexpected opportunities to consolidate data gathering or data analysis and when report preparation schedules fluctuate across fiscal year boundaries. Most noteworthy is the increase in the percent of targeted analyses delivered that were cited by identified partners within three years after delivery. This measure was exceeded because partners made use of materials provided by MRP a year earlier than anticipated.

In FY 2005, MRP delivered three systematic analyses, conducted eight formal workshops or training events, provided 746 mineral commodity reports, and continued its external research program. Selected outcomes are described briefly below.

Nickel Deposits Identified in Alaska Based on USGS-BLM Collaboration — Mineral Resource Program (MRP) scientists completed research on the mineral potential of the Nikolai

flood basalt province, a 230 million-year-old feature in the central Alaska Range. Based on the results of this work, along with detailed mapping and geochemical data from industry and the State of Alaska, industry has developed models indicating that the identified zone may be a primary target for significant deposits of nickel, platinum-group elements, and gold.

Easy Access to Internet-Based Mineral Resource Data — In FY 2005, MRP's Spatial Data Delivery project finished implementing new client Web mapping software which allows users to combine minerals data with data from other Web sites, as well as their own data, into a single map. For example, land-use data from a land-management agency may be combined with geochemical or mineral locality data from MRP to create a map to meet the user's specific needs. The public Web site, available at *http://mrdata.usgs.gov/*, now serves more than 40 national and (or) global geoscience data themes in addition to various base data layers. This work fulfills a PART action plan milestone for MRP.

New Techniques for Identifying World Class Ore Deposits — MRP scientists have discovered that strontium isotopes can be important indicators of world class ore deposits of lead, zinc, gold, manganese, nickel, molybdenum, and phosphorite. The use of strontium isotopes as an ore deposit indicator has great potential as a tool for improving mineral resource assessments and as an exploration tool for undiscovered mineral deposits.

Interagency Team Assesses Environmental Damage in the Philippines — At the request of the Republic of the Philippines, USGS scientists led a US interagency team to assess mining-related environmental problems, including potential health effects and mine safety issues, at Marinduque Island, Philippines. The team provided recommendations for environmental monitoring and health assessment studies needed to understand the extent and nature of mining-related impacts. In FY 2006, an MRP team is scheduled to travel to the Philippines, again at the request of the Republic of the Philippines, to develop a work plan for integrating existing geologic data and maps of the entire country in a digital format in preparation for a state-of-the-art mineral resource assessment. The work is coordinated by the U.S. Agency for International Development.

Impact of China on the Economy: Use of Minerals Information — Rapid growth in developing countries is greatly increasing global mineral consumption, changing global patterns of mineral production and trade, and increasing releases to the environment. A pattern of rising prices contrasts with the trend of the last 30 years, during which the prices of many minerals declined. Over the next 20 years, mineral commodity price trends may more closely resemble the period from 1950 to 1970, when a larger proportion of the world's economies were undergoing development. Preliminary information about this important topic was released in November 2004 and is available at *http://pubs.usgs.gov/of/2004/1374/*.

USGS Scientists Assist State Department in Kimberley Process Review — In 2005, at the request of the U.S. Department of State, the MRP provided technical representatives to Kimberley Process Certification System (KPCS) international expert teams in Guinea, Liberia, Sierra Leone, and Russia. The KPCS teams reviewed compliance with, or the ability to establish compliance systems for, rough diamond export standards in Africa and Russia. USGS minerals information specialists provided data on imports, exports, and other trade issues critical to the review process. Statistical analyses of data generated by the Kimberly Process were also provided by USGS specialists.

Mineral Resources External Research Program — As recommended by the National Research Council, MRP initiated an external grants program in FY 2004. In June 2005, the

Mineral Resources External Research Program (MRERP) awarded $250,000 to six institutions to conduct research supporting the goals of MRP. The MRERP is announced and managed using the Grants.gov system, as mandated by the President's Management Agenda *(http://www.grants.gov)*.

Additional information about FY 2005 accomplishments of the MRP is available at *http://minerals.usgs.gov/*.

Performance Overview

Measure	2005 Plan	2005 Actual	Change from 2005 Plan	2006 Enacted	2006 Change from 2005 Actual	2007 Request	2007 Change from 2006
Baseline Information: Average square miles of the United States with non-energy mineral information available to support management decisions **(SP) (PART)**	2,987,340	3,097,647	+110,307	3,332,038	+234,391	3,346,737	+14,699
Quality & Utility of Information: X% of U. S. with geologic, geochemical, geophysical and mineral locality data **(PART)**	84%	87%	+3%	94%	+7%	94%	0
Quality & Utility of Information: X% of mineral studies validated through appropriate peer review or independent review **(SP) (PART)**	100%	100%	0	100%	0	100%	0
# of systematic analyses & investigations delivered to customers **(PART)**	3	3	0	6	+3	1	-5
# of cumulative gigabytes managed	16.021	16.131	+0.11	16.221	+0.09	16.3	+0.08
# of formal workshops or training provided to customers (instances/issues/events) **(PART)**	8	8	0	8	0	3	-5
# of mineral commodity reports available for decisions	720	746	+26	720	-26	700	-20
X% of targeted analyses delivered which are cited by identified partners within 3 years after analysis delivered **(PART)**	80%	87%	+7%	≥80%	NA	≥80%	0
Average cost of a systematic analysis or investigation **(PART Eff. Measure)** [a/]	$4.18M	$4.18M	0	$4.40M	+$0.22M	$12.40M	+$8.00M

[a/] Cost in millions of dollars over the full lifetime of the project.

Activity: Geologic Hazards, Resources, and Processes

Subactivity: Geologic Resource Assessments
Program Component: Energy Resources

Program	2005 Actual	2006 Enacted	2007 Fixed Cost & Related Changes [a/]	2007 Program Changes	2007 Budget Request	Change from 2006
Energy Resources Program	23,250	23,760	+371	+2,000	26,131	+2,371
Total Requirements $000	**23,250**	**23,760**	**+371**	**+2,000**	**26,131**	**+2,371**
FTE	***157***	***157***	***-4***	***0***	***153***	***-4***

[a/] Fixed cost increases for this activity total $529 of which $371 will be budgeted and $158 will be absorbed. FTE changes result from rebalance and renew skills mix to gain functional and position flexibilities identified through an extensive workforce planning effort (page H-2).

Summary of 2007 Program Changes for Energy Resources Program

Request Component	Amount	FTE
Program Changes		
• Gas Hydrate Research	+500	0
• Oil Shale Studies and Assessments	+500	0
• Preservation of Data	+1,000	0
TOTAL	**+$2,000**	**0**

Justification of 2007 Program Changes

The 2007 budget request for the Energy Resources Program is $26,131,000 and 153 FTE, which is a program change of +$2,000,000 and 0 FTE.

- **Energy Program (+$500,000 and 0 FTE) —** The proposed increase of $500,000 is to expand work for which Congress provided $498,000 in FY 2006 to the Energy Resources Program (ERP) for study of gas hydrates on the North Slope of Alaska. The Department proposes increasing this $498,000 to $998,000 in FY 2007, for a coordinated effort with the Bureau of Land Management (BLM) and Minerals Management Service (MMS). The additional funds will enable a more comprehensive, cooperative effort with the BLM and MMS that includes (1) additional studies in hydrate-bearing areas of Federal jurisdiction (such as the Gulf of Mexico and Alaska), (2) a growth in the data processed, interpreted, and made available for hydrate research, and (3) study of the properties of gas hydrates in a variety of geologic and climatic settings to determine those settings and properties of greatest advantage in making hydrates a viable energy resource
- **Green River Oil Shale Assessment (+$500,000 and 0 FTE**) **—** The proposed increase of $500,000 is to support Energy Policy Act 2005 legislation requiring a national assessment of the oil shale resources in the United States. USGS will begin the

assessment in 2007 with USGS geologists in concert with IT or Geographic Information System (GIS) contractors and experts from State surveys. The proposed funding is necessary to procure contractual digitizing services (no past oil shale information is digital), build GIS databases, and partner with State surveys to conduct the evaluation and assessment efforts. The first analysis will be to determine the location, quality, and quantity of the Green River oil shale deposits of Colorado, Utah, and Wyoming (a 2-year effort). The proposed funding would be used to (1) determine the status and quality of all existing assessment data and maps, and locations of same, for these deposits, (2) determine areas of inadequate coverage of assessment data and gather additional data needed for better evaluation of the deposits, (3) evaluate the geophysical logs of oil and gas wells drilled on oil shale lands to understand the oil shale distribution, (4) digitize existing USGS oil shale resource maps, prepared in the 1980s, for immediate public distribution, (5) work on a new series of maps, sections, and tables using GIS programs to update the older oil shale quality analyses, which are central to an oil shale assessment, and (6) produce an assessment of the thickness, grade, and abundance of these oil shale deposits as well as create and compile digital (GIS) maps with overlays showing overburden thickness, grade, and abundance of the Green River oil shale resources in Colorado, Utah, and Wyoming.

- **Preservation of Geological and Geophysical Data (+$1,000,000 and 0 FTE) —** The proposed increase of $1,000,000 would be used to meet mandates in the Energy Policy Act of 2005. The USGS plans a multistage response. The first stage will be undertaken in FY 2006 starting with the formation of an ad hoc Preservation Subcommittee under the Federal Advisory Committee (FAC) for the National Cooperative Geologic Mapping Program. The Subcommittee will develop an implementation plan, which must be submitted to Congress within one year of enactment of the law, for the new preservation program. This plan will set priorities for several funding scenarios within the proposed funding level. A survey of Department of the Interior agencies and State geological surveys will be undertaken in FY 2006 to discover the risk to geological and geophysical data holdings managed by these agencies, and estimate the resources needed to rescue and make available these materials. Finally, the Office of the Chief Scientist for Geology will create a position to coordinate the preservation program and work with National Science Foundation (NSF) and the geologic community on common geoinformatics data issues.

  In the second stage, several high-priority preservation efforts will be undertaken in FY 2007 with the proposed increase:

  - A national data archive of geologic and geophysical information, including maps, well logs, engineering data and samples will be designed and started,
  - Approximately 1,000 pallets of important oil shale cores, currently inaccessible and stored in the Anvil Mine, west of Denver, CO, will be brought to the USGS core repository at the Denver Federal Center, curated, and made available to researchers both within USGS and private industry,
  - An expansion of the effort to preserve and make accessible on-line the extensive offshore seismic reflection data along the west coast of the United States donated by private industry,
  - Begin addressing the Department of the Interior preservation and data rescue needs recognized in the survey conducted during FY 2006,

- Fund the program position on the Chief Scientist's staff to coordinate all data/sample preservation efforts and geoinformatics, and
- Initiate curation of critical paleontologic and other energy-related collections.

Program Performance Change Table

Total Performance Change			+2 systematic analyses +3 formal workshops		
	A	***B***	***C***	***D= B+C***	***E***
		Overall Performance Changes from 2006 to 2007			
Measure	**2006 Enacted Performance**	**2007 Base Performance**	**2007 Impact of Program Change on Performance**	**2007 Budget Request Performance**	**Out-year Impact of 2007 Program Change on Performance**
# of systematic analyses & investigations delivered to customers (assessments) *	**5**	**5**	**0**	**5**	**2**
# of formal workshops or training provided to customers (instances/issues/events) *	**7**	**7**	**0**	**7**	**3**

Column B: The performance level expected to be achieved absent the program change (i.e., at the 2006 request level plus/minus funded fixed cost/related changes); this would reflect, for example, the impact of prior year funding changes, management efficiencies, absorption of fixed costs, and trend impacts.

Column E: The out-year impact is the change in performance level expected in 2008 and Beyond of ONLY the requested program budget change; it does <u>not</u> include the impact of receiving these funds again in a subsequent outyear.

*****Impact on these measures will be in the out years as it takes a year or more to produce.

Program Overview

Use of Cost and Performance Information

Gathering ABC information at the task level is new for FY 2006. After 3 or 4 years of tracking this valuable detailed information, ERP will be better placed to track and analyze important trends in program funding and expenditures, as well as scientific emphases within each program and links to the Department's goals and priorities.

The Nation faces simultaneous challenges from increasing energy needs, a growing dependence on imported oil from politically unstable parts of the world, and increasing demands to minimize environmental effects associated with energy resource development and utilization. The USGS Energy Resources Program (ERP) addresses these challenges by conducting research to better understand the fundamental processes that lead to the accumulation of energy resources (oil, natural gas, coal, gas hydrates, and others such as geothermal) and the environmental and human health effects of energy resource usage. ERP scientists use the results of these geoscientific studies to evaluate energy resource accumulation and distribution and to assess the energy resource potential of the Nation and the world (exclusive of U.S. Federal offshore waters). The ERP conveys results from these studies to land and resource managers and policymakers in support of the Department's strategic goal of managing resources to enhance public benefit, promote responsible use, and ensure optimal value. Collectively, this information is used to plan for a secure energy future and to allow for the strategic use and evaluation of resources. Major consumers of ERP products are the Department's land and resource management bureaus, other land management agencies such as the U.S. Forest Service (USFS), Federal environmental and national security agencies,

policy makers and other Congressional offices, State geological surveys, the energy industry, the environmental community, the international energy community, and academia.

As described in the OMB PART review, the ERP role is clearly defined and unique from other Federal, State, local, or private entities. The ERP was reviewed in FY 2003 as an independent, stand-alone program, and was found to be "moderately effective." The PART findings indicate that the ERP generates and provides objective, science-based energy information essential for: shaping policies regarding domestic and foreign energy resources, making sound decisions regarding Federal land and resource use, and maintaining a healthy domestic energy industry. The information ERP produces can be used to determine both current and future resource options.

To clearly measure progress in providing information essential to its customers, ERP tracks 4 intermediate outcome measures associated with producing baseline information about resource assessments for targeted basins, and the quality, content, and satisfaction with the data provided. Outputs associated with these intermediate outcome measures include the delivery of systematic investigations and analyses to customers, the maintenance and growth of 3 long-term data collections, and the provision of formal workshops or training to customers. In addition, as indicated in the PART review conducted by OMB, the ERP will gather information regarding the customer citation of select ERP products within a 3-year time period following product delivery, and will expand the number of ERP products released in digital format to the public.

National Oil and Gas Resources

(Estimates for FY 2005, $13.5 million; FY 2006, $13.4 million; FY 2007, $14.5 million)

The 1995 USGS National Oil and Gas Assessment concluded that there was a low probability that many more large oil accumulations would be discovered in the onshore areas and State waters of the United States. Instead, the Nation's future energy supplies will come from a mix of domestic natural gas accumulations, existing domestic oil and gas fields, and from imports. The United States will need about 50 percent more natural gas and one-third more oil to meet the projected demand in 2020, just 14 years from now. The combination of the 1990 Clean Air Act Amendments, concern about greenhouse gas emissions to the atmosphere, the re-enactment of the Energy Policy and Conservation Act (EPCA) in 2000, the Energy Policy Act of 2005, and growing demand have collectively introduced a sense of urgency in the effort to identify the Nation's remaining deposits of natural gas. On-going ERP research in 2007 is focused on regions of the Nation that have high potential for future natural gas production, including coalbed gas and gas hydrates; those areas that have oil and gas resources under public lands; on the economic and environmental impacts of developing and using energy resources; and on the scientific challenges of improving the accuracy of natural gas resource assessments. The USGS will continue to update its oil and gas resource assessments for the United States, and in FY 2007, the USGS will complete assessments of the Permian Basin, Sacramento Basin, Illinois Basin, and Gulf Coast Tertiary section.

The USGS ERP is estimating the volume of oil and gas resources that underlie Federal lands. This scientific inventory of oil and gas resources on Federal lands is mandated by the EPCA Amendments of 2000 (P.L. 106–469 §604) and forms the basis for the periodic report to Congress required by the Act. The focus in FY 2007 is to complete the documentation and publication of assessments for the 2005 and 2006 EPCA regions, including the Eastern Great Basin, Raton Basin, Michigan Basin, Hanna Basin, Wind River Basin, Washington/Oregon, and the Powder River Basin (PRB).

Alaska — The North Slope of Alaska is thought to have the greatest remaining petroleum potential of any onshore area in the United States. The USGS is conducting an intensive examination of its geology and petroleum potential with current research focused on synthesizing all the previous scientific work and assessments conducted of the National Petroleum Reserve in Alaska (NPRA), and the Arctic National Wildlife Refuge (ANWR) 1002 area, and the lands that lie between the two, so that there is a comprehensive picture of the conventional oil and gas resources on the North Slope. Work also continues on gathering the geologic information necessary to assess the unconventional resources of the North Slope, including coalbed methane. Unconventional resources on the North Slope probably occur in great abundance, but relatively little is known about them and data are scarce. Therefore, an accurate assessment is dependent upon gathering as much geologic information and data as possible. Work in FY 2007 will focus on developing a methodology for assessing the unconventional resources of northern Alaska beyond coalbed methane (CBM), such as tight gas sands. Additional work will focus on examining the natural gas potential of the Brooks Range foothills through collaborative studies with the Alaska Division of Oil and Gas, the Alaska Geological and Geophysical Surveys, and BLM.

The USGS ERP continues to support preservation of irreplaceable legacy digital and hardcopy data from the North Slope of Alaska and to provide government, industry, academic, and public institutions the ability to query and download NPRA data directly from the Internet. Similar efforts continue on a national scale to archive approximately 80,000 miles of seismic data and other data sets that currently reside on 9-track and 21-track magnetic tape. These data will be indexed in a GIS to allow ease of access and retrieval.

Gas Hydrates: North Slope — Gas (methane) hydrate is a crystalline solid formed of water and natural gas and is potentially one of the most important energy resources for the future. Gas hydrate looks and acts much like ice, but it contains abundant amounts of methane. Gas hydrates are known to exist in huge quantities in marine sediments several hundred meters below the sea floor and are also found in association with permafrost in the Arctic. However, the precise magnitude and producibility of an accumulation at a given site remains very much in question. Future contributions from gas hydrate to world energy supplies depend on these issues pertaining to the availability, producibility, and cost of extracting methane from the hydrate phase. One of the primary challenges to the study of gas hydrates is that these materials are not stable at normal surface or sea-level pressures and temperatures. To date, few surveys dedicated to identifying hydrate deposits have been conducted, and better methods to identify and survey gas hydrates, especially the high-concentration zones, need to be developed. The USGS has made important strides in improving the general knowledge of gas hydrates, yet the understanding of processes that control hydrate accumulation is still in the formative stages.

The USGS ERP participates in a number of international consortia composed of research, industry, and academic institutions. One of these is the Mallik Research Consortium. This group drilled three test wells in the Mackenzie Delta in 2002, the results of which were published in 2005. This work demonstrated that gas hydrates are a producible energy source, but further research must be undertaken to translate these results into technically recoverable resource assessments for gas hydrates. Results from the Mallik test well support ERP cooperative research efforts on gas hydrate recoverability on the North Slope of Alaska and in other international consortia efforts. ERP also plans to continue the close work with the Indian Directorate General of Hydrocarbons, started in 2005, in their effort to study, characterize, and explore for hydrates off the coast of India.

In FY 2006 and FY 2007, efforts will continue to assess the recoverability and production characteristics of permafrost-associated natural gas hydrates and associated free-gas accumulations in the Prudhoe Bay-Kuparuk River area on the North Slope of Alaska. The objective is to examine the resource potential of two known gas hydrate/free-gas accumulations (Eileen and Tarn) in the Prudhoe Bay-Kuparuk River area; and possibly drill and test a viable gas-hydrate/free-gas prospect. This effort is a cost-shared study between DOE and the USGS. Technical support and data access are being supplied by industry and academic cooperators on the North Slope.

In addition, the USGS ERP is assessing the recoverability, resource potential, environmental effects, and production characteristics of Alaskan permafrost-associated natural gas hydrates in cooperation with BLM. The primary goal of this research is to lay the groundwork for an assessment of the recoverability and potential production characteristics of onshore natural gas hydrates and associated free-gas accumulations on the Alaska North Slope. This work builds on the efforts (described above) addressing the known gas hydrate accumulations overlying the Prudhoe Bay and Kuparuk River oil fields, and provides the basis from which to assess the occurrence of gas hydrate accumulations on unexplored State and Federal managed lands. USGS cooperators (BLM) and Alaska Department of Natural Resources (DNR) in this effort are responsible for oil and gas development that takes place on Alaskan public lands, as well as for most pipeline right-of-ways. The basic and applied research that the USGS produces through this cooperative study will provide the BLM and the Alaska DNR with the knowledge of where potential gas hydrate development may take place. In FY 2007, USGS will produce an estimate of the technically recoverable hydrate resources on the North Slope. This will be the first time a technically recoverable estimate for hydrates will have been published.

Gulf Coast Region — The Gulf Coast region is one of the major hydrocarbon-producing areas of the world. As such, the USGS ERP is conducting investigations—using seismic, well, and geochemical data—into the geologic framework of this region. This effort will provide the geologic, geophysical, and geochemical framework studies necessary to evaluate the oil-, gas-, and coal-bearing rocks of the region that have the greatest potential for future oil, gas, and coalbed methane production. A better understanding of the geologic framework and petroleum systems will enable USGS scientists to (1) better assess the potential for undiscovered petroleum resources, and (2) define potential onshore extensions of plays identified by the MMS for offshore Federal resources. The work conducted in FY 2005 and FY 2006 will provide the basis for a geologic model that will facilitate, in FY 2007, an assessment of the Tertiary Gulf Coast section.

Coalbed Methane — USGS geologists are investigating the potential CBM resources in southernmost Texas and north-central Louisiana. To utilize available industry expertise, several Cooperative Research and Development Agreements (CRADA's) have been formed that facilitated USGS and Louisiana Geological Survey (LGS) participation during the industry-led drilling of several exploration holes. The USGS has analyzed core and gas samples from these exploration wells and studied the subsurface geology of the coal basins. The primary goal of this cooperative work is to identify additional resources of domestic gas and to determine the potential for CBM development in the region. Results from these collaborative studies of coalbed methane resource volumes in the Gulf Region have revealed significantly greater resources than were previously recognized. The ERP focus in FY 2007 will take this on-going work, new data, and new synthesis to assess the coalbed methane resources of the Gulf Coastal Plain.

The USGS and the BLM have an on-going cooperative agreement in the Powder River Basin (PRB) under which the USGS, in the course of its national geologic studies, produces a variety of geologic, coal, and coalbed methane information, data, and maps. These data and interpretations are used directly by BLM land managers, as well as other governmental and nongovernmental groups in the area involved with CBM exploration and development. These data are also used by BLM, the Bureau of Indian Affairs (BIA), and several Tribes for land use management plans to forecast both the minimum number of wells necessary to produce a given volume of gas, and the anticipated effect of water extraction during field development on the surficial environment. The information helps BLM, BIA, and Native groups identify areas on Federal and Native land leases where the gas resource is being drained by wells on State or private lands, consistent with the Department's strategic goal to manage resources to enhance public benefit, promote responsible use, and ensure optimal value.

Continuous Resources — Continuous gas accumulations (fig. 1, next page) generally consist of large, single fields having spatial dimensions equal to or exceeding those of conventional plays, and, in contrast to conventional gas fields, cannot be represented in terms of discrete units delineated by downdip hydrocarbon-water contacts. Estimates show that the largest remaining undiscovered domestic resource occurs in what USGS scientists term “continuous” gas accumulations (e.g., coalbed methane and basin-centered gas from low-permeability geologic units such as "tight gas sands" and shale-gas reservoirs. Note: Others use the term "unconventional" when referring to these resources, but because these resources can be developed with currently available technology and practices, the USGS employs a narrower definition of unconventional resources e.g., referring to truly frontier energy resources such as gas hydrates.) Understanding continuous gas resources–the fastest growing resource produced in the United States–is therefore critical, both in terms of the responsible use of this energy resource as well as the sustainability of the domestic energy supply. The USGS, as part of its long-term research efforts, started a small effort in FY 2006 directed at improving the understanding of continuous gas resources. The work, which will continue in FY 2007, focuses on the identification of the controls on unconventional gas accumulations, the role of gas-generation processes, and the characteristics of petroleum and associated water in these basins. The goal is to develop a sound understanding of the evolution of present-day hydrocarbon accumulations, many of which are currently being produced, but with difficulty, because little is understood about these resources.

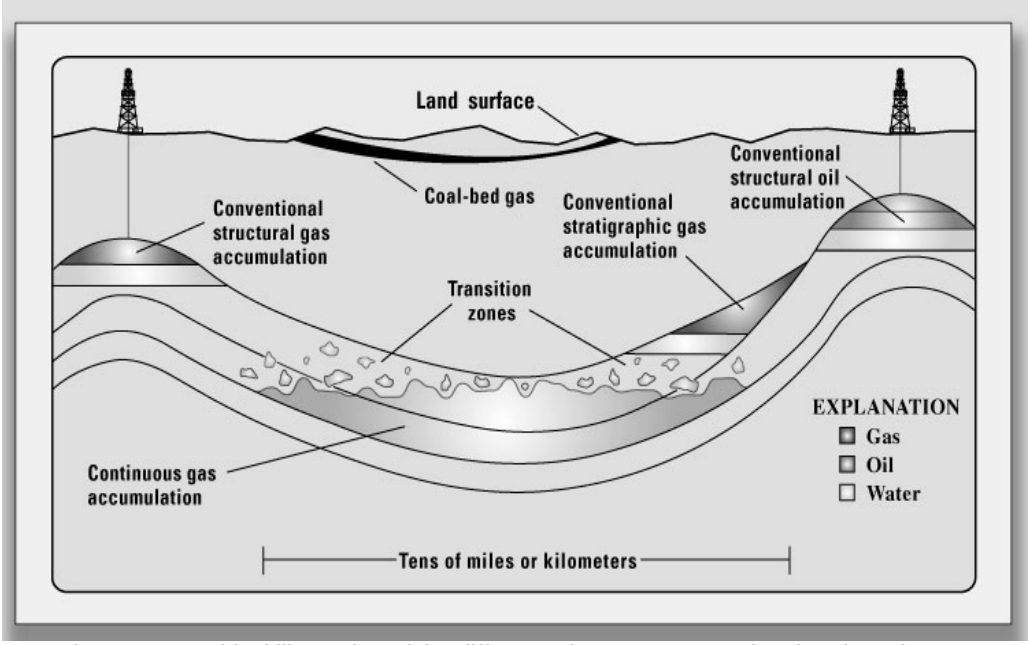


Figure 1. Graphical illustration of the difference between conventional and continuous petroleum accumulations.

Geothermal Resources

(Estimates for FY 2005, $0; FY 2006, $0.5 million; FY 2007, $0.5 million)

In FY 2006, the USGS began a 3-year project to produce a new national assessment of geothermal resources capable of producing electric power, with a focus on the western United States. This work will continue in FY 2007, leading to the ultimate completion of an assessment in FY 2008. This assessment effort, in partnership with the DOE, BLM, National Laboratories, universities, State agencies, and a consortium of the geothermal industry, will highlight geothermal energy resources located on public lands. Geological, geophysical, and geochemical data from geothermal industry exploration and development studies will be combined with existing information to establish a database for the resource assessment and to investigate the nature and extent of geothermal systems in the western United States. The last national geothermal resource assessment was published in 1979, and advances in the field of geothermal energy and technology indicate that much of the information, as well as the geologic models for geothermal resources, contained in the earlier assessment is out of date. The ERP assessment will include a detailed estimate of electrical power generation potential and an evaluation of the major technological challenges and environmental effects of increased geothermal development. Support products will include online geospatial databases of regional and system-specific geological, geophysical, geochemical, and hydrological information relevant to geothermal resources. The assessment and associated databases will be augmented with a series of research publications describing scientific advances and improved assessment methodologies.

National Coal Resources

(Estimates for FY 2005, $2.6 million; FY 2006, $2.3 million; FY 2007, $2.3 million)

The USGS ERP has recently revised the USGS coal assessment methodology in order to determine the subset of U.S. coal resources that is both available for mining and technically

recoverable (i.e., the coal reserve base). In FY 2006, ERP started to systematically evaluate the major coal-producing basins, starting with the PRB, the single largest producing coal basin in the United States. In FY 2007, ERP will finalize the revised assessment for the PRB after finishing (in FY 2006) the geological and engineering models needed for the assessment process. These new studies will illustrate how much resource is actually available and technically recoverable, given current restrictions and guidelines.

Federal and State land managers can use these results to support land-use decisions; environmental regulators use the information to evaluate compliance with regulations stemming from the 1990 Amendments to the Clean Air Act; and economists use the results to forecast economic trends at regional and national scales. Electric utilities, coal producers, and coal consumers also use these results and products for evaluating the availability and quality of coal feedstock to electricity generating power plants and to achieve compliance with emission standards and other environmental regulations. These studies form the basis for addressing the challenge of future changes in the energy mix as the Nation responds to increasing demands for cleaner-burning coal. The ERP is working closely with counterparts at other organizations (BLM, Energy Information Administration, Securities and Exchange Commission, and the Office of Surface Mining) to ensure that the revised products address a variety of needs.

With the conclusion of this first digital compilation of coal resource and coal quality data, the USGS will begin to determine how to integrate this new digital resource information with national coal quality inventories. The resulting integrated data will enable the USGS to provide critical information to land and resource managers who must contend with the Nation's ever-increasing need for energy while protecting the environment and human health.

World Oil and Gas Resources

(Estimates for FY 2005, $2.0 million; FY 2006, $2.5 million; FY 2007, $2.4 million)

In FY 2007, the USGS ERP will continue to assess those oil and gas provinces of the world that were not targeted in previous assessments. The highest priority task is the Arctic Assessment, which will assess targeted Arctic provinces in Canada, United States, Russia, Norway, Denmark, Greenland, and other countries. These provinces may contain significant petroleum hydrocarbon resources. Post appraisal of the USGS 2000 world petroleum assessment indicated that about one-quarter of the world's undiscovered petroleum resources occur in the Arctic. Thus, ERP undertook a focused approach to evaluating the Arctic, because these additional provinces will be critical for understanding not only the full resource potential of the Arctic, but also the world. This task is strongly supported by the DOE, the national security community, a consortium of companies, and most especially by the foreign governments and academic institutions of the countries of interest. Additional tasks include assessment of other provinces, such as those in the Middle East, another area of great petroleum resources, and continuing production of geologic maps and attendant geologic information.

Energy Information and the Environment

(Estimates for FY 2005, $6.3 million; FY 2006, $ 4.2 million; FY 2007, $5.2 million)

The production and use of all energy sources generates some type of environmental impact. For example, oil and gas production is attended by water production that must be disposed of in some way and coal combustion sometimes produces a wide range of potentially hazardous substances.

Environmental and human health challenges addressed by the USGS ERP include safe disposal of hazardous oilfield waters co-produced with oil and gas, disposal of waters produced during coalbed methane recovery, coastal subsidence associated with oil and gas production, and human health impacts of energy resource occurrence and use.

Coal Quality and Human Health — The global demand for power generation and hence, coal consumption is huge. World annual coal demand is projected to exceed 8 billion short tons in 2025, up from 5.2 billion short tons in 2002, with most of the increase occurring in developing countries (Source: EIA IEO 2005; available at *http://www.eia.doe.gov/oiaf/ieo/pdf/coal.pdf*.) As a result of this expected increase in usage, the ERP has revised its coal quality project to focus on current and growing concerns related to coal quality, including developing a more quantitative and predictive understanding of the impacts of United States and global coal usage. Meeting the demand of energy from coal while minimizing environmental impacts is one of the highest priorities of the Nation's Energy Plan.

Current issues pertaining to production, beneficiation and (or) conversion, and the environmental impact of coal combustion processes and coal combustion products (CCP) will be investigated. Studies that examine the feed coal(s) and CCP's from individual coal-fired power plants (commonly referred to as “cradle to grave” studies) are a key component of this effort. In the initial studies, particular emphasis will be placed on sampling feed coal and CCP components in one or more coal-fired power plants. Once the sampling is complete, ERP will document distribution of element contents between the feed coal and various CCP components by using various analytical techniques, including leaching studies.

The USGS ERP conducts research to understand the natural variability of coal quality, and the ramifications of such variability on environmental quality and human health. For example, in many parts of the country and the world, coal deposits may act as natural aquifers and convey large amounts of potable water. Balkan Endemic Nephropathy (BEN), a disease thought to develop from long-term exposure of susceptible individuals to low levels of toxic organic compounds derived from coal in drinking water in many parts of the Balkans, has been extensively studied by the USGS in conjunction with the human health care sector and international doctors. Study results from BEN research point to other potential connections between human health and toxic organics from energy resources. The ERP continues to build on the expertise developed during the BEN study by evaluating linkages in the United States and other countries where the confluence of specific human diseases and toxic organic compounds from coal may occur. In the United States, the water obtained from low-rank coal beds, either by drinking water wells or by coalbed methane production wells, may have leached toxic organic compounds from coal. These compounds may compromise human health and degrade environmental quality. The ERP is characterizing water quality in these settings. ERP researchers have been contacted by a number of foreign scientists who have noted BEN-like symptoms within their own countries. A number of cooperative efforts have formed from these contacts, leading to an increased understanding of this disease.

Because more than half of the Nation's electricity demand is met through burning coal, and that demand will continue to increase in the future, an understanding of the connections among coal quality, environmental quality, and human health during aspects of coal resource utilization is essential to resource managers and policymakers alike. The USGS ERP will continue to work with representatives from the human health care sector, CDC, NIH, National Institute of Environmental Health Sciences, and other domestic and international groups of doctors, epidemiologists, and health care providers to investigate health effects that may be associated with energy resource use. In one such project, continuing into FY 2007, the USGS will

collaborate with the Navajo Nation to study the relationship of indoor and ambient air quality to respiratory diseases in the Navajo Nation. This work will study the possible linkages between indoor coal burning and human respiratory ailments. This research provides objective scientific information to guide private industry, Federal and State policymakers, foreign government officials, and health care workers.

The USGS ERP will finalize the compilation of coal quality data on coals from around the world as part of the **World Coal Quality Inventory**. These efforts have yielded a unique set of data that a variety of customers can use to evaluate the quality of the world's coal and potentially the environmental impacts of global coal use. On-going work includes coal quality analyses of coal samples from 90 percent of the countries that contain coal. Samples from the former Newly Independent States, Europe, Australia, and other top-coal producing countries are being analyzed, and smaller coal quality data inventories for other countries will be assembled to make them accessible to the public. Once the comprehensive coal quality database is created, these newly obtained data will be incorporated into the database. Emphasis in FY 2007 will focus on finalizing the database and creating a world coal map.

The National Coal Resources Data System (NCRDS)
(Estimates for FY 2005, $0.8 million; FY 2006, $ 0.9 million; FY 2007, $0.8 million)

NCRDS provides the world's largest, most comprehensive, publicly available, electronic coal quality and quantity databases. Started more than 25 years ago, the USGS databases contain information on the location, quantity, attributes, stratigraphy, and chemical components of U. S. coal deposits, including quality analyses of more than 14,000 coal samples and some 200,000 stratigraphic records. At least 136 coal-quality parameters are determined, including detailed location information and a wide range of physical and chemical properties. The NCRDS stratigraphic database contains more than 30 parameters describing the geologic section measured from drill holes and surface exposures including specific geo-referenced information. These data are accessible through USGS-constructed interfaces using GIS, geologic correlation software, statistical, and cartographic tools. These interfaces can be used to perform several analytical capabilities and produce a robust suite of products addressing several coal resource assessment issues, including: locating coal deposits having desirable characteristics for various uses; assessing environmental impacts of coal use; evaluating coal resources; and describing technological properties of coal from specific areas and beds. A long-term partnership of the USGS and approximately 22 State geological surveys, both contributors to and users of the databases, has formed the basis of this sustained effort to collect, correlate, and analyze the basic data, build and verify the databases, and digitally utilize these USGS-maintained data sets. Portions of the coal resource and geochemical databases can be found on the USGS Energy Web site *(http://energy.usgs.gov)*, or interested parties may request selected data in several formats.

FY 2007 Program Performance Estimates

The planned accomplishments and outcomes listed below demonstrate the utility of USGS activities that are counted for GPRA and PART measures, including: "number of targeted basins with resource assessments available to support management decisions," "percent of formal USGS publications and scientific products receiving appropriate peer review," "number of systematic analyses and investigations," "long-term data collections," and "training and workshops."

USGS Scientific Efforts in Support of the Energy Policy Act of 2005 — The joint Office of Management and Budget/Office of Science and Technology Policy Research and Development priorities for FY 2007 note that the Administration's energy and environmental research initiatives are critical for achieving sustained economic growth while ensuring national energy security and a healthy environment. The Energy Policy Act of 2005 calls for several major activities for which USGS is critical for success and mandated to conduct the work. First, the Act focuses on the use of all energy sources, with an emphasis on assessment of geothermal resources (Section 226) and alternative energy sources such as gas hydrates and oil shale (Sections 968 and 369). Further, the Act calls for creation of the Preservation of Geological and Geophysical Data Program (Section 351) to rescue, curate, and preserve materials and data related to energy and minerals.

In response to mandates of the Energy Policy Act of 2005, USGS proposes to start assessment efforts on the oil shale resources of the United States, and is joining forces with the MMS and BLM to evaluate domestic gas hydrates resources in Alaska and the Gulf of Mexico. The proposed increase will allow expansion of research being done within base, such as the gas hydrate work, and allow for the start of new work mandated in the Energy Policy Act of 2005, such as conducting a national oil shale assessment.

FY 2006 Planned Program Performance

Changes in performance plans are mostly due to the difference between FY 2005 planned appropriation and the FY 2006 enacted dollars.

- The 5 systematic analyses and investigations delivered to customers in FY 2006 reflects a decrease of 1 from FY 2005 Plan and a decrease of 2 from the FY 2005 Actual as a result of the Energy and Environment Program reduction (-$500,000). The FY 2006 funding decrease eliminated research on geologic sequestration options for carbon dioxide and terminate the development of an assessment methodology for geologic sequestration of carbon dioxide.
- The number of annual gigabytes collected reflects a decrease of 77.755 from the FY 2005 actual. This decrease is not an accurate depiction of outcome because FY 2005 was a banner year for data from Alaska; many more data than anticipated were received for processing.
- A similar situation exists for the seeming decrease of 1 in the number of targeted basins with resource assessments available. The table reflects a decrease in the 2006 plan with respect to the 2005 actual. However, in 2005, ERP delivered one more than planned resource assessment, and there is no formal decrease in performance when the 2005 and the 2006 plans are compared.
- The number of cumulative gigabytes managed reflects an increase of +20.038 from FY 2005 Actual to FY 2006. The number of gigabytes in long-term databases maintained are used to measure growth. The number of gigabytes is not comparable among databases, as they contain very different types of data. However, the number of gigabytes in each is expected to grow as the databases grow in their utility.

The planned accomplishments and outcomes listed below demonstrate the utility of USGS activities that are counted for GPRA and PART measures, including "number of targeted basins with resource assessments available to support management decisions," "percent of formal USGS publications and scientific products receiving appropriate peer review," "number of

systematic analyses and investigations," "long-term data collections," and "training and workshops."

The number of long-term data collections maintained remains the same: (1) the National Coal Resources Data System, (2) the National Energy Research Seismic Library, and (3) the Organic Geochemical Database (OGD). ERP now counts the number of gigabytes in these databases as a measure of growth. The number of gigabytes is not comparable among databases, as they contain very different types of data. However, the number of gigabytes in each is expected to grow as the databases grow in their utility. In FY 2006, the ERP will develop a framework to expand the OGD, enabling the incorporation of analytical results from the Energy Analytical Laboratory (EAL). The EAL is responsible for major, minor and trace element analyses in coal, water, and related samples from major coal provinces in the United States and around the world. The integration of the two databases will provide customers, stakeholders, and the general public ready access to a unique and comprehensive suite of geochemical data, and further extend the utility of these long-term data collections.

As part of a continuing effort to demonstrate government accountability and improve performance, the ERP will initiate an external audit and review process of the Organic Geochemistry Laboratory (OGL). This process seeks to build on the successes of the EAL operating audit, and plays an important role in underpinning new geochemical data that will ultimately be served externally via the long-term data collection. Implementation of recommendations from the EAL audit has not only significantly improved the performance of data analyses, but has also achieved safer and more cost-effective laboratory operating conditions. Likewise, the audit and review of the OGL will identify opportunities for improving procedures and business practices, thereby optimizing the safety and efficiency of operations and ensuring that analytical results are of the highest quality.

In FY 2006, the number of targeted basins with resource assessments available to support management decisions is 6 and includes Northeast Greenland, Northern Afghanistan, Hanna Basin, Wind River Basin, Washington/Oregon, and the Powder River Basin.

Also in FY 2006, the ERP will provide 7 formal workshops or training to customers. ERP training consists of courses requested by customers and cooperators, and are not always predictable. Workshops are usually set up to further a common scientific or research need, to seek outside ideas or validation of ERP work, or to share our expertise with counterparts in other countries. Examples include (1) CBM courses providing instruction about CBM genesis, occurrence, migration, assessment, testing, and (2) training on oil and gas assessments for foreign scientists. ERP workshops include gatherings of experts to discuss specific oil and gas or coal issues such as reserve growth and resource assessment methodology–two issues that many groups (academic, other government, and industry consortia) struggle with as these issues evolve along with technology and our understanding of geology.

In addition, the ERP will conduct the following research and assessment activities in FY 2006:

- The ERP will continue to update its oil and gas resource assessments for the United States, and plans to complete its assessment of those basins listed above. This effort is in support of the EPCA amendments of 2000 and forms the basis for the periodic report to Congress required by the Act.
- The ERP will continue to update its oil and gas resource assessments for the world and in FY 2006 will complete its assessment of Northern Afghanistan with Afghan Ministry

counterparts. As part of its Arctic assessment, ERP will complete the assessment of Northeast Greenland, for publication in FY 2007.

- The ERP will continue work to assess the recoverability, resource potential, and production characteristics of Alaskan permafrost-associated natural gas hydrates in the Prudhoe Bay-Kuparuk River area on the North Slope of Alaska. This work is conducted in cooperation with the BLM and the Department of Energy–British Petroleum Exploration Alaska project.
- The ERP has revised its methodology for coal resource assessment to determine the subset of coal resources that are available for mining and are technically recoverable (i.e., the reserve base). The ERP will now systematically evaluate the major coal-producing basins and will begin with the PRB, the single largest producing basin in the United States. In 2006, ERP will finalize the geological and engineering models needed by the methodology.
- The ERP will start a pilot project focused on the study of reserve growth, both in the United States and the world. Additions to reserves come from a variety of factors and reserve growth is that part of the identified petroleum resources over and above measured reserves in previously discovered fields and reservoirs. The pilot project will implement a multidisciplinary approach to improve the understanding of reserve growth, and explore alternative methodologies for evaluation. This project will develop a strategy to integrate reserve growth studies into the on-going domestic and world petroleum-assessment projects.
- With the conclusion and release of geologic analyses and assessments of the petroleum resources of the three major regions of the Alaska North Slope–NPRA, ANWR-1002, and the Central North Slope–ERP will undertake efforts to synthesize these three related analyses and assessments so that USGS produces an overall synthesis and assessment of the Alaska North Slope, the first since 1995.

The ERP will continue activities on recommended actions from the ERP PART. The two recommended actions and associated activities are as follows:

1. Continue to make reports and data more accessible and user friendly.

- ERP continues to monitor the customer survey feedback from ERP-supported Web sites.
- The ERP has made a concerted effort to streamline Web sites to make products, information, and other data delivered seamless to customers. This effort was undertaken to better assist customers, particularly Federal agencies, in efficiently searching for and obtaining USGS energy-related data and products. The new, streamlined Web sites will be uploaded and enhanced in FY 2006.
- The ERP IT specialists are working with ERP scientists to serve more data sets via the Web and more quickly, as they become available. In FY 2006, particular emphasis will be given to digital coal products so as to enhance delivery of this information to levels commensurate with those of other aspects of the ERP research portfolio.

2. Refine performance measures drafted during the PART process and finalize a 5-year program plan that is consistent with these measures.

- The ERP finalized a new plan in FY 2005 and the final, approved version is available at *http://energy.usgs.gov/PDFs/USGS-ERP_5-Year-Plan.pdf*.

FY 2005 Program Performance Accomplishments

Oil and Gas Assessments on Federal Lands: EPCA Inventory — Under the Energy Policy and Conservation Act Amendments of 2000 (EPCA), the ERP is responsible for providing assessments of the undiscovered, technically recoverable oil and natural gas resources for the inventory. The ERP continues to assess petroleum-bearing basins and in FY 2005, ERP contributed the following basins to the EPCA inventory: Raton Basin, Yukon Flats, Central North Slope Alaska, Eastern Great Basin Province, and Michigan Basin.

World Oil and Gas Resources — Energy is critical to the health of the United States and world economies, and the United States is highly dependent upon imported oil. Credible scientific information on the abundance and geologic distribution of energy is vitally important. In FY 2005, the ERP completed assessment of the undiscovered oil and gas resources in the North Cuba Basin, Cuba and continued to develop its assessment methodology for undiscovered resources of the Arctic.

Gas Hydrate Activities:

- **Release of the Mallik Scientific Volume —** The Mallik International Research Consortium for the first time demonstrated the technical feasibility of producing gas from gas hydrates. Depressurization and thermal heating experiments, with real-time formation monitoring, were successful at the Mallik site. Results of the Mallik work were published in the Geological Survey of Canada Bulletin 585.
- **Use of Mallik Results Elsewhere —** Results of the Mallik effort are being used in numerous studies to evaluate the production characteristics of other, similar gas hydrate accumulations in the United States. Results are used in (1) the cooperative project between BLM and USGS to assess the recoverable potential of gas hydrate and associated free-gas accumulations on State of Alaska- and Federal-managed lands in northern Alaska, and (2) on-going MMS gas hydrate resource assessment in the Gulf of Mexico, in which ERP has contributed to the development of improved assessment methodologies within this effort.
- **Participation in Two Deep Sea Drilling Cruises – The Joint Industry Project (JIP) and the International Ocean Drilling Program (IODP) —** USGS scientists were instrumental in these scientific programs and made significant contributions to the seismic interpretations and coring site-selection process, onboard activities, and collection, synthesis and interpretation of data.
- **Alaska Gas Hydrate Workshop —** The USGS and State of Alaska jointly hosted a workshop in Anchorage, AK, with the primary goal of developing an improved understanding of the energy resource potential of gas hydrates in northern Alaska, and then identifying the various scientific and technological endeavors necessary to achieve that goal.
- **Work with DOE-BPXA Project on the North Slope of Alaska —** Within the DOE-BPXA project in northern Alaska, the USGS has the lead on assessing the geologic occurrence of gas hydrates in the area of the Milne Point Oil Field. The USGS conducted a detailed analysis to answer questions about gas-hydrate occurrence, distribution, reservoir properties, possible production methods, and economics, and to identify prospects that are appropriate for the proposed production test well drilling.

Assessing Alaska's Energy Resources — The USGS released two substantive studies of the oil and gas resources of Alaska in FY 2005, (1) assessments of Yukon Flats in Central Alaska, and (2) an assessment of the Central North Slope. Stakeholders view the USGS as an impartial, objective research agency capable of providing scientifically robust estimates of technically recoverable, undiscovered oil and gas resources. The Yukon Flats assessment was of interest to the Federal Government, the State of Alaska, and Native corporations and villages, as the major land and resource owners in the area. This assessment is being considered in discussions of a potential land swap between one of the Native corporations and the U.S. Fish and Wildlife Service. The Central North Slope assessment area consists mostly of State and Native lands and interest in gas accumulations remains high because of the discussion around the building of a natural gas pipeline.

Coal Laboratory Audit: Implementation of Recommendations — The ERP conducted an operating audit of its Energy Analytical Laboratory (EAL). The EAL is responsible for the analyses of major, minor and trace elements in coal, water, and related samples. The results of the laboratory audit were very positive and included several recommendations, and in FY 2005, a number of recommendations were implemented. Implementation of the recommendations significantly improved the performance for the determination of components, and also achieved a more cost effective and safe operation.

Revised Coal Methodology — The ERP revised the USGS methodology for coal resource assessment in FY 2005. The revision was made so ERP could determine the subset of in-place resources that are available for mining and are technically recoverable (i.e., the reserve base). This revised assessment methodology was peer reviewed and published in 2005 (USGS OFR 2005-1076). The ERP involved other Federal agencies, industry, academia, and other interested parties in the peer review and this process helped optimize the relevancy of the new procedure.

Technical Training and Assistance — Because the ERP conducts assessments with a consistent, reviewed, transparent methodology, and because many organizations accept and use the results of USGS petroleum assessments, ERP scientists are often sought out by groups for oil and gas assessment training (1) the Colombian Ministry of Energy requested training from ERP resource geologists and sent four employees to attend a 3-day training course organized and taught by ERP scientists and (2) the USGS has an agreement with the Afghan Ministry of Mines and Industry, in which we provide technical assistance and an oil and gas assessment of the northern part of Afghanistan. As part of this agreement, the USGS provided Afghan counterparts training in: petroleum systems analysis, GIS and other database techniques, seismic interpretation, geochemical parameters related to petroleum systems and assessment, and methodology of resource assessment.

Landmark publications on energy resources and utilization by ERP scientists:

- **Global Resource Estimates from Total Petroleum Systems —** The distribution, quantities, and availability of petroleum resources continue to be of paramount importance to world economies. AAPG Memoir 86 "*Global Resource Estimates from Total Petroleum Systems*," is a landmark publication on world petroleum resources that extends the utility of the USGS World Petroleum Assessment 2000 and discusses the quantity, quality, and location of petroleum energy resources.
- **GSA Special Paper on Coal Systems Analysis —** Coal is an important energy resource, and growing dependence on coal as an energy resource necessitates a thorough understanding of the quantity, quality, and distribution of coal resources. The

GSA Special Paper 387 "Coal Systems Analysis," provides a concept to better understand, characterize, and evaluate coal and coalbed methane resources.

- **Energy Resource Studies, Northern Front Range, Colorado, USGS Professional Paper 1698 —** This publication documents findings from the USGS Front Range Infrastructure Resources Project, which was designed with direct input from stakeholders and addressed multiple aspects of energy resources (oil, natural gas, coal, coalbed methane) in the region, as well as some environmental and land-use implications resulting from the exploration, development, and production of such resources.
- **Environmental Issues of Petroleum Exploration and Production —** This special issue of Environmental Geosciences details recent advances in the study of environmental effects associated with releases (e.g., oil and brine) from petroleum resource production and utilization, highlighting USGS studies of legacy issues from the Osage-Skiatook Petroleum Environmental Research sites in northeast Oklahoma. Characterization and remediation of these sites is particularly critical in areas where land use is changing from petroleum production to residential, agricultural, or recreational uses.

Performance Overview

Measure	2005 Plan	2005 Actual	Change from 2005 Plan	2006 Enacted	2006 Change from 2005 Actual	2007 Request	2007 Change from 2006
Baseline Information: # of targeted basins with resource assessments available to support management decisions **(SP) (PART)**	6	7	+1	6	-1	6	0
Quality and Utility of Information: X% of energy studies validated through appropriate peer review or independent review **(SP) (PART)**	100%	100%	0	100%	0	100%	0
# of systematic analyses & investigations delivered to customers (assessments)	6	7	+1	5	-2	5	0
# of formal workshops or training provided to customers (instances/issues/events)	8	8	0	7	-1	8	+1
X% of targeted analyses/investigations delivered which are cited by identified partners within 3 years of delivery **(PART)**	80%	86%	+6%	≥80%	0	≥80%	0
Average cost of a systematic analysis or investigation **(PART Eff. Measure)**	$2.75M	$2.73M	-$0.02M	$2.75M	-$0.02M	$2.75M	0
# of annual gigabytes collected	42.038	97.793	+55.755	20.038	-77.755	20.038	0
# of cumulative gigabytes managed	253.496	351.289	+97.793	371.327	+20.038	391.365	+20.038

This page intentionally left blank.

Water Resources Investigations

Subactivity	2005 Actual	2006 Enacted	2007 Fixed Cost & Related Changes [a/]	2007 Program Changes	2007 Budget Request	Change from 2006
Hydrologic Monitoring, Assessments, and Research	142,454	142,527	+2,805	-3,456	141,876	-651
FTE	*1,152*	*1,173*	*0*	*-9*	*1,164*	*-9*
Cooperative Water Program	62,337	62,833	+1,338	-2,000	62,171	-662
FTE	*789*	*780*	*0*	*-18*	*762*	*-18*
Water Resources Research Act Program	6,409	6,404	0	-6,404	0	-6,404
FTE	*2*	*2*	*0*	*-2*	*0*	*-2*
Total Requirements $000	**211,200**	**211,764**	**+4,143**	**-11,860**	**204,047**	**-7,717**
FTE [b/]	***1,943***	***1,955***	***0***	***-29***	***1,926***	***-29***

[a/] Fixed cost increases for this activity total $5,916, of which $4,143 will be budgeted and $1,773 will be absorbed.
[b/] The decrease of -18 FTE in the Cooperative Water Program subactivity is matched by a decrease of -18 FTE in the reimbursable program, for a total decrease to this Activity of -47 FTE.

Activity Summary

The 2007 budget request for the Water Resources Investigations Activity is $204,047,000 and 1,926 FTE, which is a net change of -$7,717,000 and -29 FTE from the 2006 enacted level. Additional information on program changes is provided in each program element section of this document.

Use of Cost and Performance Information

Activity Based Costing data for FY 2005 demonstrate that the Cooperative Water Program has maintained an approximate proportion of half data collection and half interpretive studies.

Given Administration priorities and PART recommendations for emphasizing data collection, the USGS chose to reduce interpretive studies (systematic investigations) to maintain data collection (number of streamgages reporting in real-time through NWISWeb).

Since 1879, the USGS has been involved in issues related to water availability, water quality, and flood hazards. This work, conducted by more than 3,500 hydrologists, technicians, and support staff located in every State, includes collection, management, and dissemination of hydrologic data; analysis of hydrologic systems through modeling or statistical methods; and research and development leading to new methods and new understanding.

The mission of the USGS Water Programs supports the mission and goals outlined in the USGS Strategic Plan (2000–05), which states: "The USGS serves the Nation by providing reliable scientific information to describe and understand the Earth; minimize loss of life and property from natural disasters; manage water, biological, energy, and mineral resources; and enhance and protect our quality of life." The mission also supports the Serving Communities portion of the Department's Strategic Plan, in particular end outcome goal SEO.2, "Advance knowledge through scientific leadership and inform decisions through the application of science." This is accomplished through activities

that contribute to the Department's Intermediate Outcome: "Improve information base, information management, and technical assistance."

Congressional Directives

The FY 2006 Appropriations Act for the Department of the Interior and Related Agencies included the following directive for the USGS water programs:

> "The managers are concerned by continuing reports that suggest the Survey's water resources program is providing or seeking to provide a variety of commercial services to Federal and non-Federal entities in direct competition with the private sector. The managers have previously encouraged the Survey to use the services of the private sector in the conduct of its activities wherever feasible, cost effective, and consistent with the quality standards and principles pertaining to the effective performance of governmental functions. The managers expect that the Survey should strive to implement such a policy to the best of its ability in the performance of its work."

The USGS recognizes that the capabilities of the private sector to conduct hydrologic investigations have increased in recent years, and that many USGS "services" can also be performed by the private sector. The appropriate role for the Federal Government is addressed in Cooperative Water Program policy statements that appear on the USGS Web site regarding avoiding competition (*http://water.usgs.gov/coop/competition.html*). This Web site also includes guidance for USGS managers regarding the need to avoid competition with the private sector. The USGS is also preparing a report for the Appropriations Committee that details USGS efforts in this area.

In many cases the USGS works with State and local partners and private sector interests to bring all available expertise to the table. For example, the USGS has collaborated with the private sector and the New York State Department of Environmental Conservation, which is interested in learning about emerging contaminants in wastewater and wants to determine the occurrence of certain contaminants in and evaluate the efficacy of various treatment systems for removing these contaminants prior to release to rivers or injection into aquifers. The private-sector member of the team—the firm Camp, Dresser, and McKee (CDM)—provides expertise in advanced wastewater treatment technologies and sampling strategies for wastewater systems. The USGS brings an ability to process samples and run laboratory analyses for large numbers of chemicals down to very low concentrations. Furthermore, the USGS has expertise in analysis of such data in light of temporal and spatial variabilities. The USGS and CDM are publishing and presenting results jointly at technical meetings. The State funds CDM and USGS separately, but with a clear understanding of the collaborative nature of the work. This partnership was recognized with a Platinum Award from the New York Chapter of the American Council of Engineering Companies in April 2005.

Program Assessment Rating Tool (PART) Evaluation

In FY 2004, the majority of the Water Resources Investigations program underwent PART evaluation. In keeping with the President's Business Reference Model, rather than conducting the PART for eight individual programs, the USGS was evaluated in (1) research and (2) data collection and dissemination categories and was rated "moderately effective." The PART evaluations found that the programs have a clear purpose, do a good job at leveraging resources, work with a wide array of partners, and maintain an effective Web site for distributing and visualizing water information. The evaluations also concluded that the USGS has

effectively used the FACA Advisory Committee on Water Information and the National Water Quality Monitoring Council for feedback to improve programs and coordinate activities.

The USGS worked with the OMB to develop an action plan for carrying out the PART recommendations. Performance measures resulting from the PART are shown in the performance tables for the Water programs, and the USGS is taking the following actions to improve program performance:

- Working with other Federal agencies on a multi-year plan to coordinate water research,
- Developing shared water research performance measures across agencies,
- Planning regular, independent reviews of the entire USGS water program,
- Working with partners to develop and share monitoring plans, and
- Working with EPA and other partners to integrate water information systems.

Workforce Planning

The USGS is working hard to change skill sets to keep pace with changing customer needs, anticipated level budgets, and reduced reimbursable income. The bureau is using creative solutions for rapid changes in technology and workforce flexibility through the use of contractors and term appointments. In some cases, funding freed from salary load will be used to invest in partnerships through grants. However, in some cases the nature of the work requires the use of government employees. Thus, the USGS has initiated a VSIP/VERA process for a number of Water Science Centers. Some of the positions vacated through the VSIP/VERA process will be filled with new employees who possess the requisite skills.

The WRD expects that only about 6 percent of its total workforce will choose to leave the USGS as a result of the various VSIP/VERAs currently under consideration, and in some cases those positions will be refilled with employees who possess different skill sets. Thus, the VSIP/VERA process is not expected to have any significant impact on program performance measures. The reason for this is twofold:

- Most of the water performance metrics measure the adequacy of scientific instrumentation on the landscape and subsequent analysis of the data from that instrumentation — for example, "% of proposed streamflow sites currently in operation that meet one or more Federal needs," or "% of U.S. with ground water availability status and trends information to support resource management decisions." The changes in personnel will allow the USGS to continue to meet those goals.
- The VSIP/VERA is spread across many cost centers. As a result, the performance measures for each program area are only minimally affected.

Subactivity Overview

Water Resources Investigations comprises three subactivities that operate with three distinctly different funding mechanisms:

The **Hydrologic Monitoring, Assessments, and Research subactivity** includes six programs funded directly from Federal appropriations and conduct work primarily inhouse, using the expertise of scientists on the Federal payroll. The programs in this subactivity include: Ground-Water Resources, National Water-Quality Assessment (NAWQA), Toxic Substances Hydrology, Hydrologic Research and Development, National Streamflow Information Program (NSIP), and Hydrologic Networks and Analysis (HNA). These programs are primarily research oriented, with the exception of NSIP and portions of HNA, which focus on long-term data collection, and NAWQA, which provides status and trends information on water-quality conditions across the Nation.

The **Cooperative Water Program subactivity** provides information needed to understand the Nation's water resources through a program of shared efforts and funding with 1,400 State, tribal, and local partner agencies. Authorizing legislation requires that States and localities pay at least half the cost of the work that the USGS performs under this subactivity, so program resources are leveraged and program priorities are determined in concert with partners. About half the funding supports basic data collection, including approximately 65 percent of the USGS streamgaging network, and the remaining half supports interpretive investigations, with the goal of seeking solutions to water-resources issues of national and local concern.

USGS Science in Professional Journals

USGS work continues to have high visibility in scientific journals. The journal *Environmental Science and Technology* recently compiled a list of the papers most frequently downloaded from their Web site in the first six months of 2005. Three of the top 20 were by USGS authors: a 2002 paper on emerging contaminants written by seven USGS authors, a 2005 paper by Sam Luoma on metal bioaccumulation, and a 2005 paper on MTBE (a gasoline additive) by Joe Ayotte and Denise Argue of the USGS New Hampshire Water Science Center.

Through the **Water Resources Research Act subactivity**, the USGS administers grants for 54 State research institutes designated by the Water Resources Research Act. The program supports academic research to aid in the resolution of State and regional water problems, promotes technology transfer, and provides for the training of scientists and engineers. Grant monies under this program must be matched by the receiving universities.

Activity: Water Resources Investigations

Subactivity: Hydrologic Monitoring, Assessments, and Research
Program Component: Ground-Water Resources Program

Program	2005 Actual	2006 Enacted	2007 Fixed Cost & Related Changes [a/]	2007 Program Changes	2007 Budget Request	Change from 2006
Ground-Water Resources Program	6,998	8,027	+115	-720	7,422	-605
Total Requirements $000	**6,998**	**8,027**	**+115**	**-720**	**7,422**	**-605**
FTE	***60***	***60***	***0***	***0***	***60***	***0***

[a/] Fixed cost increases for this program total $163, of which $115 will be budgeted and $48 will be absorbed.

Summary of FY 2007 Program Changes for Ground-Water Resources Program

Request Component	Amount	FTE
Program Changes		
• Memphis Aquifer Study	-493	0
• Ozarks Aquifer Study	-227	0
TOTAL	**-720**	**0**

Justification of FY 2007 Program Changes

The 2007 request for the Ground-Water Resources Program (GWRP) is $7,422,000 and 60 FTE, which is a program change of -$720,000 and 0 FTE. The reduction will end two unrequested earmarked projects. These projects are not Administration or USGS priorities and do not address the highest priority science needs in ground-water research and monitoring. This will keep the core program intact while allowing the USGS to make the best use of resources.

- **Memphis Aquifer Study (-$493,000 and 0 FTE) —** This reduction would end a project begun in FY 2006 that supports hydrologic monitoring, geologic mapping, and modeling provided by three USGS Water Science Centers in support of the Mississippi, Arkansas, and Tennessee Regional Aquifer Study.
- **Ozark Aquifer Study (-$227,000 and 0 FTE) —** This reduction would end a project begun in FY 2006 to develop a ground-water flow model of the Ozark and Springfield Plateau aquifers in the tri-State (KS, MO, and OK) area.

Performance impacts of these reductions will not occur until FY 2008 or later.

Program Performance Change Table

Total Performance Change		*-2 systematic analyses and investigations delivered to customers*			
	A	*B*	*C*	*D= B+C*	*E*
	Overall Performance Changes from 2006 to 2007				
Measure	**2006 Enacted Performance**	**2007 Base Performance Level**	**2007 Impact of Program Change on Performance**	**2007 Budget Request Performance**	**Out-year Impact of 2007 Program Change on Performance**
Systematic analyses and investigations delivered to customers	**18**	**17**	**0**	**17**	**-2**

Column B: The performance level expected to be achieved absent the program change (i.e., at the 2006 request level plus/minus funded fixed cost/related changes); this would reflect, for example, the impact of prior year funding changes, management efficiencies, absorption of fixed costs, and trend impacts.

Column E: The out-year impact is the change in performance level expected in 2008 and Beyond of ONLY the requested program budget change; it does not include the impact of receiving these funds again in a subsequent outyear.

Program Overview

Ground water is one of the Nation's most important natural resources and is becoming increasingly important to all our lives. Ground water serves as the primary source of drinking water to approximately half the Nation's population (134 million people), provides about 40 percent of the irrigation water essential for the Nation's agriculture, sustains the flow of most streams and rivers, and helps maintain a variety of aquatic ecosystems. The continued availability of ground water is essential for current and future populations and the health of our Nation's economy in all 50 States.

The first goal of the GWRP is to identify, describe, and make available fundamental information regarding ground-water availability in the Nation's major aquifer systems, and evaluate this information over time. To this end, the program conducts regionally integrated ground-water assessments that fill the information gap between national efforts (such as the previous generation of regional aquifer system studies) and local-scale efforts (like those studies conducted by the USGS Cooperative Water Program in conjunction with local partners).

The second goal is to characterize the natural and human factors that control recharge, storage, and discharge in the Nation's major aquifer systems, and to improve understanding of these processes.

The third goal is to develop and test new tools and field methods for analyzing ground-water flow systems and their interactions with surface water.

Finally, the program provides scientific leadership across all USGS programs on matters pertaining to the Nation's ground-water resources, including research directions, quality control, technology transfer, and information storage and delivery.

The GWRP 5-Year Plan is being updated and reviewed to conform to the new outline, format, and internal/external team approach. The goal is for completion by March 2006.

The GWRP includes the following activities:

- Regional ground-water investigations (Estimates for FY 2005, $3.6 million; FY 2006, $4.4 million; FY 2007, $3.7 million)
- Field methods and model development (Estimates for FY 2005, $0.9 million; FY 2006, $1.0 million; FY 2007, $1.1 million)
- Fundamental data and ground-water level monitoring (Estimates for FY 2005, $0.5 million; FY 2006, $0.4 million; FY 2007, $0.4 million)
- Technical support (Estimates for FY 2005, $2.1 million; FY 2006, $2.1 million; FY 2007, $2.2 million)

FY 2007 Program Performance Estimates

The 2007 budget request for the GWRP is $7,422,000 and 60 FTE. To address the goals listed above, the GWRP is planning the following activities for FY 2007:

Regional Ground-Water Evaluations — Regional ground-water evaluations consist of multiple large-scale study areas or aquifers that collectively make up a national assessment. Individual studies form the building blocks that can be used to develop a comprehensive regional and national perspective. In FY 2007, USGS regional ground-water evaluations will include investigations such as the study of ground-water availability in California's Central Valley—one of the most productive agricultural regions in the world—where the combination of demands from agriculture and rapid population growth has created concern for future water supplies. This program component also includes the Water Availability and Use Initiative that began in FY 2005 and is currently focused on the Great Lakes Basin.

Field Methods and Model Development — The GWRP is always searching for more efficient methods of evaluating ground-water resources at a variety of different scales. The USGS has been at the forefront of devising new analytical techniques to solve practical problems in the study of ground-water resources. Geophysical methods and application research and ground-water model development are specialized activities that support and benefit all USGS projects in accomplishing organizational goals. Predictive models are needed to make informed decisions in many emerging areas related to the effects of ground-water development. New models and methods developed in FY 2007 will enhance all USGS water programs and State and local governments, as well as ground-water scientists and engineers in the private sector who use these tools.

Fundamental Data and Ground-Water Level Monitoring — Collection of fundamental ground-water information is critical to the ability to assess and assure the availability of the Nation's ground-water resources. Measurement of ground-water levels is

USGS Begins Water Availability and Use Pilot in the Great Lakes Basin

In response to Congressional direction, and framed by USGS Circular 1223 and the National Science and Technology Council *Report on Fresh Water Availability*, the USGS has initiated an assessment of water availability and use. As part of this initiative, a pilot study for the Great Lakes Basin was started in January 2005.

Water availability is determined by both water storage and water movement through the environment. Key indicators for water storage and movement are being identified and refined in this project.

Goals of the pilot study include developing methods to analyze the indicators and demonstrating how these indicators may be used to assess water availability. The study will generate scientific information of interest to the Great Lakes Charter Annex 2001 process. The main study components are surface-water flows and storage, ground-water flows and storage, and water-use assessment.

used to monitor changes in conditions (water levels and storage) due to climate and withdrawals. The development of the Ground-Water Climate-Response Network seeks to assess changes in ground-water conditions due to climate stresses. This national network is augmented by ground-water-level monitoring that is supported by the Cooperative Water Program. Additionally, periodic evaluation of water levels on a regional scale is necessary to properly inventory ground-water reserves in areas experiencing intense development, such as the High Plains aquifer.

Technical Support — This support provides quality control to assure the technical excellence of ground-water field programs and provides a structured way of transferring new technology to activities that are conducted at USGS Water Science Centers in each State. This program component also provides a formal way of establishing research priorities and making ground-water information available to other agencies, the scientific community, and the public.

FY 2006 Planned Program Performance

Unless otherwise noted, the planned program activities listed below demonstrate the utility of scientific publications and other products that are counted under the output measures for "systematic analyses and investigations delivered to customers," and "number of formal workshops or training provided to customers."

Regional Ground-Water Evaluations

Ground-Water Availability of Regional Aquifers — The GWRP will continue three studies begun in FY 2004 to evaluate ground-water availability of regional aquifers in the Atlantic Coastal Plain of North and South Carolina, the Denver Basin in Colorado, and California's Central Valley. In FY 2006, a study of the Mississippi Alluvial and Embayment regional aquifers in parts of Arkansas, Louisiana, Mississippi, and Tennessee will begin. Information about these aquifers is critically needed to support better management of ground-water resources in these areas with chronic water-supply issues. GWRP scientists are taking advantage of the quantitative work previously conducted about 20 years ago under the USGS Regional Aquifer-System Analysis Program to provide updated quantitative assessments of ground-water availability in areas of critical importance. These assessments will document the effects of human activities on water levels, ground-water storage, and discharge to streams and will evaluate the adequacy of data networks for these regions.

Great Lakes Basin Water Availability and Use Pilot Study — In FY 2006, the Great Lakes Basin Water Availability and Use pilot study began its second year. Water availability and use are a function of the total flow of water through a basin, its quality, and other factors that control its use for human needs and ecological support. The pilot study focus is on determining indicators of the status and trends of the basins water resources from a water quantity perspective. The assessment of water availability will include investigation of surface-water flows and storage, ground-water flows and storage, and water use.

Ground-Water Issues for Karst Aquifers — Karst-aquifer systems (limestone and other rocks that can be dissolved by ground water) underlie about 20 percent of the United States. About 40 percent of the ground water used for the Nation's drinking water comes from karst aquifers. In spite of the value of these aquifers for supply, their hydrogeology is not as well understood as other aquifer systems, especially at a regional scale. To help increase knowledge about karst systems, the USGS began a regional study of the karst aquifers in Alabama, Illinois, Indiana,

Kentucky, and Tennessee in 2002, as a prototype for regional studies of karst aquifers. The GWRP is also supporting karst aquifer studies in the Shenandoah Valley of Virginia and West Virginia. These studies will continue in FY 2006.

Field Methods and Model Development

Field development and application of advanced geophysical methods to assess and monitor hydrologic processes including aquifer storage and recovery, saltwater intrusion into coastal aquifers, and karst imaging provide valuable opportunities to enhance our understanding of the Nation's ground-water resources. Current studies of regional ground-water availability in the Atlantic Coastal Plain, the Denver Basin, the Central Valley of California, and most recently the Mississippi Alluvial and Embayment aquifers enable development and testing of models to simulate dynamic ground-water systems.

- **Research in Geophysics —** The USGS Office of Ground Water's Branch of Geophysics and scientists from the Idaho National Environmental and Engineering Laboratory and Pennsylvania State University conducted an experiment in August 2005 to obtain time-lapse tomographic images (similar to detailed X-Ray images) of an Aquifer Storage and Recovery (ASR) experiment in Charleston, SC. Data analysis will be the focus of their effort in FY 2006. ASR modeling will also take place to investigate methods for linking hydrologic and geophysical modeling. ASR is a method for storing freshwater in an aquifer containing water of poor quality where the freshwater can be withdrawn later when needed. The ASR technology used here will help expanded our knowledge of this process and facilitate the monitoring of larger-scale hydrologic behavior such as saltwater intrusion in coastal aquifers.

- **Model Development —** In FY 2006, the USGS will continue development and testing of a model capable of simulating coupled ground-water and surface-water flow at a watershed scale. The code is based on the USGS MODFLOW ground-water model and PRMS (Precipitation-Runoff Modeling System) watershed model. The combined MODFLOW-PRMS model will be able to simulate water flow from land surface, through the unsaturated zone, to the water table. Documentation of the code will be completed during FY 2006.

Fundamental Data and Ground-Water Level Monitoring

Monitoring Water Levels in the High Plains Aquifer — The High Plains aquifer is a principal source for irrigation and drinking water for one of the major agricultural areas of the Nation. The USGS assembles water-level data for the High Plains aquifer from wells that are measured by Federal, State, and local water-resource agencies to assess annual water-level changes in the aquifer. Decisions about future use of the aquifer depend on a clear understanding of the aquifer's status—amount of water extracted and remaining—and the probable impact of future extractions. A USGS report on water-level changes in the aquifer is prepared biannually; the next report on water-level changes through 2005 will be published in early 2006. The reports on water-level changes in the aquifer are intended to help those who are interested or involved in the protection, management, and sustainable use of the High Plains aquifer to better understand the aquifer and to make the best possible decisions.

U.S.-Mexico Border Human Health Initiative

This interdisciplinary study of environmental health issues along the rapidly developing U.S.-Mexico border takes advantage of data and information generated by previous and current USGS studies in water, geology, biology, and geography but focuses on understanding disease-causing agents in the environment and their specific exposure pathways in water, air, and soil. The work is a partnership with the National Institute of Environmental Health Sciences, which brings the human health dimension to the study. Starting in FY 2006, this project will be expanded to encompass the entire U.S.-Mexico border region, an area over 157,000 square miles and home to more than 12 million people, from the Gulf of Mexico to the Pacific Ocean. Planned tasks for FY 2006 include establishing a borderwide base map on the bi-national, Web-based Internet Mapping Service (IMS) using a medium-resolution basic geospatial framework, including satellite imagery and digital elevation models with the locations of the major population centers. This will provide the platform upon which to subsequently overlay more comprehensive data sets. This work builds on the data sets compiled in FY 2005 for the Rio Grande Valley.

FY 2005 Program Performance Accomplishments

Unless otherwise noted, the program accomplishments listed below demonstrate the utility of scientific publications and other products that are counted under the output measures for "systematic analyses and investigations delivered to customers," and "number of formal workshops or training provided to customers."

Regional Ground-Water Evaluations

Ground-Water Availability in California's Central Valley — For more than 50 years, California's Central Valley has been one of the most productive agricultural regions in the world. This irrigated agriculture relies heavily on surface-water diversions and ground-water pumping. Approximately one-sixth of the Nation's irrigated land is in the Central Valley, and about one-fifth of the Nation's pumping is from its aquifers. Large increases in population have increased the competition for water within the Central Valley and statewide. As a result, the USGS is developing an update to the regional ground-water flow model of the Central Valley that is capable of being accurate at scales relevant to the water management decisions of today. By the end of FY 2005, USGS hydrologists had assembled a database for approximately 10,000 well logs throughout the Central Valley and constructed a three-dimensional texture model of the internal architecture of the Central Valley deposits. Another major accomplishment is the development and documentation of a process for the MODFLOW ground-water model that provides the ability to simulate irrigated agriculture with the additional feature of priority of water allotments (water-rights).

Estimating Ground-Water Recharge in the Humid East — Recharge is a major component of the ground-water system and has important implications for the quantity and quality of the ground-water resource. To address this, the USGS has conducted several independent studies to develop a better understanding of how to quantify recharge at several scales:

- A study in cooperation with the USDA compared methods for estimating ground-water recharge and base flow (as a proxy for recharge) at Agricultural Research Service sites in east-central Pennsylvania underlain by fractured bedrock.

- In cooperation with the North Carolina Department of Environment and Natural Resources, the USGS used multiple methods to estimate ground-water recharge. Results indicate that average annual recharge varied widely across the coastal plain, was greater in winter than in summer, and was related to the sand and silt content of surface sediments. These results help provide more accurate estimates of annual and seasonal recharge for different areas of the coastal plain—knowledge that is important for water planners to accurately evaluate seasonal ground water availability and contamination potential within a particular watershed.
- A third study conducted in collaboration with the NAWQA Program estimated recharge using five different methods and compared results at the regional scale. During the course of the study, over 800 sediment cores were procured and analyzed, and a database of measured sediment properties was developed.

Field Methods and Model Development

Monitoring Aquifer Storage and Recovery — The USGS Branch of Geophysics and geoscientists from Idaho National Laboratory and Pennsylvania State University used an experimental monitoring system to obtain time-lapse images of an ASR experiment conducted in August 2005 in Charleston, SC. The objective of the project is to develop and apply advanced geophysical imaging methods to assess and monitor hydrologic processes, including ASR and saltwater intrusion into coastal aquifers. ASR is a method for storing freshwater in an aquifer containing water of poor quality. The stored, high-quality water can be withdrawn during an emergency or when demand exceeds the normal or seasonal supply. At the Charleston site, freshwater was injected into and withdrawn from a brackish aquifer. Information gleaned should refine the conceptual model of the site and help improve existing ASR modeling approaches. In addition, project scientists hope that lessons learned from the experiment can be applied at other ASR sites and help monitor larger-scale hydrologic behavior, including saltwater intrusion in coastal aquifers.

New Ground-Water Management Module for MODFLOW-2000 — The USGS worked collaboratively with researchers at the University of Massachusetts and Woods Hole Oceanographic Institution to develop a new optimization-modeling process for the widely used USGS MODFLOW ground-water simulation model. This new Ground-Water Management (GWM) process can be applied to a broad range of ground-water management problems, such as limiting ground-water level declines or streamflow depletions, managing ground-water withdrawals, and conjunctively using ground water and surface water. Management variables that can be specified in GWM include withdrawal and injection wells, artificial-recharge basins, and imports and exports of water. The types of constraints that can be specified include upper and lower bounds on pumping and injection rates, and water-supply demands. The GWM code is documented in USGS Open-File Report 2005-1072.

USGS Computer Model Used Worldwide to Protect Coastal Ground-Water Resources — Coastal aquifers are under constant threat from contamination by seawater and a wide range of anthropogenic pollutants. The USGS is continuing development and support of the internationally accepted SEAWAT computer program. SEAWAT was designed specifically for coastal aquifers, where the density contrasts between freshwater and seawater affects the direction of ground-water flow. Since its release in 2002, SEAWAT gained widespread recognition in the ground-water modeling community as an accurate, easy-to-use tool. The program has been applied in most coastal States and is being used in at least 16 other

countries to help manage water resource problems associated with saltwater intrusion, deep-well injection, and ASR. Examples of how the program has been used to protect coastal aquifers include: simulation of saltwater intrusion by Moroccan government scientists, determination of effective aquifer storage and recovery strategies by the U.S. Army Corps of Engineers, and prediction of the fate and transport of deep-well injectate by the USGS.

Fundamental Data and Ground-Water Level Monitoring

Development of Bi-national GIS Product for the U.S.-Mexico Border — The primary product of this project is the IMS, which serves two functions: providing a geospatial interface loaded with tools that allow the manipulation of spatial data and serving as a data portal that allows users to integrate the data sets into their own analyses. Accomplishments in FY 2005 included the development of a comprehensive Web site (*http://borderhealth.cr.usgs.gov*), which includes background project information, white papers describing methodology for bi-national data set integration, links to publications and references, and spreadsheets with health and natural resource data. Fact sheets have been published in both English and Spanish describing the availability and utility of the IMS, and a number of bi-national demonstration workshops were held to inform stakeholders, partners, and potential users of the project and its products. During workshops and conferences, representatives of local, State, and U.S. and Mexican Federal entities have indicated their endorsement and utilization of the project products and incorporation of the information into their business practices. Efforts to date have focused on the U.S.-Mexico border in the Lower Rio Grande Valley.

Performance Overview

There are no performance measures that can be tied exclusively to the GWRP, except for "systematic analyses and investigations delivered to customers." However, in conjunction with the Cooperative Water Program, Hydrologic Networks and Analysis, and an array of reimbursable projects, the GWRP contributes to all the measures listed below.

Measure	2005 Plan	2005 Actual	Change from 2005 Plan	2006 Enacted	2006 Change from 2005 Actual	2007 Request	2007 Change from 2006
# real-time ground-water sites reporting in NWISWeb	700	796	+96	692	-104	685	-7
# systematic analyses & investigations delivered to customers	16	16	0	18	+2	17	-1
% of ground-water stations that have real-time reporting capability in the ground water climate response network **(PART)**	62%	67%	+5%	67%	0	63%	-4%
% of the Nation's 65 principal aquifers with monitoring wells used to measure responses of water levels to drought and climatic variations to provide information needed for water-supply decisionmaking **(PART)**	61%	61%	0	62%	+1%	60%	-2%

Measure	2005 Plan	2005 Actual	Change from 2005 Plan	2006 Enacted	2006 Change from 2005 Actual	2007 Request	2007 Change from 2006
% of U.S. with ground water quality status and trends information to support resource management decisions **(PART)**	39%	39%	0%	45%	+6%	51%	+6%
% of U.S. with ground water availability status and trends information to support resource management decisions **(PART)**	7%	7%	0%	8%	+1%	7%	-1%

This page intentionally left blank.

Activity: Water Resources Investigations

Subactivity: Hydrologic Monitoring, Assessments, and Research
Program Component: National Water-Quality Assessment Program

Program	2005 Actual	2006 Enacted	2007 Fixed Cost & Related Changes [a/]	2007 Program Changes	2007 Budget Request	Change from 2006
National Water-Quality Assessment	61,645	62,203	+1,308	-940	62,571	+368
Total Requirements $000	**61,645**	**62,203**	**+1,308**	**-940**	**62,571**	**+368**
FTE	***430***	***451***	***0***	***-9***	***442***	***-9***

[a/] Fixed cost increases for this program total $1,867, of which $1,308 will be budgeted and $559 will be absorbed.

Summary of FY 2007 Program Changes for National Water-Quality Assessment

Request Component	Amount	FTE
Program Changes		
• Technical support activities	-940	-9
TOTAL	**-940**	**-9**

Justification of FY 2007 Program Changes

The 2007 request for the National Water-Quality Assessment (NAWQA) program is $62,571,000 and 442 FTE, which is a program change of -$940,000 and -9 FTE.

NAWQA Technical Support (-$940,000 and -9 FTE) — This funding level will keep the core program intact while allowing the USGS to make the best use of resources. The reduction would focus on a portion of the funding used for national technical support and training activities for the geographically distributed USGS water-quality studies. Technical support activities provides quality control to assure the technical excellence of water-quality field programs and provides a structured way of transferring new technology to USGS investigative and data activities that are primarily conducted at the USGS Water Science Centers located in each State. Technical support also includes a formal way of establishing priorities for water-quality research by the USGS and provides a mechanism to make water-quality information available to other agencies, the scientific community, and the public. The proposed reduction would:

- Slow research and development of field instrumentation and electronic entry of field data using handheld computers for water quality activities, and
- Slow technical support to USGS State Water Science Centers for technology transfer and for training in new water-quality techniques.

Program Performance Change — Though the program contributes to the strategic goals of advancing knowledge in the hydrologic sciences, there are no performance measures specifically linked to this program change.

Program Overview

The 2007 budget request for the NAWQA program is $62,571,000. The program addresses three long-term goals:

- Describe the status and trends in the quality of a large, representative part of the Nation's surface-water and ground-water resources,
- Provide an improved understanding of the primary natural factors and human activities affecting these conditions, and
- Provide information that supports development and evaluation of management, regulatory, and monitoring decisions by other Federal, State, and local agencies.

Study Unit Investigation Topics

Effects of nutrient enrichment on streams

Sources, transport, and fate of agricultural chemicals

Transport of contaminants to water supply wells

Effects of urbanization on stream ecosystems

Bioaccumulation of mercury in aquatic organisms

The USGS approaches these goals using five major program elements:

- **Study Unit Investigations** of major river basins and aquifer systems — Study unit investigations follow consistent practices from data collection through interpretation, to generate comparable findings over time and across the Nation. Study units collaborate with national teams on five water-quality topics selected for study on the basis of an extensive analysis of national and regional water-quality issues and priorities. NAWQA relies on fundamental research accomplished in other water programs like the Toxic Substances Hydrology program. For example, NAWQA collaborates with other USGS scientists funded by the Toxics program on the topic of mercury bioaccumulation in aquatic organisms, using appropriate sampling and laboratory analytical techniques for methyl mercury occurrence in the environment and in aquatic organisms. (Estimates for FY 2005, $36.3 million; FY 2006, $36.1 million; FY 2007, $36.6 million)
- **National Syntheses** of key findings related to important water-quality topics from investigations in the study units and from other water-quality — National synthesis projects compare findings across the country and identify relationships between land use, geology, soils, climate, and water quality conditions. The current national synthesis topics are pesticides, nutrients, volatile organic compounds, trace elements, and aquatic ecology. (Estimates for FY 2005, $7.2 million; FY 2006, $7.4 million; FY 2007, $7.9 million)
- **Supporting Research and Methods —** To ensure NAWQA data collection and analyses are relevant to emerging issues, about 10 percent of program resources is devoted to developing new methods of sample collection and analysis and to continuously improving assessment techniques. (Estimates for FY 2005, $6.2 million; FY 2006, $6.0 million; FY 2007, $6.3 million)

- **Coordination** at local, State, regional, and national levels with environmental and natural resources managers and other users of water-quality information — Nationally, over the past several years NAWQA coordination has increased significantly with the EPA. NAWQA provides direct service to the EPA Office of Pesticide Programs; Office of Wetlands, Oceans, and Watersheds; Office of Ground Water and Drinking Water; and Office of Science and Technology, assisting in the timely and relevant application of NAWQA data to those offices' decisionmaking processes. This association has made millions of dollars of field pesticide data available in a useful form for EPA decisionmaking. Liaisons with agencies from national to local have involved over 1,500 organizations and individuals. (Estimates for FY 2005, $2.2 million; FY 2006, $2.6 million; FY 2007, $2.6 million)

- **Technical Support** of USGS water-quality activities — The USGS has a long tradition of providing national technical support and training for its geographically distributed water-quality studies. This support provides quality control to assure the technical excellence of water-quality field programs and provides a structured way of transferring new technology to investigative and data activities that are primarily conducted in USGS Water Science Centers in each State. Technical support also includes a formal way of establishing priorities for water-quality research by the USGS and provides a mechanism to make water-quality information available to other agencies, the scientific community, and the public. (Estimates for FY 2005, $9.7 million; FY 2006, $10.1 million; FY 2007, $9.2 million)

All these program components include an element of outreach and liaison, both at all levels of the program (individual study units and nationally) and at all levels of government. The USGS has a NAWQA Web site *(http://water.usgs.gov/nawqa/)* to provide rapid access to NAWQA data, reports, and methods documents. Also available is an up to date listing of current developments that allows interested parties to get new information in a timely fashion. By 2004, the program made publicly available water-quality data for 7,000 wells and 6,400 stream sites. Stream data include 3,000 samples of contaminants in bed sediment and aquatic animal tissues and 1,000 sites with information on biodiversity and abundance of fish and aquatic insects.

"NAWQA is an important national resource, and a key component of the nation's water quality monitoring and research infrastructure. The rich data it produces has helped advance greatly our understanding of how our use of the land affects water quality in different settings and regions. Its blending of responsiveness to local needs and attention to national reporting and assessment requirements is unique. Our report, *The State of the Nation's Ecosystems*, relies heavily on NAWQA data, and we hope that program resources can be maintained and expanded, so that the information base for making local, state, regional, and national water quality decisions can also be expanded."

Robin O'Malley
Director, Environmental Reporting Program
H. John Heinz III Center for Science, Economics and the Environment
October 2005

Reduce the number of study units to accommodate current NAWQA purchasing power. The USGS decided on a total of 42 study units for Cycle II, with 14 investigations started in 2001, a second group of 14 investigations that started in 2004, and plans for the final group of 14 to start in 2007. The number of study units was determined on an assumption the NAWQA program would not get funding increases, but would get fixed cost adjustments each year.

To share program knowledge, NAWQA managers coordinate extensively with Federal agencies such as the EPA, USDA, State and local agencies, non-governmental organizations, and the private sector. For example, NAWQA staff share office space in selected EPA offices to ensure

that technical information and resources are shared, so that duplication can be avoided and Federal dollars can be saved. Input from these same groups is sought and incorporated in program activities. For example, these groups influence the selection of sampling sites and the selection of chemicals to be analyzed and assist the USGS in gaining access to sampling locations.

The NAWQA 5-Year Plan is undergoing internal and external review and is expected to be completed by mid 2006.

FY 2007 Program Performance Estimates

A new set of study units will begin work in FY 2007, as shown on the map below. Cycle II studies began in 2001. Cycle II studies focus on water-quality trends over time and expand on the explanation of environmental conditions that influence contaminant distribution. During FY 2005, the first group of 14 Cycle II study units is completing data collection, and NAWQA completed sampling in source water areas in these 14 units. With the FY 2005 budget request level, a second group of 14 Cycle II study units will begin intensive data collection in 2005. These additional study areas will increase investigations of the effects of urbanization in Seattle and Tacoma, WA; San Antonio, TX; Albuquerque, NM; St. Louis, MO; New Jersey; and Sacramento, CA.

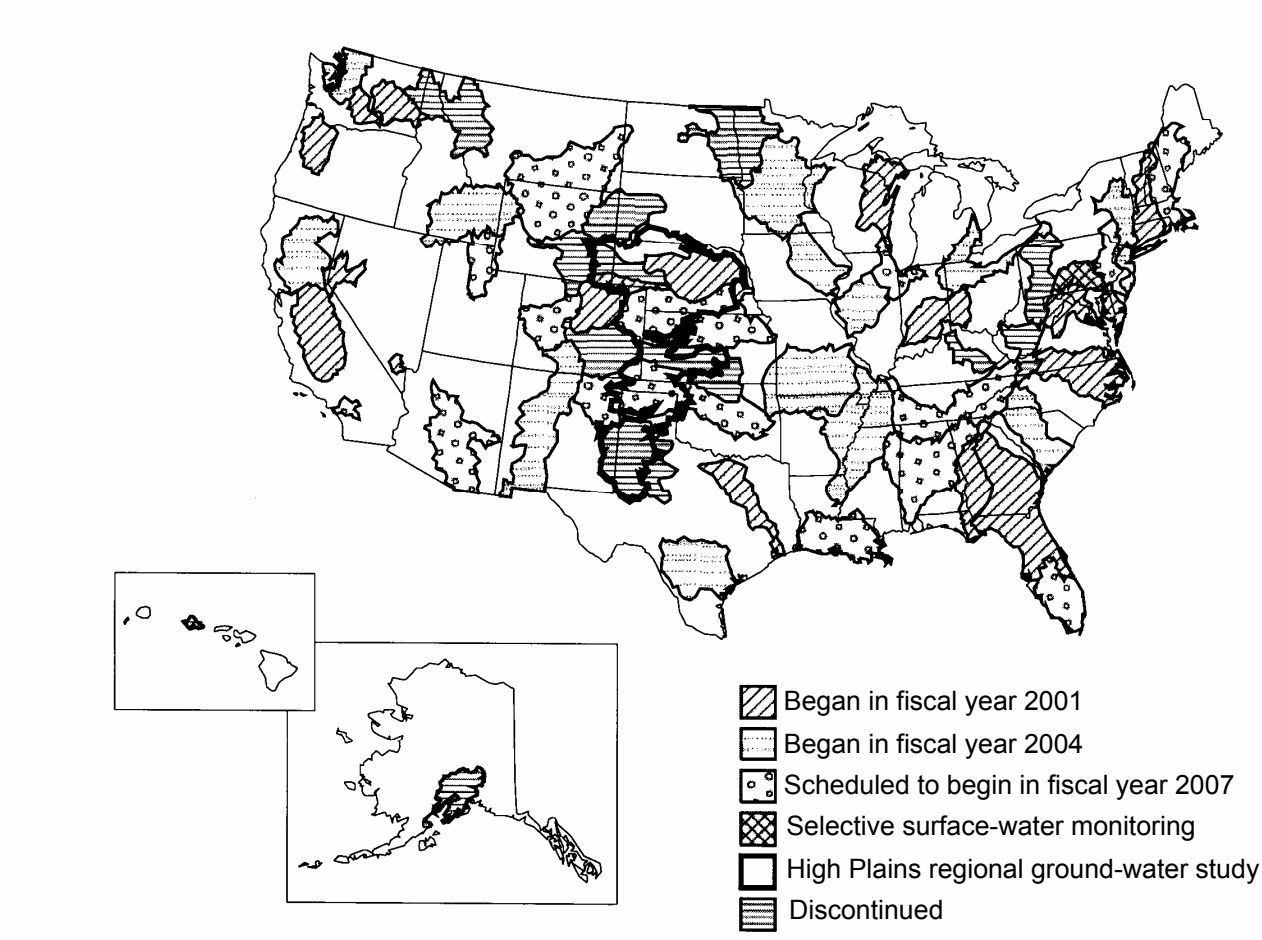
As in Cycle I, NAWQA uses a rotational design for its investigations that consists of three groups of 14 study units with staggered intervals of high and low intensity study. About one third of all study units will be under highly intensive investigation at any given time for 4 years, and trends will be assessed about every 10 years for the areas studied.

USGS planning for Cycle II included two major changes from Cycle I emphasis. The changes were twofold:

- Increase emphasis on understanding time trends and processes governing water quality. This change does not eliminate the status assessment, but rather reduces it to bring more balance to the program, particularly given the substantial advances made in assessing the status of water-quality conditions during Cycle I. Strategic planning of the trends component of the NAWQA program considered streams and aquifers most susceptible to urbanization and agricultural practices for resampling and long-term monitoring to provide land and water-resources managers and policymakers an information base to assess the value of programs such as conservation, farming practices, and planned urban growth.

- Reduce the number of study units to accommodate current NAWQA purchasing power. The USGS decided on a total of 42 study units for Cycle II, with 14 investigations started in 2001, a second group of 14 investigations that started in 2004, and plans for the final group of 14 to start in 2007. The number of study units was determined on an assumption the NAWQA program would not get funding increases, but would get fixed cost adjustments each year.

National Water-Quality Assessment
Cycle II Study Units



With current funding, one special topical study is being undertaken in each of the 14 study units starting up in 2005, compared to about 2 special studies per study unit in the first group. Further adjustments in 2004 included a reduction in the number of long-term stream monitoring sites for trend detection from 145 to 84 and to extend the period of data collection and intensive activity from 3 to 4 years for each of the three groups of study units. The extended intensive data-collection and analysis period allows the program to stretch limited dollars out over time but also extends by 2 to 3 years the period between the completion of data collection and the publication of findings. The overall effect on the program has been to extend Cycle II to the year 2013 and to reduce the level of activities in each study unit.

FY 2006 Planned Program Performance

The activities described below demonstrate the utility of USGS products that are counted under the output measures for "number of systematic analyses and investigations delivered to customers."

In FY 2006, there are several planned accomplishments related to the national synthesis of Cycle I activities and progress of Cycle II activities. Major products planned in 2006 from the NAWQA national synthesis are two USGS Circulars, one on pesticides and one on volatile organic compunds (VOCs). While there are many other reports being published by NAWQA in 2005, the pesticide and VOC circulars synthesize the accumulated knowledge from 51 geographic areas together at the national scale. Products from Cycle II activities are planned for release in 2006. Some of these are the first national-scale NAWQA Source-Water Quality Assessments, which examine and compare the quality of the untreated and treated resource at public water supplies in 13 NAWQA study units. Other planned products for 2006 will be some of the first publications from NAWQA Cycle II topical studies. A series of articles on the sources, fate, and transport of agricultural chemicals in streams and shallow ground water are planned to be published in a special issue of the *Journal of Environmental Quality.* A special publication on the effects of urbanization of stream quality containing four NAWQA papers is being released in 2006. In a major outreach and technology transfer effort, the NAWQA program is cosponsoring the biannual conference of the National Water-Quality Monitoring Council in San Jose, CA, in May 2006. NAWQA scientists plan to present 87 oral presentations, 58 poster presentations, and 3 workshops. This effort will greatly expand NAWQA's interaction with water-quality practitioners in other Federal, State, and volunteer water quality programs and will communicate scientific findings and management implications of NAWQA products from both cycles. The workshops will provide hands-on training on new tools and innovative methods with other Federal and State agencies and non-governmental volunteer organizations.

> "EPA is partnering with USGS and the States to support integrated monitoring designs that address multiple decision needs. … Imperative for future success is that data collection and monitoring are consistent and comparable so that the findings can be integrated. EPA and USGS are committed to increasing such comparability and integration of monitoring in order to enhance our ability to answer critical questions about our Nation's waters that no one program can answer alone."
>
> Mike Shapiro, Associate Deputy Director, EPA, Office of Water
> February 2005

FY 2005 Program Performance Accomplishments

In addition to the accomplishments listed below, the NAWQA program reports several accomplishments outside of the program components described above that relate to hazard response sampling in Mississippi, Louisiana, Alabama, and Texas in a multi-agency effort to assess impacts of Hurricanes Katrina and Rita in August and September 2005. Selected efforts include:

- Sampling for fecal bacteria of public health significance in the Lake Pontchartrain system (in coordination with the Louisiana Department of Environmental Quality),
- Sampling for chemical contaminants in water and sediment in Lake Pontchartrain,
- Flood deposit sampling for contaminants,
- Water-quality sampling in Mississippi rivers discharging to the Gulf Coast (in coordination with the Mississippi Department of Environmental Quality),
- Ground-water sampling of public supply wells along the Alabama coast (in coordination with the Alabama Department of Environmental Quality), and

- Ground-water sampling of drinking-water and monitoring wells in Louisiana (in coordination with the Louisiana Department of Environmental Quality and Louisiana Office of State Geologists).

The sampling of NAWQA accomplishments and outcomes listed below demonstrates the utility of USGS products that are counted under the output measures for "number of systematic analyses and investigations delivered to customers" and the PART measure "improvement in accuracy of watershed (SPARROW) model prediction for total nitrogen and total phosphorus (measured as reduced error)." All of these accomplishments and outcomes relate to the "Coordination" program component described above under "Program Overview." Linkages to other program components are shown with each accomplishment below.

Study Unit Investigations

USGS Findings Used to Predict Occurrence of Arsenic in Unmeasured Areas — The National Cancer Institute uses a model based on NAWQA findings to estimate lifetime arsenic exposure for individuals living in New England, including exposure from drinking-water sources.

SPARROW Findings for Nutrients Are Used in the Long Island Sound — Results for nitrogen and phosphorus from the USGS statistical model (referred to as SPARROW for Spatially Referenced Regressions on Watershed Attributes) were used by the Long Island Sound Study, part of the EPA National Estuary Program, to assess dissolved oxygen conditions in the Long Island Sound related to nutrient loadings, standards, and exposure criteria.

Support for Development of TMDLs in the San Joaquin Valley, California — NAWQA data were incorporated in the development of a TMDL for the insecticides diazinon and chlorpyrifos in the San Joaquin River Basin in central California by the Central Valley Regional Water Quality Control Board. NAWQA data and assessments are unique in that they help to explain variations in concentrations over seasons, including during winter storms and periods of heavy irrigation. In addition, the NAWQA data and assessments help to explain atmospheric contributions, including both wet and dry deposition.

> "NAWQA monitoring and assessment in the San Joaquin River Basin has provided foundational information for the development of [TMDLs] for diazinon and chlorpyrifos in the San Joaquin River Basin. This information helps assure that the Central Valley Regional Water Quality Control Board makes informed water quality management decisions that are based on sound science."
>
> Leslie F. Grober
> Senior Land and Water Use Scientist
> California Regional Water Quality Control Board
> Fall 2005

Modeling Findings Support Formulation of Kansas Nutrient Reduction Plan — The Kansas Department of Health and Environment, Bureau of Water, used NAWQA modeling results in the development of their State's nutrient reduction plan to address point and non-point sources of nutrients. The modeling results help to identify watersheds that have a high potential to transport nitrogen, and to target non-point source management funds and activities in watersheds that have the greatest potential to improve stream water quality. Many point sources in Kansas are now committed to upgrading treatment to address both nitrogen and phosphorus reduction.

National Synthesis

Percentage of Stream Miles Meeting EPA Recommended Goal for Phosphorus — USGS scientists developed and applied the SPARROW model to predict concentrations of phosphorus in streams and rivers across the Nation that meet the EPA recommended goal to control excessive growth of algae and other nuisance plants. Findings indicated that only about 40 percent of U.S. stream miles meet the recommended goal, and that concentrations vary regionally. Model findings help to identify regions that are most vulnerable to elevated concentrations of phosphorus and contribute scientifically defensible information to the development of regional water-quality criteria for nutrients.

Polycyclic Aromatic Hydrocarbons in Austin Streams — NAWQA provided sound data and research that helped explain an important source—abraded seal coat from parking lots—of polycyclic aromatic hydrocarbons (PAHs) in urban streams and reservoirs. PAHs are potentially toxic to mammals (including humans), birds, fish, amphibians, invertebrates, and plants. Vehicle tires abrade parking-lot seal coat into small particles, which are washed off parking lots by rain into storm sewers and streams. Seal coat is commonly applied to parking lots associated with commercial businesses (including strip malls and shopping centers); apartment and condominium complexes; churches, schools, and business parks; and residential driveways. During FY 2005, the City of Austin used USGS findings to guide management strategies for controlling PAHs and protecting urban streams, and to guide their consideration to ban the use of certain seal coats.

> "The NAWQA staff in Austin has been instrumental in taking our findings related to pavement sealants to a much higher level, both in the recognition and exposure that the USGS carries, and in the quality of their science. The City of Austin has benefited greatly from collaboration with USGS/NAWQA staff over the last year and their professionalism and productivity has been exemplary for all of us involved with the sealant PAH source issue."
>
> Mateo Scoggins, Researcher, Watershed Protection
> City of Austin
> Fall 2005

Pesticide Risk Assessment — NAWQA scientists worked with the EPA to evaluate models for predicting the leaching of agricultural contaminants to ground water. The EPA Office of Pesticide Programs used the evaluation in their efforts to assess drinking-water exposure to carbamate pesticides.

Extension of Predictive Modeling to Include Multiple Pesticides — In cooperation with EPA, the USGS has developed new tools to assess risks posed by pesticides in surface water. The newly improved national-scale WARP model, which was originally developed to predict concentrations of atrazine in watersheds, increases EPA's capability to predict potential impacts of pesticide use on water quality, especially in areas where monitoring data are not available. In addition, the model helps to identify areas where additional monitoring is most needed to evaluate ecological condition of watersheds, and to provide estimates of potential exposure for implementation of the Food Quality Protection Act, which requires estimation of human exposure to pesticides in drinking water.

Performance Overview

The NAWQA program addresses the Department's Serving Communities strategic goal of advancing knowledge through scientific leadership and informing decisions through the application of science. Key indications of USGS performance in describing the status and trends in the quality of the Nation's surface-water and ground-water resources and informing decisions are reflected in the end outcome measure for research: soundness of methodology,

accuracy, and reliability of science (100 percent of science is validated through appropriate peer review); and the end outcome measure for informing decisions through the application of science: percent of stakeholders reporting that information provided by the USGS helped them achieve their goal. To clearly measure progress in achieving intermediate outcome of improving the information base, information management, and technical assistance by assessing water quality conditions and trends, the USGS tracks outputs including the number of long-term data collections, and the number of systematic analyses and investigations delivered to customers.

Only one GPRA output measure and one PART performance measure can be tied exclusively to NAWQA; however, in conjunction with the other USGS water programs and an array of reimbursable projects funded by partner agencies, NAWQA contributes to all the measures listed below.

Measure	2005 Plan	2005 Actual	Change from 2005 Plan	2006 Enacted	2006 Change from 2005 Actual	2007 Request	2007 Change from 2006
Systematic analyses and investigations delivered to customers	137	137	0	136	-1	135	-1
# real-time water-quality sites reporting in NWISWeb	900	1,125	+225	896	-229	887	-9
% of U.S. with ground-water quality status and trends information to support resource management decisions **(PART)**	39%	39%	0%	45%	+6%	51%	+6%
% of targeted contaminants for which methods are developed to assess potential environmental and human health significance **(PART)**	20%	20%	0	30%	+10%	33%	+3%
Average cost per analytical result, adjusted for inflation, is stable or declining over a 5-year period **(PART)**	$8.64	$8.63	0	$8.64	+$0.01	$8.64	0
% improvement in accuracy of watershed (SPARROW) model prediction for total nitrogen and total phosphorus (measured as reduced error) **(PART)**	36%	31%	-5%	32%	+1%	32%	0

This page intentionally left blank.

Activity: Water Resources Investigations

Subactivity: Hydrologic Monitoring, Assessments, and Research
Program Component: Toxic Substances Hydrology

Program	2005 Actual	2006 Enacted	2007 Fixed Cost & Related Changes [a/]	2007 Program Changes	2007 Budget Request	Change from 2006
Toxic Substances Hydrology	14,476	14,386	+287	-1,458	13,215	-1,171
Total Requirements $000	**14,476**	**14,386**	**+287**	**-1,458**	**13,215**	**-1,171**
FTE	***64***	***64***	***0***	***0***	***64***	***0***

[a/] Fixed cost increases for this program total $410, of which $287 will be budgeted and $123 will be absorbed.

Summary of FY 2007 Program Changes for Toxic Substances Hydrology

Request Component	Amount	FTE
Program Changes		
• Roubidoux Aquifer study	-1,231	0
• Skiatook Lake study	-227	0
TOTAL	**-1,458**	**-0**

Justification of FY 2007 Program Changes

The 2007 request for Toxic Substances Hydrology is $13,215,000 and 64 FTE, which is a program change of -$1,458,000 and 0 FTE. The reduction will end one unrequested earmarked project and one project from the base program. The earmarked project does not address the highest priority science needs for toxic substances hydrology research. This will keep the core program intact while allowing the USGS to make the best use of resources.

- **Roubidoux Aquifer (-$1,231,000 and 0 FTE) —** This is a reduction of an unrequested earmark that will bring to a close a study with the University of Oklahoma to characterize the Tar Creek Superfund site in Oklahoma, including characterization of mine drainage discharges, characterization of waste pile and pond drainage runoff, assessment of in-stream contaminant loading, characterization of asphalt road runoff, assessment of surface water impacts, and air quality and meteorological monitoring. In FY 2005 and 2006, most of the funding went to the University in the form of a pass-through grant.
- **Skiatook Lake Study of Petroleum-Related Contamination (-$227,000 and 0 FTE) —** The USGS will end a study of petroleum-related contamination at Skiatook Lake in the southeastern part of the Osage Indian Reservation in northeastern Oklahoma.

Under the Department's Serving Communities—Advance Knowledge mission goal, the decrease of -$227,000 for the Skiatook Lake study will result in the loss of -1 systematic analysis and investigation in FY 2007, compared to the FY 2006 level. There is no change in FTE or other resources associated with either of the decreases described above.

Program Performance Change Table

Total Performance Change		*-1 systematic analysis and investigation delivered to customers*			
	A	*B*	*C*	*D= B+C*	*E*
	Overall Performance Changes from 2006 to 2007				
Measure	**2006 Enacted Performance**	**2007 Base Performance Level**	**2007 Impact of Program Change on Performance**	**2007 Budget Request Performance**	**Out-year Impact of 2007 Program Change on Performance**
Systematic analyses and investigations delivered to customers	**31**	**31**	**-1**	**30**	**0**

Column B: The performance level expected to be achieved absent the program change (i.e., at the 2006 request level plus/minus funded fixed cost/related changes); this would reflect, for example, the impact of prior year funding changes, management efficiencies, absorption of fixed costs, and trend impacts.

Column E: The out-year impact is the change in performance level expected in 2008 and Beyond of ONLY the requested program budget change; it does not include the impact of receiving these funds again in a subsequent outyear.

Program Overview

The Toxics program provides unbiased and reliable scientific information and tools that explain the occurrence, behavior, and effects of toxic substances in the Nation's hydrologic environments. These results support sound decisionmaking by resource managers, regulators, industry, and the public at the Federal, State, and local levels. The program addresses the Department's Serving Communities strategic goal of advancing knowledge through scientific leadership and informing decisions through the application of science.

The contamination problems investigated by the Toxics program are widespread and pose significant risk to human health and the environment. Based on input from many agencies and organizations, the USGS identifies high priority problems for intensive, field-based research. These field studies are conducted at representative sites, watersheds, or areas that focus on subsurface, point-source contamination or nonpoint source contamination at the watershed or regional scale. Study results help water managers 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 program complements other USGS programs that monitor and assess the quality of the Nation's waters by focusing rapidly on new issues and on new and understudied contaminants, by identifying which issues warrant future attention, and by developing improved and needed methods.

The Toxics program's strengths are its long-term field-based approach, interdisciplinary research teams, ability to address contamination problems with a wide range of geographic scales and geologic terrain, and ability to bring fundamental scientific knowledge to define the natural environmental response to contamination and natural clean-up capacity. Maintenance

of long-term field research laboratories and data collection on extensive regional and national networks, using consistent and reliable methods, makes this contribution particularly unique.

The Toxics program works in partnership with other Federal agencies to ensure that priorities for science needs are coordinated, including other Interior bureaus, the EPA, USDA, DOD, DOE, the Nuclear Regulatory Commission, and more recently, public health agencies, such as the Centers for Disease Control and Prevention (CDC), the Food and Drug Administration, and the National Institute for Environmental Health Sciences. Because the USGS is an objective science agency, program information and methods often provide a basis for consensus in contentious issues and for achieving cost efficiencies by meeting the needs of numerous management and regulatory agencies. Scientists from universities, other Federal agencies, and industry find significant research opportunities through collaboration in Toxics program activities and at program research sites. The Toxics program complements and coordinates with a range of other USGS programs, by providing new methods and information on new issues to monitoring and assessment programs such as NAWQA and NASQAN, by addressing environmental effects of resource development with programs such as the Energy Resources and Mineral Resources programs, and by evaluating the connections between environmental contamination of toxicological effects in fish and wildlife with the Contaminant Biology program. Program results are distributed at briefings for regulatory agencies and industry groups, at workshops, at national scientific meetings, in USGS reports, and in scientific journals and books. More information about the Toxics program is available on the Web at *http://toxics.usgs.gov/*.

The Toxics program is made up of three components:

Investigations of Subsurface, Point-source Contamination — Interdisciplinary USGS research teams conduct long-term intensive field investigations of common types of subsurface contamination in a variety of hydrogeologic environments. These investigations provide fundamental knowledge of the processes that control contaminant-plume transport and persistence. This knowledge and new methods are applied to similar sites across the Nation. The Toxics program conducts the only organized research on subsurface contamination from point sources within the USGS and is looked upon by those responsible for contaminated site cleanup as a unique provider of information and methods on issues such as contamination in fractured rock aquifers and long-term performance of monitored natural attenuation. The USGS is initiating a review of this program component in FY 2006. This review will identify research priorities, gaps in existing activities, and actions needed to fill those gaps. Expert scientists and managers representing government partners and the academic community will participate in the review. This program component also includes development of laboratory and field methods. (Estimates for FY 2005, $4.7 million, FY 2006, $4.9 million; FY 2007, $4.8 million)

Investigations of Watershed-scale and Regional-scale Contamination — Watershed-scale and regional-scale investigations address 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 involve characterizing contaminant sources, investigating the mechanisms by which nonpoint-source contamination affects aquatic ecosystems, and investigating the processes that transform contaminants into different and possibly more toxic forms. This program component also includes development of laboratory and field methods. (Estimates for FY 2005, $7.1 million; FY 2006, $6.7 million; FY 2007, $5.6 million)

Technical Support — The USGS has a long tradition of providing national technical support for its geographically distributed water resources studies. This support provides quality control to assure the technical excellence of water resources field programs and provides a structured way of transferring new technology to investigative and data activities that are primarily conducted in USGS Water Science Centers in each State. Technical support also includes a formal way of establishing priorities for water research by the USGS and provides a mechanism to make water resources information available to other agencies, the scientific community, and the public. In the case of the Toxics program, this amount also includes support for various interdisciplinary Priority Ecosystem studies, some of which are described in the Science on the Landscape section beginning on page F - 30. (Estimates for FY 2005, $2.7 million; FY 2006, $2.8 million; FY 2007, $2.8 million)

The 5-Year Plan for the Toxics program is being updated to conform to the new outline, format, and internal/external team approach. The goal is for completion in FY 2006.

Major program activities are developed and revised through internal and external planning and review processes led by Toxics program managers.

FY 2007 Program Performance Estimates

A brief description of planned program accomplishments in FY 2007 follows, organized by the program's two major components. These activities demonstrate the utility of products that are counted under the output measures for "systematic analyses and investigations delivered to customers."

Investigations of Subsurface, Point-source Contamination

Program activities in FY 2007 will focus on implementing changes in response to a review of this program conducted in 2006. Program activities are anticipated to include continuation of research on the following major contamination problems, but may include new efforts.

- **Hydrocarbons and Petroleum-Related Contamination —** Hydrocarbon contamination occurs in association with petroleum development, transport, storage, and use. The large number of hydrocarbon contamination sites across the Nation makes systematic management and cleanup decisionmaking essential. The introduction of fuel oxygenates such as MTBE to improve air quality have significantly exacerbated subsurface contamination problems from gasoline. Research will focus on addressing contamination associated with petroleum production, the limitations to natural clean-up options, and development and improvement methods to design, monitor, and evaluate natural remediation including bioremediation.

- **Mixed-Waste Disposal and Contamination in Arid Environments —** Mixed radioactive and organic wastes often are disposed in the shallow subsurface in arid regions. Contamination leaks from disposal facilities result in gaseous and water-borne contamination that violates accepted theories of contaminant transport. As a result, there are concerns for management of existing leaks and plans for future waste disposal. Inadequate knowledge of the behavior of these wastes has deadlocked national decisions about the disposition of low-level radioactive wastes. Delays in resolving these questions are costly (due to the interim solutions used) and can pose a health risk (due to the multitude of temporary waste-storage sites located in highly populated areas of the Nation). Research will focus on quantifying the processes that

affect movement of radionuclides and volatile organic chemicals in these unique environments and methods to monitor and evaluate contaminant migration in the subsurface.

- **Contamination in Fractured-Rock Aquifers —** Great uncertainty exists in determining the direction and rate of water and contaminant movement, and the ability of chemical and microbial reactions to mitigate contamination in fractured-rock aquifers. Remediation is delayed or stymied at many such sites by an inability to measure properties that control water and contaminant movement and a lack of knowledge of fundamental contaminant transport processes. Researchers will help with design and performance evaluation of new remediation technologies and development of new methods to characterize subsurface contamination sites. The research will include noninvasive geophysical techniques.

- **Contaminant Plumes with Complex Chemical Mixtures —** Contaminant plumes with complex mixtures of organic and inorganic contaminants, such as landfill leachate and wastewater discharges, are difficult to characterize, manage, and remediate. Reactions among dissolved chemicals, reactions between dissolved chemicals and the aquifer material, and microbial reactions can significantly accelerate or retard contaminant movement and complicate natural and engineered cleanup. Research will focus understanding the geochemical conditions that control contaminant transport and methods to characterize process rates and the corresponding properties that control them.

Investigations of Watershed-scale and Regional-scale Contamination

Program activities in FY 2007 will focus on the following contamination problems:

- **Watershed Contamination from Hard-Rock Mining —** Affected watersheds often have hundreds of abandoned mine sites with little information on their relative significance, making the traditional site-by-site cleanup approach grossly inefficient. Toxics program scientists have helped develop and are applying a revolutionary, watershed-based approach to remediation. This research has enabled decisionmaking that identifies realistic cleanup goals and targets contamination sources that have the most significant effect on watershed quality. Activities in FY 2007 will focus on publication of significant findings. A project review completed during FY 2005 identified research priorities, gaps in existing activities, and actions needed to fill those gaps. Expert scientists and managers representing government partners and the academic community participated in the review.

- **Mercury in Aquatic Ecosystems —** Trace loadings of atmospheric mercury deposition from natural and man-related sources have resulted in widespread accumulation of methylmercury in fish and wildlife in remote wetlands, lakes, and streams, often at levels that present toxicological concerns. However, a general understanding of the factors that result in some aquatic ecosystems susceptible to mercury loading remains elusive, making protection of human health and the health of fish-eating wildlife a challenge. Research efforts in 2007 continue to focus on the factors controlling mercury methylation and accumulation among aquatic ecosystem types, factors that control methylmercury contamination locally, regionally and globally, and investigation of whether plans for emissions reductions will result in corresponding reduced levels in bioaccumulation and

at what timescales. The results will be used to advance discussions of pending mercury emissions regulation and health standards.

- **Unsaturated Zone Processes and Shallow Ground Water Quality —** The Toxics program will expand research on transport processes in the unsaturated zone and the movement of contaminants across the water table in 2007. This research will address fundamental questions about ground-water contamination, mitigation, and remediation such as the design of vapor extraction remediation, the evaluation of the contribution of hydrocarbon degradation and volatilization to natural attenuation at gasoline spill sites, and determining the contribution of atmospheric sources of MTBE to its occurrence in aquifers. Currently project researchers are engaged in several collaborative activities within New Jersey that are designed to answer fundamental questions about often overlooked unsaturated zone processes in contaminant fate and transport and ultimately to determine practical uses of those answers to solve environmental problems.

- **Human Stresses on Sensitive Aquatic Ecosystems —** The increasing complexity of human stresses on natural ecosystems requires a sound interdisciplinary scientific basis for decisions to preserve and restore unique and valued ecosystems. Restoration schemes must be developed that do not exacerbate contamination issues in these systems. Effective restoration will depend on a practical understanding of the processes that affect contamination and other human influences on aquatic ecosystems. Interdisciplinary approaches capable of addressing the broad range of controlling factors are employed in ecosystems that are identified to have high Department and national priorities. Research in 2007 will focus on the Everglades, Platte River, Chesapeake Bay, Mojave Desert, and San Francisco Bay. The Toxics program supports these activities directly and through contributions to Priority Ecosystems Science activities, which are described in more detail in the Science on the Landscape section beginning on page F - 30.

- **Amphibian Research and Monitoring Initiative —** Reports of declining amphibian populations and of populations with excessive occurrence of limb deformities are increasing dramatically. Evidence indicates that stress from human influences is either a direct or a contributing factor. In 2007, Toxics program scientists will continue efforts with USGS biologists and scientists from other Interior bureaus to design and implement a national framework for monitoring the status and trends in amphibian populations and for research into factors that affect amphibian declines and deformities.

FY 2006 Planned Program Performance

A brief description of selected program accomplishments planned for FY 2006 follows, organized by the program's major components as described above. These activities demonstrate the utility of products that are counted under the output measures for "systematic analyses and investigations delivered to customers."

Investigations of Subsurface, Point-Source Contamination

- Improve understanding of the geochemical conditions controlling contaminant pathways in landfill leachate plumes, including redox (reducing-oxidizing) conditions and organic matter availability.

- Improve geophysical methods for characterization of faults and other three-dimensional features in the subsurface, including liquids injected to enhance bioremediation.

- Improve knowledge of the conditions under which the fuel oxygenate MTBE is degraded by microorganisms, including the role of hydrogen and the effects of low-temperature conditions.

- Characterize the biodegradation pathway for the explosive RDX under manganese-reducing conditions.

- Define the mechanism by which the toxic contaminant N-Nitrosodimethylamine is mineralized at an artificial recharge facility. Although no longer used, NDMA is a byproduct of various industries and treatment processes and is found in wastewater.

- Enhance the Time of Remediation Software, developed by the Toxics program, Virginia Polytechnic Institute, and the U.S. Navy, to (1) expand the kinds and numbers of contaminants considered, (2) allow concurrent consideration of chlorinated ethenes and petroleum hydrocarbons, and (3) compare times of remediation associated with monitored natural attenuation to pump-and-treat remediation.

- Summarize the scientific issues related to cessation of long-term release of sewage to the subsurface at the Cape Cod research site, including discussion of physical and chemical processes that affect natural recovery of ground-water quality.

- **Emerging Contaminants —** Many chemicals such as household products, human and veterinary pharmaceuticals, and commercial chemicals can be concentrated in household, industrial, and livestock wastewaters and can contaminate water resources. The environmental occurrence of these compounds, individually and in mixtures, has significant implications for drinking water, water re-use, occurrence of bacterial and viral pathogens, endocrine disruption, antibiotic resistance, chemical production, chemical registration and use, management of animal agriculture including aquaculture, and priorities for research and toxicological studies. In FY 2006 the project is continuing to expand efforts to integrate environmental chemistry studies with ecological health effects research; in addition a new national reconnaissance is planned that will incorporate additional sites, new compounds, and new understandings gained from previous results. This review will identify research priorities, gaps in existing activities, and actions needed to fill those gaps. Expert scientists and managers representing government partners and the academic community will participate in the review.

Investigations of Watershed-Scale and Regional-Scale Contamination

- Define relations between frog malformations in Minnesota and the physical, chemical, and biological factors that influence them.

- Summarize results of a decade of measuring triazine herbicides in the Mid-continent including results of measurements in ground water, surface water, reservoirs, and precipitation.

- Define the contributions of glyphosate and its primary degradation byproduct AMPA from urban sources to surface waters.

- Characterize the presence and distribution of wastewater-derived pharmaceuticals in soil irrigated with reclaimed water. Land application of reclaimed wastewaters is a major pathway for release of wastewater contaminants to the subsurface.

- Characterize the loading of organic and inorganic wastewater contaminants along a hydrogeochemical and land use gradient, in the research watershed at Boulder Creek, CO.

- Summarize the tracer-injection approach for quantifying metal loading to streams, including specific case studies in mined watersheds.

- Characterize metals concentrations in water, sediment, biofilm, benthic macroinvertebrates, and fish in the Boulder River watershed, MT, and define the role of colloids in the associated metal uptake.

- Summarize long-term research on the phytoplankton ecology of San Francisco Bay and provide a synthesis of contemporary understanding of the processes that shape phytoplankton communities.

Development of Laboratory and Field Methods

- Develop the capability to make centimeter-scale geochemical measurements in the subsurface at hydrologic interfaces, such as the sediment water interface. Biodegradation often occurs at these interfaces where geochemical conditions are suitable.

- Develop and patent a bioreactor to treat methyl bromide residuals from fumigation treatments.

FY 2005 Program Performance Accomplishments

The program accomplishments listed below demonstrate the utility of products that are counted under the output measures for "systematic analyses and investigations delivered to customers."

Development of New Laboratory and Field Methods

USGS Patents Bedrock-Aquifer Testing Tool — A USGS scientist designed, constructed, and patented the multifunction Bedrock-Aquifer Transportable Testing Tool (BAT^3) designed to measure the permeability of fractures and to collect water samples for geochemical analyses from specific permeable layers in fractured-rock aquifers. The equipment was designed to be easily transported from site to site and includes data-acquisition equipment integrated with a laptop computer to store, display, and interpret hydraulic data *as it is collected*. The BAT^3 has been used at contaminated ground water sites throughout the eastern United States and has the ability to conduct multiple types of hydraulic tests, geochemical sampling, and tracer tests.

New Lab Methods Help Track Emerging Environmental Contaminants — USGS chemists have developed several new lab methods for measuring emerging contaminants in water and sediment samples, expanding capabilities to approximately 140 compounds, including pharmaceuticals, personal care products, detergent metabolites, fire retardants, and other organic wastewater compounds. USGS scientists continue to assess the need to add

compounds to these capabilities based on a range of criteria including the volumes manufactured, the estimated concentrations reaching the Nation's water resources, and the potential or known biological health effects due to acute or chronic exposures. These methods continue to be refined, improved, and expanded in response to research and stakeholder needs as field data from many related USGS studies are collected and analyzed.

Effective, Inexpensive Monitoring of Volatile Organic Compounds (VOCs) in Ground Water — USGS scientists working at the Massachusetts Military Reservation (MMR), where the Air Force and Army spend about $5 million annually for monitoring, have demonstrated that diffusion samplers are a cost-effective method for sampling VOCs in ground water. Based on this work, Air Force engineers have recently incorporated diffusion sampling into the long-term monitoring program at the MMR. Their analysis indicates that this should result in substantial cost savings and also minimize impacts to the landscape from monitoring activities.

Subsurface Point-Source Investigations

Predicting Contaminant Plume Growth Rates — Predicting the rate that contaminant plumes will grow beneath oil and gasoline spill sites is an important component of evaluating the potential success of remediation using monitored natural attenuation. USGS researchers working at the Toxics program crude oil and gasoline field research sites have developed a new method to predict the rate that benzene and other VOCs will spread in a contaminant plume. The simple method enables clean-up professionals and regulators to assess the long-term performance of monitored natural attenuation as a remediation alternative.

New Model of Gaseous Transport of Radio-Carbon Isotopes — USGS scientists developed a new computer model that simulates the transport and reaction of gases in the unsaturated zone. USGS scientists studying the transport of contaminants (including radioactive carbon and tritium) at the Amargosa Desert Research Site, NV, applied the new model to help understand the transport of gases in the site's thick dry zone between the land surface and the water table. The model gives scientists, water-resource managers, and hazardous waste clean-up professionals a useful tool to better understand and predict the occurrence, transport, and fate of radioactive and other gases in desert environments.

USGS Patents Bioreactor to Treat Nitrate Contamination in Water Supplies — A USGS scientist has designed, constructed, and patented a bioreactor that utilizes microorganisms to remove nitrate contamination from water supplies. The bioreactor is designed as a small-scale unit to treat single-well water supplies, which are typically affected by rural, non-point sources of nitrate contamination. The bioreactor microbes grow on nitrate and hydrogen, and produce only water and nitrogen gas, harmless end-products. As safety features, the bioreactor is designed to contain only small amounts of hydrogen at any one time, produces the hydrogen it needs only when required, and aerates and filters the treated water. The bioreactor was tested with ground water and surface water and was found to be functional and stable for long periods of time, and capable of completely removing high levels of nitrate with only a 2-hour contact time.

Watershed-Scale and Regional-Scale Investigations

National Fish Mercury Model Available On-Line — Identifying waterways susceptible to fish mercury contamination and developing fish consumption advisories is complicated by interpretation of highly varied and inconsistent data on mercury in fish. Fish samples are taken

from different fish species, from fish of different sizes, and from different parts of fish. USGS scientists have developed a national model of mercury concentrations in fish tissue, which predicts mercury concentrations in a single standardized fish species, of a specified length, and type of fish sample. The model enables analysis of variations in fish-mercury concentrations between sites and over time that, otherwise, might go unnoticed. Additionally, the model can estimate mercury concentrations in many fish with very different characteristics, thus providing the potential to dramatically lower the size and cost of fish monitoring programs without decreasing accuracy. The model was developed in cooperation with the NIEHS and *The National Map* Program.

Nitrogen Isotopes Explain Transport of Nutrients in Streams — Hypoxia (depressed levels of dissolved oxygen) in the northern Gulf of Mexico is believed to be caused primarily by nutrients, especially nitrogen, transported by the Mississippi River. Nitrogen loads in streams have increased from increasing inputs from diverse sources, and from loss of wetlands and natural stream channels, which reduce nitrogen through natural processes. To quantify the processes that affect nitrogen after it enters the streams that feed the Mississippi River, USGS scientists conducted an experiment in an agricultural watershed in Indiana that allowed them to directly measure the conversion of nitrate to harmless nitrogen gas. This and other experiments are providing knowledge that assists those designing management solutions to hypoxia and other problems associated with excess nutrients.

Multidisciplinary approach to Abandoned Mine Lands (AML) in Watersheds — Since the late 1990s, the USGS has conducted an AML initiative to provide technical assistance in support of Federal land management agencies' actions to remediate contamination associated with abandoned hard rock mining. A USGS Professional Paper released in 2005 presents results of the Boulder River watershed AML study and reports on studies that provide the science needed to make informed decisions about remediation of mine drainage problems. The report includes information on the implications of pre-mining conditions, characterizing and prioritizing existing geologic and mining sources, understanding the pathways for movement into aquatic resources, exposure and effects on aquatic organisms, and cleanup targets.

Biodynamic Model Unravels Complexities of Metals Bioaccumulation — Metal bioaccumulation rates are a key factor in risk assessments for metals-contaminated sediment. Metal bioaccumulation rates, however, are highly variable due to differences among species, the bioavailability of metals, and the complexities of the cycling of metals in aquatic ecosystems. USGS scientists and their colleagues have developed a model that predicts metal bioaccumulation in affected organisms, such as clams and ducks. This model and approach has been used to help water resource managers make decisions involving selenium contaminated sediments in the San Francisco Bay area.

Performance Overview

A key indication of USGS performance in characterizing the occurrence, fate, and effects of toxic substances is reflected in the end outcome measure for research: soundness of methodology, accuracy, and reliability of science—100 percent of the science products are validated through appropriate peer review. To clearly measure progress in achieving intermediate outcomes of improving the information base, information management, and technical assistance through Toxics program studies, the USGS tracks outputs including the number of systematic analyses and investigations delivered to customers. In addition, in conjunction with the Hydrologic Research and Development program and an array of

reimbursable research projects, the Toxics program contributes to the PART measure shown below.

Measure	2005 Plan	2005 Actual	Change from 2005 Plan	2006 Enacted	2006 Change from 2005 Actual	2007 Request	2007 Change from 2006
Systematic analyses and investigations delivered to customers	32	32	0	31	-1	30	-1
% of targeted contaminants for which methods are developed to assess potential environmental and human health significance **(PART)**	20%	20%	0	30%	+10%	33%	+3%

This page intentionally left blank.

Activity: Water Resources Investigations

Subactivity: Hydrologic Monitoring, Assessments, and Research
Program Component: Hydrologic Research and Development

Program	2005 Actual	2006 Enacted	2007 Fixed Cost & Related Changes [a/]	2007 Program Changes	2007 Budget Request	Change from 2006
Hydrologic Research and Development	15,997	14,609	+285	-1,241	13,653	-956
Total Requirements $000	**15,997**	**14,609**	**+285**	**-1,241**	**13,653**	**-956**
FTE	***294***	***294***	***0***	***0***	***294***	***0***

[a/] Fixed cost increases for this program total $406, of which $285 will be budgeted and $121 will be absorbed.

Summary of FY 2007 Program Changes for Hydrologic Research and Development

Request Component	Amount	FTE
Program Changes		
• Hood Canal study	-99	0
• San Pedro Partnership	-296	0
• LEAG study	-846	0
TOTAL	**-1,241**	**0**

Justification of FY 2007 Program Changes

The 2007 request for Hydrologic Research and Development is $13,653,000 and 294 FTE, which is a program change of -$1,241,000 and 0 FTE. This funding level eliminates unrequested earmarked projects, as they do not address the highest priority science needs for hydrologic research and development. This will keep the core program intact while allowing the Survey to make the best use of resources.

- **Hood Canal (-$99,000 and 0 FTE) —** Research to help determine the causes of low dissolved oxygen levels and fish mortality in Hood Canal, WA, is in its final year. FY 2006 funding is being used to complete and publish a study of freshwater and nitrogen inputs into the canal from the surrounding ground water. Under the Department's Serving Communities—Advance Knowledge mission goal, the completion of this study will decrease the "systematic analyses and investigations" performance target by -1.
- **San Pedro Partnership (-$296,000 and 0 FTE) —** USGS participation in the interagency Upper San Pedro Partnership and the reporting requirements of Public Law 108–136, Section 321, will not be funded. Under the Department's Serving

Communities—Advance Knowledge mission goal, the discontinuation of these activities in FY 2007 will affect the "systematic analyses and investigations" performance target by -1.

- **Participation in the Long-Term Estuary Assessment Group (LEAG) Consortium (-$846,000 and 0 FTE) —** Pass-through grants to Tulane and the other LEAG universities will end, and the USGS will end in-house efforts related to LEAG activities. The USGS will ensure that this shift in priorities does not cause the closure of streamgages or water-quality monitors on the lower Mississippi and tributaries.

Program Performance Change Table

Total Performance Change		*-2 systematic analyses and investigations delivered to customers*			
	A	*B*	*C*	*D= B+C*	*E*
	Overall Performance Changes from 2006 to 2007				
Measure	**2006 Enacted Performance**	**2007 Base Performance Level**	**2007 Impact of Program Change on Performance**	**2007 Budget Request Performance**	**Out-year Impact of 2007 Program Change on Performance**
Systematic analyses and investigations delivered to customers	**32**	**32**	**-2**	**30**	**0**

Column B: The performance level expected to be achieved absent the program change (i.e., at the 2006 request level plus/minus funded fixed cost/related changes); this would reflect, for example, the impact of prior year funding changes, management efficiencies, absorption of fixed costs, and trend impacts.

Column E: The out-year impact is the change in performance level expected in 2008 and Beyond of ONLY the requested program budget change; it does not include the impact of receiving these funds again in a subsequent outyear.

Program Overview

The Hydrologic Research and Development (HR&D) program conducts long-term sustained research on complex problems in the hydrologic sciences and supports the research and development needs of other water resource and USGS programs. HR&D program investigations integrate hydrological, geological, chemical, climatic, and biological science in addressing water resources issues. The program seeks to maintain an appropriate balance between high-risk high-reward research that leads to major scientific breakthroughs and future applications, and more applied research that helps keep the program relevant and focused on today's water resource issues. The research and development efforts of the HR&D program are typically multidisciplinary in nature and require strong collaborative relations, both among scientists funded by the program and with scientists in other parts of the USGS, in Federal and State agencies, universities, and foreign countries.

To fulfill their critical role in support of other USGS programs, scientists funded by the HR&D program:

- Provide training, workshops, reviews, and advice on water resource issues to respond to national, regional, and local needs,

- Provide specialized laboratory services, such as chemical and isotopic analyses and methods to characterize microbes,

- Develop new geophysical and geochemical techniques and numerical modeling tools, and

- Provide advice to USGS leadership on future program directions.

The long-term goals of the HR&D program are:

- To understand ecological and biogeochemical processes in the context of the hydrologic cycle and of process responses to system perturbations, to enable discrimination between natural and human-induced changes, and to ensure effective water-availability, water-quality, and ecosystem management,

- To understand chemical and biochemical processes affecting organic and inorganic solutes and gases in aquatic systems to enable evaluation of water quality, helping managers make informed water-management decisions,

- To understand the physical processes controlling the distribution and quality of the Nation's surface-water resources to improve flood and drought hazard mitigation,

- To understand the movement, availability, and transport of subsurface water in order to minimize further contamination of the Nation's ground waters, optimize aquifer remediation efforts, and ensure effective ground-water management,

- To understand stream-channel morphology and erosional processes governing the source, mobility, and deposition of sediment to ensure scientifically based management of rivers, dams, and reservoirs, and

- To understand long-term processes in small watersheds, including the effect of atmospheric and climatic variables, and provide water and land managers with information needed for water resources management.

HR&D includes two components:

- Long-term interdisciplinary research (Estimates for FY 2005, $13.3 million; FY 2006, $13.4 million; FY 2007, $13.7 million), and

- Short-term research to meet congressional priorities (Estimates for FY 2005, $2.7 million; FY 2006, $1.2 million; FY 2007, $0).

The long-term interdisciplinary research program component provides the core funding for the National Research Program (NRP) and the smaller Water, Energy, and Biogeochemical Budgets (WEBB) program. Both the NRP and the WEBB programs are also dependent on funding from other USGS programs, and they leverage their core funds with funds from other Federal and State agencies. These linkages ensure that research efforts are focused on developing new concepts and future techniques and remain relevant to current USGS programs and Interior management responsibilities.

Several forms of internal and external reviews are used to evaluate progress in the HR&D program. Each scientific project funded by the HR&D program is internally reviewed for its accomplishments and plans on a yearly basis. In FY 2004, 76 NRP projects and 5 WEBB

projects were reviewed. In addition, in-depth reviews of projects and associated personnel were conducted for 27 NRP projects. These in-depth reviews examine: the relationship of project work to the USGS mission and its disciplinary and regional needs; the productivity, relevance, and scientific impact of the project; the project plans and goals for the next 5 years; and the expertise and responsibilities of project personnel. The Research Grade Evaluation Process, a double-tiered peer/research-manager review system, ensures that the progress of each research scientist funded by HR&D funds is thoroughly reviewed by other scientists and program managers at least once every 4 years. During FY 2004, 45 NRP and WEBB scientists were reviewed through this process for their scientific contributions and for the relevance and impact of their work. Publications in the externally reviewed scientific literature are considered primary products of work conducted under the HR&D program. The National Academy of Sciences also conducts reviews through its Committee on USGS Water Resources Research, parts of which apply to research funded under the HR&D program.

The 5-Year Plan for the HR&D program is being updated to conform to the new outline, format, and internal/external team approach. The goal is for completion in FY 2006.

FY 2007 Program Performance Estimates

The FY 2007 activities listed below demonstrate the utility of products that are counted under the output measures for "systematic analyses and investigations delivered to customers" and "formal workshops or training provided to customers." They are all related to the "long-term interdisciplinary research" component of the HR&D program.

Nutrient Cycling, Biotic Response, and Mercury Contamination in the Lower Mississippi — The lower Mississippi receives considerable inputs of nutrients, especially nitrate. Studies will be conducted to monitor and assess the complex coupling between nutrient transport and removal mechanisms, biotic responses to excess nutrients, the consequent build-up of highly reactive carbon from decaying algal blooms, and its impact on mercury methylation. Improved understanding of these processes will allow better management of water and sediment resources, and scientifically based responses to nutrient and mercury issues.

Drought — During the past several decades, the United States as a whole has been wetter than the long-term average, and although short-term (1-3 years) droughts have affected some parts of the Nation, prolonged droughts of the magnitude experienced during the 1930s and 1950s have not occurred. A new research effort will be carried out in collaboration with scientists from the Midwestern Regional Climate Center, NOAA, State water agencies, and universities to characterize the development and persistence of drought in the conterminous United States. This study will be done in cooperation with the USGS Hydrologic Networks and Analysis and National Streamflow Information programs. The study objective is to provide a scientific basis that will allow improved, longer-term management of water resources across the Nation during both wet and dry periods.

New Techniques Related to Streamflow — Emerging and traditional technologies for the estimation of streamflow to assist in forecasting flood magnitudes will be evaluated and new methods will be developed. Studies will focus on flood data from the Southeast. In a pilot study in the Arkansas-White-Red River Basin, mass balance principles will be incorporated into traditional statistical methods in order to correct regression estimates of mean monthly and mean annual flows for each reach on a river network and thus improve the accuracy of calculated streamflow characteristics. The study will lead to improved forecasting of flood magnitudes and travel times.

Development of a General Surface Flow and Sedimentation Model — In cooperation with the National Streamflow Information Program, a two-dimensional surface water computer model will be developed as a precursor to increasingly complex models that will include features such as sediment transport, flow over dry areas, and dam-break flows. This work has a wide range of potential applications, ranging from the improved management of sediment transport in the Lower Mississippi to slow land loss and seawater encroachment in the wetlands, to the management or restoration of ecological environments in river systems.

Integrated Modeling of Ground-Water / Surface-Water Interactions — Traditionally, numerical models of ground-water and surface-water flow and transport have been conducted in isolation, at the expense of a proper description of their significant interactions and feedback effects. Models that integrate ground-water/surface-water interactions will be constructed and will be applied to a diversity of water resource management problems, including "whole-system" management of watersheds, and assessments of the potential impacts of ground-water pumping on streamflow. This effort will extend the capabilities and impact of current USGS-developed numerical models, such as MODFLOW and the Modular Modeling System.

Coalbed Methane Hydrology — Hydrological properties of fractured coal aquifers will be investigated and evaluated through a variety of geophysical logging techniques and observations. This effort will provide a better assessment of water storage and transport in areas of coalbed methane exploitation, and will be coupled with geochemical investigations of the solutes and nutrients associated with waters produced during extraction of coalbed methane. The results of the study should help guide best management practices and will provide fundamental improvements in the use of geophysical techniques and in understanding fractured-coal aquifers and nutrient reactions and transformations.

Climate, Location and Topography Effects on Mercury and Methyl-Mercury Fluxes and Occurrence — This effort will complement and extend knowledge gained to date in comparing and understanding the effects of climate, location, and topography on the overall fluxes of water, major solutes, and nutrients through small watersheds. The idea is to determine the sources of mercury input in up to five small watersheds and examine the processes that affect the transport of mercury and its transformation into toxic methyl-mercury. Given the diversity of settings for the watersheds involved, the study is expected to have high transfer value in understanding the overall distribution and transformation of mercury across the Nation.

FY 2006 Planned Program Performance

The FY 2006 activities listed below demonstrate the utility of products that are counted under the output measures for "systematic analyses and investigations delivered to customers" and "formal workshops or training provided to customers." They are all related to the "long-term interdisciplinary research" component of the HR&D program.

Arsenic-Contaminated Aquifers — Drinking arsenic-rich water over a long period results in various health effects including various cancers, diseases of the blood vessels, and possibly also diabetes, high blood pressure, and reproductive disorders. Results of USGS laboratory-based studies in FY 2005 indicate that mobilization of arsenic in subsurface aquifer materials in one of the most severely affected areas—Bangladesh and West Bengal—is partly, if not primarily, a microbiological process. Further investigations underway in FY 2006 hope to identify which specific microbiological mechanisms are responsible for arsenic dissolution.

Mercury Bioaccumulation in Stream Ecosystems — Mercury contamination has resulted in fish-consumption advisories in 46 States and accounts for 81 percent of all contaminant advisories for consumption of fish in the United States. The 3,094 mercury advisories currently in effect represent 30 percent of the total lake acreage and 24 percent of the river miles for the Nation. To help land-resource managers address this widespread problem, the USGS has engaged in mercury research to quantify mercury in streams and assess bioaccumulation of mercury in fish. Recent data suggest that patterns and processes governing mercury distributions may not have been evident through more focused regional studies. Ongoing and future work will address mercury cycling in streams across nationally important gradients of mercury inputs, hydroclimate, land cover, and land use.

Streamflow Forecasting for Improved Water Resource Management — Water managers are increasingly dependent on watershed models that can accurately predict streamflow across a range of spatial and temporal scales. The USGS has developed models to forecast runoff from rainfall and snowmelt and in the coming year will be expanding collaboration with other Federal agencies to improve model capabilities so that agencies now using seasonal forecasts will be able to make daily forecasts. New USGS-developed models have been refined to run at timesteps of minutes or seconds on a wide range of basin sizes. These models will be enhanced, in collaboration with other Federal agencies, to develop robust precipitation runoff forecasting capability that will be applicable in a variety of settings across the Nation.

Controlled-Flood Experiments on the Colorado River in Grand Canyon — The sediment-transport paradigm for the regulated Colorado River in Grand Canyon was that, under normal releases from Glen Canyon Dam, tributary-supplied sand would accumulate in the channel over multiple years and could then be transferred from the channel bed to eddies during controlled floods, increasing both the area and volume of eddy sandbars. Recent work indicates that this paradigm was not well based; work planned for 2006 will evaluate the locations, amounts, and controls on sediment redistributed by a 2005 release that was timed to follow the accumulation of sediment inputs from Colorado River tributaries.

Climate Change in the Western United States: Evidence of Earlier Spring — The timing and volume of snowmelt runoff in the West is critical to agriculture and public supply interests. The onset of spring in the western United States has been earlier from the late 1970s to the present than it was from the mid-1950s to the late 1970s. These conclusions are based on evidence from the timing of snowmelt-runoff pulses and changes in the blooming of lilac and honeysuckle bushes. The pattern of earlier spring onsets over much of the West is consistent with warmer than normal temperatures in western North America. It is unclear whether this is predominantly an expression of natural variablity or a symptom of global warming. Work planned for 2006 will further evaluate medium- to long-term trends in temperature, precipitation, and runoff in western watersheds.

FY 2005 Program Performance Accomplishments

The program accomplishments listed below demonstrate the utility of products that are counted under the output measures for "systematic analyses and investigations delivered to customers" and "formal workshops or training provided to customers." These accomplishments are all related to the "Long-term Interdisciplinary Research" component of the HR&D program.

Land Subsidence in the Houston Area — Extensive flooding associated with Hurricane Katrina storm surge in September 2005 highlights the importance of subsidence in the Gulf coast region. Subsidence in the United States has directly affected 17,000 square miles in

45 States. Subsidence caused mainly by ground-water extraction has increased the frequency of flooding, caused extensive damage to industrial and transportation infrastructure, and resulted in the necessity for major improvements in levees in the greater Houston area. In addition, subsidence has caused substantial loss of wetland habitat in and around Galveston Bay, the site of the Nation's worst loss of life from storm surge, during the hurricane of 1900. In the low-lying coastal environment of greater Houston, as much as 10 feet of subsidence has shifted the position of the coastline and changed the distribution of wetlands and aquatic vegetation. During the 20th century, human-induced subsidence has been the dominant cause of relative sea-level rise along the Texas Gulf coast, exceeding 1 inch per year in much of the affected area. One of the first steps necessary for solving the serious problems caused by subsidence is the compilation and summary of information and knowledge into a concise publication that can be used by planners and policymakers. A new USGS publication that serves this purpose is available at: *http://pubs.usgs.gov/circ/circ1182/.*

State of the Water Quality of Boulder Creek Watershed — The Boulder Creek watershed is a 447-square-mile catchment that provides a reliable source of drinking water for the cities of Boulder, Lafayette, Louisville, and Erie along the Front Range of the Rocky Mountains north of Denver. Recent research published by the USGS using methods to assess the quality of water and for human consumption and for aquatic life provided information on the relation between land use, geology, and downstream changes in water chemistry. Rivers receive water that has interacted with upstream regions, such that water chemistry reflects both natural and human activity in a watershed. The chemical analyses presented in a new USGS report include traditional water-quality constituents as well as low-level determinations of trace elements, pesticides, and wastewater compounds determined by relatively new analytical techniques. Additionally, the USGS worked with the city of Boulder to prepare a "State of the Watershed" report for use in the city's Water Quality Master Plan. The report, now a USGS Circular, is a citizen's guide to the state of water quality in the watershed.

Arsenic-Contaminated Aquifers — Arsenicosis is the effect of sub-lethal arsenic poisoning, usually over a long period such as 5–20 years. Drinking arsenic-rich water over a long period results in various health effects including various cancers, diseases of the blood vessels, and possibly also diabetes, high blood pressure, and reproductive disorders. Eventually, these exposures lead to critical organ failures and death. The health of tens of millions of people worldwide is at risk from drinking well water contaminated with arsenic. In general, this arsenic occurs naturally, rather than coming from identifiable point sources of pollution. The mobilization of arsenic from subterranean geologic formations into the aqueous phase is the first crucial step in a process that eventually leads to human arsenicosis.

Increasing evidence published by USGS and other scientists suggests that this arsenic mobilization is a microbiological phenomenon, in part because various types of microorganisms gain energy for growth from this toxic element. USGS laboratory-based studies have been conducted with minerals and subsurface materials to better understand microbe and mineral interactions. Results from FY 2005 research indicate that mobilization of arsenic in subsurface aquifer materials in one of the most severely affected areas—Bangladesh and West Bengal—is partly, if not primarily, a microbiological process.

To address this question, USGS scientists have isolated new species of bacteria that metabolize arsenic. In collaborative investigations with colleagues in academia, these microorganisms have been further studied with regard to their physiology, biochemistry, and genetics. Research has also been fundamentally advanced in this direction by the genomic sequencing of several of these microbes under the cooperative auspices of the DOE, as well as

with the Canadian National Research Council. Genomic sequences allow for better understanding of the inner workings of these microbes with respect to their metabolism of arsenic, and the development of appropriate genetic probes to assess their numbers and genetic diversity in natural environments.

Streamflow Timing at Different Basin Scales — New work by USGS scientists shows that measurement of hourly flows from snow-fed watersheds can provide improved understanding of basin hydrology. This improved understanding of the day-to-day changes in the daily streamflow cycles provides water managers with new tools—based on new interpretations of existing flow measurements—that will allow better flood forecasting, reservoir and hydropower management, and predictions of chemical transport in snowmelt-dominated regions of the United States. Day-to-day changes in travel times of melting snow from the top of the snowpack (where melt typically peaks in the afternoon) through the watershed to the river gage (where the daily maximum flows often arrive many hours later) are helping scientists to identify snowmelt and snowpack changes in remote parts of the basins that determine where today's flows are coming from and how much more flow can be expected later in the season.

Performance Overview

There is only one performance measure that can be tied exclusively to Hydrologic Research and Development (systematic analyses and investigations delivered to customers); however, in conjunction with the other programs in this subactivity and an array of reimbursable research projects, Hydrologic Research and Development contributes to the PART measures listed below.

Measure	2005 Plan	2005 Actual	Change from 2005 Plan	2006 Enacted	2006 Change from 2005 Plan	2007 Request	2007 Change from 2006
Systematic analyses and investigations delivered to customers	35	35	0	32	-3	30	-2
% of targeted contaminants for which methods are developed to assess potential environmental and human health significance **(PART)**	20%	20%	0	30%	+20%	33%	+3%

Activity: Water Resources Investigations

Subactivity: Hydrologic Monitoring, Assessments, and Research
Program Component: National Streamflow Information Program

Program	2005 Actual	2006 Enacted	2007 Fixed Cost & Related Changes [a/]	2007 Program Changes	2007 Budget Request	Change from 2006
National Streamflow Information Program	13,814	13,944	+295	+2,525	16,764	+2,820
Total Requirements $000	**13,814**	**13,944**	**+295**	**+2,525**	**16,764**	**+2,820**
FTE	***43***	***43***	***0***	***0***	***43***	***0***

[a/] Fixed cost increases for this program total $422, of which $295 will be budgeted and $127 will be absorbed.

Summary of FY 2007 Program Changes for National Streamflow Information Program (NSIP)

Request Component	Amount	FTE
Program Changes		
• Multi-Hazards Initiative	+200	0
• Network Operations	+2,325	0
TOTAL	**+2,525**	**0**

Justification of FY 2007 Program Changes

The 2007 request for NSIP is $16,764,000 and 43 FTE, which is a program change of +$2,525,000 and 0 FTE. The increase has two components:

Integrated Multi-Hazards Demonstration Project (+$200,000 and 0 FTE) — To improve efficiencies and effectiveness of current research and response to natural hazards, the USGS is proposing a demonstration project that holistically links natural hazards mitigation efforts in specific geographic areas. The NSIP part of the demonstration project includes flood inundation analysis and improved streamgaging networks to fill critical gaps in the areal coverage within the project area. About 18 streamgages and raingages will be added to the existing network in the Southern California study area. Sites will be upgraded to allow real-time transmission of soils and environmental monitoring data. These data are used in flood, landslide, and debris-flow forecasting and warning. The work described above would be accomplished with a combination of the $200,000 increase requested in this budget and the redirection of $900,000 from lower priority NSIP activities in other areas of the country.

Network Operations (+$2,325,000 and 0 FTE) — The funds requested would enable the USGS to continue operation of 114 streamgages that would otherwise have been shut down due to anticipated loss of partner contributions. The funds would also allow the number of streamgages to increase by 30. Also, funding would give the USGS the flexibility to continue operations at high-priority sites identified in the NSIP plan as "Federal interest" streamgages, in the event that non-USGS funding partners decrease their contributions in FY 2007. Though the total number of streamgages has increased over the past 3 years, the loss of partner funding has caused a number of streamgage shut-downs in the last few years, and this trend is expected to continue in FY 2007, especially in Mississippi and Louisiana, where the budgets of State and local partner agencies have been taxed to their limit in the wake of Hurricane Katrina. The USGS anticipates that the funding requested for FY 2007 will help to ease the impact of funding pressures among the network's 800 partner agencies nationwide. In addition, the funds would provide resources for technological investments that will make the entire network more cost-efficient in the long term. These include procurement or development of improved software for data collection and data processing, and new instruments that are more reliable or make the data collection process more efficient.

Program Performance Change Table

Total Performance Change		***+1% content and expanse of knowledge base +144 real-time streamgages reporting in NWISWeb +1% of river basins that have streamflow stations +1% of WRD streamflow stations with 30 or more years of record***			
	A	***B***	***C***	***D= B+C***	***E***
	Overall Performance Changes from 2006 to 2007				
Measure	**2006 Enacted Performance**	**2007 Base Performance Level**	**2007 Impact of Program Change on Performance**	**2007 Budget Request Performance**	**Out-year Impact of 2007 Program Change on Performance**
SIM.2.1.01 content and expanse of knowledge base (% of proposed streamflow sites currently in operation that meet one or more Federal needs) **(PART) (SP)**	**62%**	**61%**	**+1%**	**62%**	**0%**
# real-time streamgages reporting in NWISWeb	**6,165**	**6,051**	**+144**	**6,195**	**0**
% of river basins that have streamflow stations **(PART)**	**81%**	**83%**	**+1%**	**84%**	**0%**
% of WRD streamflow stations with 30 or more years of record **(PART)**	**62%**	**62%**	**+1%**	**63%**	**0%**

Column B: The performance level expected to be achieved absent the program change (i.e., at the 2006 request level plus/minus funded fixed cost/related changes); this would reflect, for example, the impact of prior year funding changes, management efficiencies, absorption of fixed costs, and trend impacts.

Column E: The out-year impact is the change in performance level expected in 2008 and Beyond of ONLY the requested program budget change; it does <u>not</u> include the impact of receiving these funds again in a subsequent outyear.

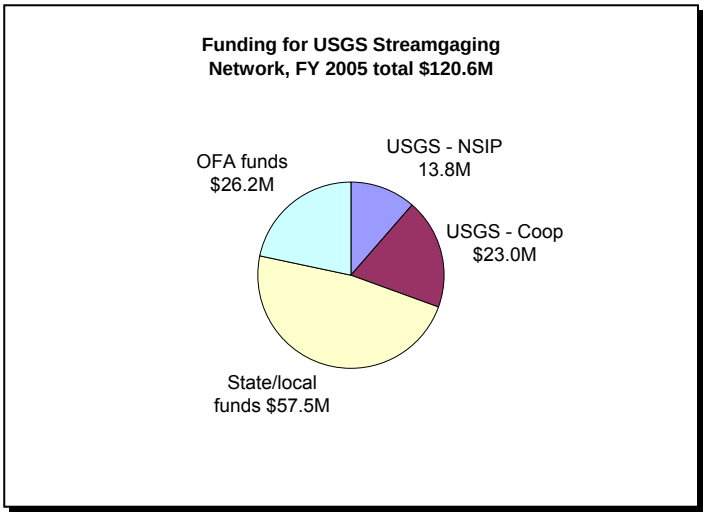
Program Overview

The USGS has the responsibility within the Federal Government for collecting and disseminating information about flow in the Nation's rivers and streams. This information is

used for (1) providing for national and local needs for water availability planning and management, (2) managing water quality and habitat, (3) engineering design, (4) understanding the changing characteristics of the hydrologic system in response to water use, land use, and climate variations, and (5) recreation enjoyment and safety. The USGS also provides the streamflow and related hydrologic information needed by the National Weather Service (NWS) to predict and monitor floods and for general streamflow forecasting.

USGS flood hazard experts work closely with local, State, and Federal partners, in pursuit of the national goals of reducing the toll of natural disasters and building disaster-resilient communities. The streamflow information produced by the USGS is crucial to the success of the NWS Advanced Hydrologic Prediction Services and the FEMA's $200 million per year floodplain map modernization initiative that began in FY 2003. Neither of these programs designed to save lives and property from flooding can be successful without the streamflow information provided by the USGS NSIP.

NSIP Federal interest streamgages reflect that portion of the national streamgaging network that is planned to be funded exclusively by the USGS and, therefore, that part of the network over which the USGS maintains maximum control. As planned, NSIP would be the Federal core of the national streamgaging program that helps to assure stability of long-term data collection. In addition to NSIP funding, support for the network is supplied by other Federal agencies and by 800 State, local, municipal, and tribal partners through the Cooperative Water Program. The shared funding and single-agency operation of the USGS network provides high-quality information to all potential users, for a wide variety of uses, at low cost to the Federal Government. Because a single agency operates this network, data are collected using nationally consistent methods, which enables comparability of data across jurisdictional boundaries and acceptance of results by water management agencies and courts at all levels of government. Operation of the national network by a single agency also helps to minimize the costs of providing the needed streamflow information by consolidating the data collection and information management infrastructure required.



The NSIP addresses the Department's Serving Communities strategic goal of advancing knowledge through scientific leadership and informing decisions through the application of science. The USGS has chosen to classify the entirety of NSIP under this goal even though the NWS, the FEMA, and local emergency managers use data from some USGS streamgages in their efforts to address hazardous or potentially hazardous flood situations. The streamgaging network is a multi-purpose network, and the same data from a single streamgage may be used for flood forecasting, engineering design for bridges and culverts, evaluating water availability for habitat requirements, evaluating the impacts of land use change, and a host of other purposes. Splitting performance metrics and funding for the streamgaging network between hazards and non-hazards goals is problematic at best. The expenditures cannot be tied to individual purposes because they all contribute to the creation of the multi-purpose information.

Therefore, the USGS has chosen to classify the entire streamgaging network under the "Advance knowledge through scientific leadership" goal, which is more appropriate to multi-purpose information.

NSIP has several major components, most of which are described in more detail in the "FY 2007 Program Performance Estimates" section. Those components are:

- Maintain and operate a nationwide Federal-interest streamgaging network for measuring streamflow and related environmental variables (precipitation, temperature) reliably and continuously in time (Estimates for FY 2005, $8.7 million; FY 2006, $8.3 million; FY 2007, $10.6 million),
- Provide a better understanding of hydrologic extremes (floods and droughts) by more intensive data collection during and immediately following the event and analyses of the information collected (Estimates for FY 2005, $0.1 million; FY 2006, $0.1 million; FY 2007, $0.1 million),
- Provide periodic assessments and interpretation of streamflow information on a regional scale (Estimates for FY 2005, $0.1 million; FY 2006, $0.1 million; FY 2007, $0.1 million),
- Develop, implement, and maintain a highly reliable system for real-time streamflow information delivery to customers that includes data processing, quality assurance, storage, and easy access (Estimates for FY 2005, $0.8 million; FY 2006, $1.3 million; FY 2007, $1.6 million),
- Investigate, develop, and implement new methodologies and equipment to more accurately, safely, and inexpensively obtain and deliver streamflow information (Estimates for FY 2005, $1.4 million; FY 2006, $1.2 million; FY 2007, $1.2 million),
- Program coordination (Estimates for FY 2005, $0.4 million; FY 2006, $0.4 million; FY 2007, $0.4 million),
- Technical support for geographically distributed USGS water resources studies and data collection activities, including mechanisms for quality control, technology transfer, and priority setting (Estimates for FY 2005, $2.3 million; FY 2006, $2.5 million; FY 2007, $2.5 million), and
- Integrated Multi-Hazards Demonstration Project (Estimates for FY 2005, $0; FY 2006, $0; FY 2007, $1.1 million).

The NSIP 5-Year Plan is undergoing internal and external review and expected to reach completion by mid 2006.

FY 2007 Program Performance Estimates

The FY 2007 budget request for the NSIP is $16,764,000. Because of relatively level funding, NSIP has been operating in a "steady state" since FY 2001. Thus, activities in FY 2006 and FY 2007 will be geared toward maintaining the network.

Funding NSIP at $16,764,000 in FY 2007 will allow the USGS to maintain operations at all the streamgages that are currently operating under this Program and add about 30 new streamgages, as shown in the performance table above. This funding level would help maintain the core network of streamgages needed to ensure the USGS can provide the data needed by various government, industry, and private organizations that rely on streamflow information to

assure public safety during floods, conduct business, provide appropriate engineering design for bridges and culverts, and ensure efficient and effective allocation of the water resources among competing needs. However, in Louisiana and Mississippi, where State and local agency budgets have been stretched thin by the aftermath of Hurricane Katrina, there is still a possibility that some streamgages may be shut down as a consequence of decreased partner funding for the network. In addition, some streamgages that funding partners consider to be a lower priority may be shut down to ensure higher priority streamgaging needs are met.

The following description of program activities reflects the work that would take place in each of NSIP's major program goals in FY 2007 with the anticipated funding level. These goals were first laid out in the NSIP plan published in 1999: *Streamflow Information for the Next Century – A Plan for the National Streamflow Information Program of the U.S. Geological Survey*. These goals are also consistent with recommendations provided by the National Research Council in 1992, 1999, and 2004.

Goal 1 — A nationwide Federal-interest streamgaging network for measuring streamflow and related environmental variables (precipitation, temperature) reliably and continuously in time. When the last network inventory was taken, at the end of FY 2005, NSIP was fully funding about 560 streamgages. A fully implemented NSIP would fully fund a core, or backbone, network of 4,425 Federal-interest streamgages, and approximately the same number of streamgages would be cooperatively funded to meet joint Federal, State, and local needs through the USGS Cooperative Water Program; together, these would constitute the USGS national streamgaging network. This goal also includes activities to reduce infrastructure costs and upgrade equipment. At the funding level proposed for FY 2007, the USGS will maintain operations at all the streamgages that are currently operating under this Program and add about 30 new streamgages, as shown in the performance table above.

National Academy of Sciences – Evaluation of NSIP Plans

The National Research Council's Committee on Water Resources Research completed an assessment of the USGS plans for NSIP at the end of 2004. The Committee's report said, "Overall, the Committee concludes that the National Streamflow Information Program is a sound, well-conceived program that meets the Nation's needs for streamflow measurement, interpretation, and information delivery."

The following are recommendations and comments about NSIP from the Committee's report.

- Federal support of a base streamgaging network is recommended to assure long-term viability of the network for national needs.
- The goals of the NSIP are an appropriate foundation for the program.
- The set of minimum national streamflow information needs that underlie the goals are reasonable and appropriate.
- Designing the base streamgaging network by establishing national goals and then using GIS-based methods to select sites to provide the required national coverage is reasonable.
- Intense data collection and interpretation during floods and droughts is a strength of the USGS and should be continued.
- Periodic regional and national assessments of streamflow characteristics are fundamental to NSIP and should be continued.
- Enhanced data delivery is an important and highly valued component of NSIP.

Goal 2 — Provide a better understanding of hydrologic extremes (floods and droughts) by more intensive data collection during and immediately following the event and analyses of the information collected. As major floods or droughts occur, funds are allocated each year to assist in additional data collection and analyses to better define the event by measuring streamflow more often and at a greater number of locations. This practice will continue during FY 2007.

Goal 3 — Provide periodic assessments and interpretation of streamflow information on a regional scale to better define streamflow statistics and trends, to estimate streamflow at ungaged sites, and as an evaluation of the network to provide needed streamflow information to perform such analyses. Planning for the regional assessments was completed in FY 2003, and a pilot regional assessment was started. The pilot assessment will continue in FY 2007.

Goal 4 — Develop, implement, and maintain a highly reliable system for real-time streamflow information delivery to customers that includes data processing, quality assurance, storage, and easy access. Some progress has been made toward this goal over the past few years, but there are many functions that still need to be developed. For example, the USGS completed NATWEB, a system of backup redundant data servers to help ensure reliability of data delivery during times of extreme conditions such as floods and hurricanes. In FY 2007, NSIP will invest in additional improvements to help meet this goal, so users can be assured of being able to get the information when they most need it. This program component also includes funding for continuous database development and maintenance.

Goal 5 — Investigate, develop, and implement new methodologies and equipment to more accurately, safely, and inexpensively obtain and deliver streamflow information. Many streamflow measurements are being made today by the same methods used when the USGS started its first streamgage in 1889. The USGS continues to invest in research and investigations of new technologies and development of new methods of information delivery. Even small advances made in this area can help assure a more efficient, more cost-effective program and greater safety for the technicians who must go into the field to make measurements.

FY 2006 Planned Program Performance

In FY 2006, under Goal 4, NSIP will continue to support improvements and maintenance of the database to ensure that the information is available when required. In addition, under Goals 3 and 5, efforts will continue to develop regional streamflow assessment techniques and procedures to estimate streamflow characteristics at ungaged locations and to develop new technologies and tools to measure streamflow more accurately, safer, and at less cost. Another effort that will continue under Goal 3 in FY 2006 is an evaluation of extremely high flood values in the USGS database to verify their accuracy.

These program accomplishments contribute to the intermediate outcome goal "improve information base, information management, and technical assistance" through support for the national streamgaging network. In addition, the Program contributes to the output measure for "number of real-time streamgages reporting in NWISWeb." For the intermediate outcome measure "content and expanse of knowledge base—percent of land with temporal and spatial monitoring, research, and assessment/data coverage to meet land use planning and monitoring requirements (percent of proposed streamflow sites currently in operation that meet one or more Federal needs)," the performance table shows a decrease from FY 2005 to FY 2006. This is because the number of hydrologic data collection sites is affected by changes in the funding contributed by partners, who provide most of the financial support for the water data collection networks. In a time of level budgets for the USGS, as long as funding partners are unable to increase their financial contributions faster than the rate of inflation, the number of data collection sites in operation will continue to decline every year.

FY 2005 Program Performance Accomplishments

The program accomplishments listed below contribute to the intermediate outcome measure "content and expanse of knowledge base" through its support for the national streamgaging network. In addition, the Program contributes to the output measure for "number of real-time streamgages reporting in NWISWeb."

For the intermediate outcome measure "content and expanse of knowledge base—percent of proposed streamflow sites currently in operation that meet one or more Federal needs," the master performance table (section B - Goal Performance Table) shows a decrease from FY 2004 to FY 2005. This is because the number of hydrologic data collection sites is affected by changes in the funding contributed by partners, who provide most of the financial support for the water data collection networks. In a time of level budgets for the USGS, as long as funding partners are unable to increase their financial contributions faster than the rate of inflation, the number of data collection sites in operation will continue to decline every year.

In response to a decline in critical streamgages and increased demand for real-time streamflow information, in FY 2000 the USGS began to implement network enhancements to provide real-time data at more sites and to ensure more reliable data delivery to emergency response officials, the NWS, and the public. These improvements continued into FY 2005. During FY 2005, the USGS undertook the following activities:

- Under Goal 1, maintained operation of most existing NSIP Federal-goal streamgages to provide streamflow information to meet national needs, in spite of rising costs,
- Under Goal 1, upgraded about 25 existing streamgages, including equipment modernization,
- Under Goal 4, invested in data systems, including upgrading and finalization of NATWEB, a system of backup redundant data servers to ensure reliability of data delivery during times of crisis such as floods and hurricanes, and supported maintenance of the NWIS database to help ensure that data are available when needed,
- Under Goal 5, invested in new technology and techniques, providing funding for a proof-of-concept study for real-time non-contact streamflow measurements and for the development of technology and tools to measure streamflow more accurately, safer, and at less cost, and
- Maintained a quality assurance program to help ensure nationally consistent and high quality streamflow information.

In addition, efforts continued in FY 2005 to develop a process to perform regional assessments of streamflow characteristics and to develop a Web-based process to provide streamflow characteristics for any point on any stream in the Nation.

Performance Overview

There are no performance measures that can be tied exclusively to NSIP; however, in conjunction with the Cooperative Water Program, Hydrologic Networks and Analysis, and an array of reimbursable projects funded by 800 partner agencies, NSIP contributes to all the measures listed below.

Measure	2005 Plan	2005 Actual	Change from 2005 Plan	2006 Enacted	2006 Change from 2005 Actual	2007 Request	2007 Change from 2006
SIM.2.1.01 content and expanse of knowledge base (% of proposed streamflow sites currently in operation that meet one or more Federal needs) **(PART) (SP)**	63%	61%	-2%	62%	+1%	62%	0%
# real-time streamgages reporting in NWISWeb	5,187	6,246	+1,059	6,165	-81	6,195	+30
% of river basins that have streamflow stations **(PART)**	79%	82%	+3%	81%	-1%	84%	+3%
% of WRD streamflow stations with 30 or more years of record **(PART)**	61%	58%	-3%	62%	+4%	63%	+1%
% of States with Web-based Streamflow statistics tools to support water management decisions **(PART)**	11%	10%	+1%	18%	+8%	20%	2%

USGS WATER DATA COLLECTION ACTIVITIES

Types of Stations

Continuous record: Hydrologic information is collected continuously over a long period to detect trends, and in many instances, the station is instrumented to transmit data in near real time.
Partial record: Hydrologic information is collected only during selected periods, for example, during floods.
Periodic record: Ground-water levels and ground-water quality are measured manually according to a schedule.

Number of Stations

Column A – Stations totally supported by funds appropriated to the Hydrologic Monitoring, Assessments, and Research subactivity.
Column B – Stations partially supported by funds appropriated to the Cooperative Water Program subactivity.
Column C – Stations totally supported by reimbursement from other Federal agencies.
Column D – Stations supported by a combination of two or more of the above.

Number of Stations as of October 2005

Types of Stations	A Federal Program	B Coop Water Program	C Other Federal Agencies	D Combined Support	Total
SURFACE WATER					
Discharge					
Continuous record	564	4,484	1,531	785	7,364
Partial record	37	2,327	126	44	2,534
Stage Only–Streams					
Continuous record	27	344	254	19	644
Partial record	0	150	20	0	170
Stage Only–Lakes/Reservoirs					
Continuous record	4	356	185	12	557
Partial record	0	42	4	0	46
Quality					
Continuous record	50	748	218	17	1,033
Periodic record	135	1,793	210	94	2,232
GROUND WATER					
Water Levels					
Continuous record	292	1,837	406	69	2,604
Periodic record	4,457	8,192	1,826	545	15,020
Quality					
Continuous record	0	6	30	10	46

This page intentionally left blank.

Activity: Water Resources Investigations

Subactivity: Hydrologic Monitoring, Assessments, and Research
Program Component: Hydrologic Networks and Analysis

Program	2005 Actual	2006 Enacted	2007 Fixed Cost & Related Changes [a/]	2007 Program Changes	2007 Budget Request	Change from 2006
Hydrologic Networks and Analysis	29,524	29,358	+515	-1,622	28,251	-1,107
Total Requirements $000	**29,524**	**29,358**	**+515**	**-1,622**	**28,251**	**-1,107**
FTE	***261***	***261***	***0***	***0***	***261***	***0***

[a/] Fixed cost increases for this program total $736, of which $515 will be budgeted and $221 will be absorbed.

Summary of FY 2007 Program Change for Hydrologic Networks and Analysis

Request Component	Amount	FTE
Program Changes		
• Lake Champlain Monitoring	-291	0
• Monitoring in Hawaii	-444	0
• Tongue River Coalbed Methane	-887	0
TOTAL	**-1,622**	**0**

Justification of FY 2007 Program Changes

The 2007 request for Hydrologic Networks and Analysis is $28,251,000 and 261 FTE, which is a program change of -$1,622,000 and 0 FTE. This funding level will end three unrequested earmarked projects. These projects do not address the highest priority science needs for hydrologic data collection, research, and analysis. This will keep the core program intact while allowing the Survey to make the best use of resources.

- **Lake Champlain Monitoring (-$291,000 and 0 FTE) —** The USGS would end expanded water-quality monitoring for mercury and other toxic substances in Lake Champlain. At the level proposed for FY 2007, $157,000 would remain in the program for basic data collection in the Lake.
- **Monitoring Water in Hawaii (-$444,000 and 0 FTE) —** The USGS would end expanded monitoring of water resources in Hawaii, in cooperation with the State Department of Natural Resources.
- **Tongue River Coalbed Methane Study (-$887,000 and 0 FTE) —** The USGS would stop the collection of hydrologic data that was begun in FY 2004 to document and

establish a baseline for current conditions in the streams in the Tongue River watershed. All data collected in prior years of this effort would continue to be available to the public, though no new data would be available.

Under the Department's Serving Communities—Advance Knowledge mission goal, the discontinuation of these activities in FY 2007 will affect performance targets by decreasing the number of real-time data collection sites. The number of sites to be discontinued will depend upon the willingness of non-Federal partners to fund continued operation of those sites.

No performance change is shown for these reductions in FY 2007 because performance will not be affected until FY 2008. The -2 systematic analyses and investigations delivered to customers reflects reports that will not be delivered due to elimination of the coalbed methane study and elimination of the expanded water-quality work at Lake Champlain.

Program Performance Change Table

Total Performance Change		*-2 systematic analyses and investigations delivered to customers*			
	A	*B*	*C*	*D= B+C*	*E*
	Overall Performance Changes from 2006 to 2007				
Measure	**2006 Enacted Performance**	**2007 Base Performance Level**	**2007 Impact of Program Change on Performance**	**2007 Budget Request Performance**	**Out-year Impact of 2007 Program Change on Performance**
# systematic analyses & investigations delivered to customers	**64**	**64**	**+0**	**64**	**-2**

Column B: The performance level expected to be achieved absent the program change (i.e., at the 2006 request level plus/minus funded fixed cost/related changes); this would reflect, for example, the impact of prior year funding changes, management efficiencies, absorption of fixed costs, and trend impacts.

Column E: The out-year impact is the change in performance level expected in 2008 and Beyond of ONLY the requested program budget change; it does not include the impact of receiving these funds again in a subsequent outyear.

Program Overview

Data on the quantity and quality of water in the Nation's streams, lakes, and aquifers, as well as analytical studies, are necessary for the wise planning, development, utilization, and protection of the Nation's water resources. As the Federal Government's primary agency for water quantity and quality information, the USGS maintains national networks for collecting long term, comprehensive data on water quantity and quality and atmospheric deposition (such as the chemical quality of rain and snow). The Federal funds appropriated through the Hydrologic Networks and Analysis (HNA) program support three distinct water-quality networks, one for large rivers, one for relatively pristine streams, and one, in collaboration with many other agencies and organizations, for atmospheric deposition. The HNA program also supports selected hydrologic analysis and modeling activities, and a small but vital portion of the overall information delivery activity of the USGS water resources programs.

The program addresses the Department's Serving Communities strategic goal of advancing knowledge through scientific leadership and informing decisions through the application of science. A key indication of USGS performance in collection of water-quality and atmospheric deposition data and in hydrologic analysis is reflected in the end outcome measure for research: soundness of methodology, accuracy, and reliability of science (100 percent of science is

validated through appropriate peer review). To clearly measure progress in achieving the intermediate outcome of improving the information base, information management and technical assistance, the USGS tracks outputs including real-time streamgages reporting in the National Water Information System-Web (NWISWeb), real-time ground-water sites reporting in NWISWeb, real-time water-quality sites reporting in NWISWeb, and new systematic analyses and investigations delivered to customers.

The HNA has four major components:

- **Hydrologic networks —** This program component supports long-term national networks for the collection of data on water quality and acid precipitation, including the National Stream Quality Accounting Network, the Hydrologic Benchmark Network, and the National Atmospheric Deposition Program / National Trends Network (Estimates for FY 2005, $4.4 million; FY 2006, $4.4 million; FY 2007, $4.5 million)
- **Hydrologic analysis —** This program component includes studies of climate variability and change, watershed modeling activities in support of the BOR, USGS science for the NPS, DOI Cost-Share (which pays the portion of indirect costs not covered by the standard overhead charge on reimbursable projects that the USGS water programs conduct for other Interior bureaus), support for the USGS National Research Program in the hydrologic sciences, and support for the USGS Priority Ecosystems Science (PES) program (Estimates for FY 2005, $11.9 million; FY 2006, $11.8 million; FY 2007, $10.4 million)
- **Information delivery —** The USGS funds the delivery of basic hydrologic data directly as a part of the overall cost of the data collection. The HNA program provides for the delivery of results and water information beyond the immediate needs of funding agencies or programs. This activity has two pieces: publications and the computer-based National Water Information System. This component of the HNA program also supports activities of the Advisory Committee for Water Information (ACWI) and its subcommittees. (Estimates for FY 2005, $5.9 million; FY 2006, $5.6 million; FY 2007, $5.7 million)
- **Technical support —** This program component includes national technical support for the geographically distributed USGS water-resources studies, including quality control to assure the technical excellence of water resources programs. Technical support also provides a structured way of transferring new technology to USGS investigative and data activities that are primarily conducted in the USGS Water Science Centers located in each State, and a formal way of establishing priorities for water-resources research by the USGS. (Estimates for FY 2005, $7.1 million; FY 2006, $7.1 million; FY 2007, $7.2 million)

The objectives of these program components are as follows:

- Monitor the chemical quality of rain and snowfall,
- Monitor streamflow and the water quality of streams and ground water to fulfill USGS obligations for specific river basin compacts and treaties,
- Provide direct technical support to Interior bureaus for hydrologic concerns,
- Understand the impacts of global climate change; monitor long-term changes in streamflow and stream quality at sites relatively unaffected by human activities,
- Provide direct technical support to the NPS for water-quality concerns,

- Monitor the water quality and trends of selected major rivers,
- Maintain and enhance USGS data delivery systems to process and disseminate water data and study results, and
- Develop decision-support systems for specific river basins in the western United States.

Some of these activities (such as monitoring) are fairly fixed and will not change for a number of years. Others have some flexibility in planning and implementation. The HNA 5-Year Plan is being updated to conform to the new outline, format, and internal/external team approach. The goal is for completion in FY 2006.

Because of the wide range of activities funded by HNA, the water-quality data and analytical information that the USGS provides through this program are used by a variety of stakeholders, including other Interior bureaus (through the NPS water quality partnership and the DOI Cost-Share), EPA and USDA (both customers for baseline water-quality information), Department of Commerce (for real-time flood level information provided through the National Water Information System, which this program supports), State and local governments (for both water-quality and flood level information), academia, consulting and advocacy organizations, industry, and private citizens.

FY 2007 Program Performance Estimates

The activities listed below demonstrate the utility of USGS products that are counted under the following output measures: "number of systematic analyses and investigations delivered to customers," "number of real-time streamgages reporting in NWISWeb," "number of real-time ground-water sites reporting in NWISWeb," and "number of real-time water-quality sites reporting in NWISWeb." Planned program performance in FY 2007 focuses on several key scientific and basic data collection and management areas, including the continuation of the following:

Hydrologic Networks

National Stream Quality Accounting Network (NASQAN) — NASQAN operates 32 fixed stations to measure water quality and to calculate the loading (pounds per year) and time trends of sediments and chemicals in five of the Nation's largest rivers (Mississippi, Columbia, Colorado, Rio Grande, and Yukon) and their major tributaries. Data from these stations aid in the planning, utilization, and protection of these major rivers that flow across interstate and international boundaries and are the subject of complex regulatory requirements. Monitoring of the Yukon River began in FY 2001 and continued through 2005; operations in the Columbia and Colorado were reduced to provide the resources for this activity in Alaska. During FY 2007, Yukon data and information publication begun in FY 2006 will continue.

Hydrologic Analysis

Interdisciplinary Science — PES — The HNA program also provides support for interdisciplinary work and the PES activities that are described in more detail in the Science on the Landscape section beginning on page F - 30. Through PES, in FY 2007 HNA will support studies within the Everglades, San Francisco Bay, Chesapeake Bay, the Platte River, and the Mojave Desert to integrate hydrological, geological, chemical, climatological, and biological

information related to water resources and environmental hazards in support of land managers needs.

National Research Program — All of the Water Resources Investigations programs contribute funding to the National Research Program, which encourages pursuit of a diverse agenda of research topics to provide new knowledge and gain insights into hydrologic processes that are not well understood, at the same time promoting management efficiency and facilitating interaction among scientific disciplines. This practice will continue in FY 2007.

Competing Uses for Water in the Klamath Basin — The competing needs of people, agriculture, and ecosystems is a major issue throughout the West, especially in the Klamath Basin. Water quality conditions in Upper Klamath Lake can become severe in the summer months due to massive blooms of blue-green algae and can lead to periodic mass mortalities of two endangered fish species, the Lost River and shortnose suckers. Understanding how these suckers respond to poor water quality, and the development of severe water quality conditions, are critical information needs for BOR and FWS natural resource managers in the Klamath Basin. In FY 2006, the HNA program includes $486,000 million for work at Klamath Lake in south-central Oregon, to help determine the water-quantity and water-quality benefits that can be expected in the Lake in response to various restoration activities. This amount will be increased in FY 2007 by redirecting an additional $250,000. With the redirected funds, the USGS proposes to identify the effects of water quality on the health and disease susceptibility of suckers, collect data on spawning distribution, habitat and reproductive success requirements of endangered suckers, develop a population dynamics model for the suckers, develop remediation strategies to address phosphorus internal loading concerns, and measure evapotranspiration from various wetlands communities in the Klamath Basin. This study is a joint effort involving the HNA, Cooperative Water, and Biological Research and Monitoring programs and is described in more detail in the Science on the Landscape section, which begins on page F - 1.

Water Information Delivery

The USGS funds the delivery of basic hydrologic data directly as a part of the overall cost of the data collection. The HNA program provides for the delivery of results and water information beyond the immediate needs of funding agencies or programs. This activity has two pieces: publications and the computer-based National Water Information System. This component of the HNA program also supports activities of the Advisory Committee for Water Information (ACWI) and its subcommittees.

National Water Information System (NWIS) — The USGS maintains the NWIS, a distributed network of computers and fileservers for the acquisition, storage, and retrieval of the water data collected across the country. Many types of data are stored in NWIS, including site information, time-series, streamflow, ground water, water use, and water quality. The NWIS contains the data the USGS has collected, compiled, and archived on U.S. water resources for more than a century. The NWISWeb is the WWW application that allows users, both internal and external, to retrieve information from the NWIS *(http://waterdata.usgs.gov/nwis).* Data are retrieved by category (surface water, ground water, or water quality) and by geographic area. Of the 1.5 million sites with NWIS data, more than 9,700 report their data in real time. The NWISWeb provides the public access to 204 million daily values (mostly streamflow), 7.8 million ground-water level values, 4.4 million water-quality samples resulting in more than 69 million water quality analyses, and 655,000 peak discharges (floods). The NWISWeb makes data that are collected in real time available to all within a few minutes or hours. During times of crisis,

managers and emergency management agencies can make critical decisions for saving lives and property based on up-to-date information. For FY 2007, improvements will be made to facilitate the entry of field data, and additional data "collections" and metadata will be available from the NWISWeb.

FY 2006 Planned Program Performance

The activities listed below demonstrate the utility of USGS products that are counted under the following output measures: "number of systematic analyses and investigations delivered to customers," "number of real-time streamgages reporting in NWISWeb," "number of real-time ground-water sites reporting in NWISWeb," and "number of real-time water-quality sites reporting in NWISWeb." Planned program performance in FY 2006 focuses on several key scientific and basic data collection and management areas, including the continuation of the following:

Hydrologic Networks

Hydrologic Benchmark Program (HBN) — Annual interpretive products on HBN monitoring results will be supported and produced in FY 2006, along with more comprehensive assessments at 5-year intervals. The HBN supports monitoring sites and assesses streamflow and water quality in a national network of undeveloped watersheds which serve as benchmarks against which to measure human impacts on water quantity and quality. These watersheds are also useful to monitor the more subtle effects of inputs from atmospheric deposition and changes in geochemical cycling resulting from climate change. Chemical and hydrologic monitoring provides basic, yet critical, data needed as part of any ecosystem monitoring effort. Stream chemistry integrates the chemical and hydrologic processes in basins. HBN monitoring and assessments can objectively gage the effectiveness of control measures intended to mitigate impacts of sulfur and nitrogen deposition to sensitive ecosystems. A major redesign of the network was completed and implemented in FY 2004 and FY 2005. A revised network of 36 sites is now operational with intensive water-quality sampling underway at 16 of the 36 sites. All data and major reports from HBN sites dating back to the 1960s has been loaded to a new public Web site, and the program is developing partnerships with Interior and other land management agencies to restart water-quality sampling at additional Benchmark sites.

National Atmospheric Deposition Program (NADP) — As the lead Federal agency for monitoring wet atmospheric deposition (chemical constituents deposited to the Earth's surface from the atmosphere via rain, sleet, and snow) in the United States, the USGS supports 87 sites in the interagency NADP. Under this program, the USGS pools resources with over 100 other Federal, State, and local organizations to provide scientists and policymakers with a national-scale, long-term network measuring atmospheric deposition. In FY 2006, the program is updating assessments to detect the latest trends in mercury and nitrogen deposition since the mid-1990s at NADP deposition monitoring sites, and begin the installation of next-generation deposition sampling instruments needed to modernize aging field equipment at NADP sites.

Hydrologic Analysis

Studies of Climate Variability and Change — In FY 2006, the Global Change Hydroclimatology program continues (1) monitoring climate-sensitive glaciers, (2) identifying past hydrologic variations by examination of sediment and mineral deposits, biotic material, and historical and instrumental records, (3) determining relations between hydrologic variations and large-scale atmospheric circulations and other climatic indices, and (4) determining effects of

climate variation and change on streamflow, erosion, sedimentation, water quality, and vegetation. Studies include simulation of conditions that lead to high wildfire potential, with the expectation of achieving a better understanding of climate-fire relationships in the West and perhaps the opportunity to develop new fire indices based on a broader set of atmospheric, surface hydrologic, and vegetation parameters. Studies also include investigation of regional relations among glaciers in the North Cascades with the objective of determining the annual storage or release of water by glaciers, and studies of the timing of snowmelt and spring runoff.

Competing Uses for Water in the Klamath Basin — In FY 2006, the USGS is conducting a study to determine if the behavior, distribution, and movements of radio-tagged adult Lost River and shortnose suckers are influenced by water quality conditions in the Upper Klamath Lake, to document the presence and location of any water quality refuges, and determine if suckers are able to locate these refuges. In addition, the USGS is collecting data on water quality dynamics in the lake to improve understanding of how conditions that lead to mass mortalities of suckers develop. Results to date indicate both species will move to avoid areas with low dissolved oxygen, but conditions must be quite extreme. During these events, most suckers moved into or just off the mouth of Pelican Bay, a water quality refuge on the western shore of Upper Klamath Lake, while another nearby refuge, the Williamson River, remained largely unused. These activities span Oregon and California and focus on environmental, economic, and statutory concerns. The USGS is working closely with the BOR, BLM, FWS, NOAA Fisheries, Natural Resources Conservation Service, several Tribes, the Oregon Departments of Water Resources, Fish and Wildlife, and Environmental Quality, California Department of Water Resources, and Siskiyou and Modoc Counties in California to address basin issues. This study is a joint effort involving the HNA, Cooperative Water, and Biological Research and Monitoring programs and is described in more detail in the Science on the Landscape section, which begins on page F - 1.

USGS Science for the NPS — Since 1998, the USGS/NPS water-quality assessment and monitoring partnership program has provided a unique and seamless mechanism for sister bureau collaboration within the Department and assures appropriate science is made available to park managers for defensible decisionmaking to address a range of water-quality issues in national parks. Data and information from more than 100 partnership projects are being, or will be, used to address water-quality issues in 90 national park units across the United States. Projects for FY 2007 will be selected when the USGS has completed its consultation process with NPS to identify new NPS needs. The scope of individual projects varies in accordance with the objectives of individual park managers, and all new projects are selected annually by a panel of USGS and NPS personnel through a competitive proposal process. Activities range from data collection of targeted baseline water-quality constituents to longer term intensive investigations of potential human impacts on water quality and associated aquatic resources. In FY 2006, there are 10 new and 17 continuing projects in the partnership. Results of the first completed projects are already being used during FY 2006 to make decisions on a variety of issues, such as when and where background water quality is degraded by anthropogenic sources of contamination and determination of the best management practices within and outside park boundaries that can affect the biological health of water resources within park units.

Water Information Delivery

Guidelines for Water Quality Data Elements — To facilitate data sharing, the ACWI has developed a core set of data elements that provide metadata to help users determine whether

the data are compatible with other data sets and might be combined for other uses. Guidelines have been prepared to facilitate the voluntary use of these data elements by Federal agencies, States, volunteer monitoring groups, and others. The list and guide include data elements for physical, chemical, and biological sampling of water quality. In FY 2006, the guide will be published as a National Water Quality Monitoring Council Technical Report and disseminated throughout the monitoring community. Future elements under consideration include physical habitat assessment and fish tissue studies.

Design of a National Monitoring Network — As co-chair of the ACWI's National Water Quality Monitoring Council (NWQMC), the USGS is participating in the design of a National Water Quality Monitoring Network for U.S. coastal waters and their tributaries. The task was requested by the Council on Environmental Quality and the Office of Science and Technology Policy in January 2005 and responds to an OMB PART recommendation that directs the USGS to "work with the EPA and other federal and state agencies through the ACWI and NWQMC to develop shared water monitoring plans." In FY 2005, the NWQMC documented network goals, objectives, and management issues, and identified methods to ensure comparability. A preliminary report provided in September 2005 was well received, and the final report was submitted to ACWI in January 2006. ACWI feedback is expected by February 10, and the report is scheduled to be sent to the Council on Environmental Quality in March 2006. Future design elements may include monitoring atmospheric deposition and ground water. The resulting network design will become part of the response to President's Ocean Action Plan, will be used by the NOAA to enhance monitoring of upland effects on coastal waters and to link with the output from the Integrated Ocean Observing System, and will be used by the USGS and EPA to evaluate and enhance monitoring efforts to meet coastal and upland monitoring needs.

Information Technology Improvements

Water resources mission-critical information systems have submitted Capital Asset Plans and have received certification and accreditation (C&A). The NWIS is undertaking process improvements to improve productivity. As a cost avoidance measure, the NWIS is developing failover and recovery capabilities to minimize costly disruption and recovery of lost data. The USGS water resources programs are gaining efficiencies in timeliness and cost by serving digital data and analysis tools through common Web portals.

The 2005 general release of the NWIS provided:

- improved loading of water quality laboratory analyses, including additional metadata on analytical methods,
- improved processes and metadata for estimating missing time-series data,
- new capabilities to allow USGS users to group data-collection and monitoring sites by "theme," such as a project or network, and
- a consistent set of national aquifer codes to facilitate the identification and aggregation of sites nationally and regionally.

The NWIS continues to maintain its FISMA C&A and Capital Planning and Investment Control requirements.

FY 2005 Program Performance Accomplishments

The FY 2005 program accomplishments listed below demonstrate the utility of USGS products that are counted under the following output measures: "number of systematic analyses and investigations delivered to customers," "number of real-time streamgages reporting in NWISWeb," "number of real-time ground-water sites reporting in NWISWeb," and "number of real-time water-quality sites reporting in NWISWeb."

Hydrologic Analysis

Reaching Out on Agriculture Land Use — The USGS is increasing collaborative monitoring, assessment, and research opportunities and improving delivery of existing environmental science for use by those who plan and implement agricultural practices. Stakeholders include Interior land management agencies, Tribes, EPA, USDA, States, interstate compact organizations, State Land Grant Universities, and numerous national, regional, and local farm interest groups. These stakeholders have requested that the USGS continue to play a leading role in performing resource assessments, analysis, monitoring, and data management to help assess the environmental effects of agricultural practices on natural resources, particularly water quality, water availability, and wildlife habitat. In FY 2005, listening sessions were held with external partners, and the results are being used to develop USGS science priorities and future directions based on stakeholder needs, existing programs, and interdisciplinary expertise and capabilities. The Biological Research and Monitoring program also contributes to this effort.

Studies of Nutrient Enrichment to Coastal Estuaries in National Parks — The USGS is helping the NPS make scientifically based decisions needed to maintain and improve protected estuarine and near-coastal water resources. FY 2005 studies in Acadia National Park and Assateague Island National Seashore assessed the potential sources and levels of excess nitrogen inputs from upland sources in and near NPS lands to the associated estuarine environments. These types of studies provide insights that enable resource managers to help reduce the input of nitrogen at the source before it becomes associated with nutrient enrichment in the protected estuaries.

Instream Flows and Habitat Studies of the Upper Salmon River — Fish populations in the Columbia River Basin have plummeted over the last 100 years. This severe decline led to Federal listing of Chinook salmon and steelhead trout stocks as endangered or threatened in the 1990s. Human development has modified the original flow conditions in many streams in the upper Salmon River Basin. Summer streamflow changes resulting from irrigation practices have directly affected the quantity and quality of fish habitat and also have affected migration and access to suitable spawning and rearing habitat for these fish. In FY 2005, continuous streamflow data and habitat data were collected and included in the physical habitat simulation model to develop habitat-discharge relations and are summarized for juvenile, adult, and spawning life stages at each study site. Results of these habitat studies can be used to prioritize and direct cost-effective actions to improve fish habitat of native fish species in the basin.

Water Information Delivery

Reliably Serving Real-Time Water Information for the Nation — In FY 2005 the NWIS continued improvements to back-up systems, to ensure that real-time data processing and delivery to internal and external users via NWISWeb continue during natural disasters such as floods and storms. Despite the office evacuations and subsequent power and telecommunications outages that occurred during the hurricanes and floods in Louisiana and Mississippi, USGS offices in these States continued to provide vital real-time streamflow information through NWISWeb by utilizing the backup systems in Virginia, California, and Minnesota. Not only did the backup systems handle the immediate need, providing

Growth in the Use of the NWISWeb

The public face of the NWISWeb continues to grow rapidly. In 2004 the system experienced a 28 percent increase in the number of page requests compared to 2004, reaching a record number of 240 million hits and an average rate of 8.2 gigabytes per day.

uninterrupted delivery of real-time water data, but they also provided key data processing services to USGS hydrologic staff in Louisiana. This ensured that the water data could be adequately reviewed and quality assured, and that new data-collection sites could be added quickly as needed by the U.S. Army Corps of Engineers and other water managers to help monitor changes in the water-levels in Louisiana in the days following Hurricane Katrina.

Guidelines for Water Quality Data Elements — To facilitate data sharing, the ACWI has developed a core set of data elements that provide metadata to help users determine whether the data are compatible with other data sets and might be combined for other uses. In FY 2005, metadata elements for biological sampling were added to the list, and a comprehensive guide for use of all data elements was submitted to the ACWI for review. The biological elements were prepared with input from Interior's Fish and Wildlife Service, the USGS Biological Resources Discipline, EPA, and others. The data elements have been adapted for use by the Pacific Northwest Data Exchange, the Delaware River Basin Commission, and the California State Water Resources Control Board, and have been adopted by the EPA as voluntary guidelines for the States.

Improvements to the National Environmental Methods Index (NEMI) — The ACWI has enhanced a free Web-searchable database that provides extensive information on standardized environmental sampling methods. The NEMI allows scientists and managers monitoring water quality to compare data collection methods at a glance and find the method that best meets their needs. The tool also allows data to be shared among agencies and organizations that use different methods at different times. The database contains chemical, microbiological, radiochemical, and biological method summaries of lab and field protocols for regulatory and non-regulatory water quality analyses. In FY 2005, the NEMI was expanded to better meet the needs of the monitoring community. One-hundred new methods were added, for a total of about 700. A new user-friendly query interface was installed, enabling greater functionality and flexibility, and the forms for input of new methods were significantly improved. Users can complete these forms to propose additional methods for the NEMI, which then go through a rigorous review and verification process before being added to the database. The Board also developed a Cooperative Research and Development Agreement between the USGS, EPA, and the private sector to allow private sector partnerships in the future development of the NEMI.

Users and future applications for NEMI

The NEMI was developed in a collaborative effort among the USGS, Environmental Protection Agency, Federal Laboratories, and contributions from the private sector and standard method associations, with each of these organizations contributing methods to the database. State water laboratories and quality control officers are among the many regular users of the NEMI. The concept has been so well received that a database of methods to monitor chemical, biological, and radiological contaminants that might be the basis of a terrorist attack on water supplies is also under development.

Performance Overview

There are no PART performance measures that can be tied exclusively to HNA; however, in conjunction with the other programs in this subactivity, the Cooperative Water Program, and an array of reimbursable research projects, HNA contributes to all the measures listed below.

Measure	2005 Plan	2005 Actual	Change from 2005 Plan	2006 Enacted	2006 Change from 2005 Actual	2007 Request	2007 Change from 2006
SIM.2.1.01 content and expanse of knowledge base (% of proposed streamflow sites currently in operation that meet one or more Federal needs) **(PART) (SP)**	63%	61%	-2%	62%	+1%	62%	0%
# real-time streamgages reporting in NWISWeb	5,187	6,246	+1,059	6,165	-81	6,195	+30
# real-time ground-water sites reporting in NWISWeb	700	796	+96	692	+104	685	-7
# real-time water-quality sites reporting in NWISWeb	900	1,125	+225	896	-229	887	-9
# systematic analyses & investigations delivered to customers	65	65	0	64	-1	64	0
# of formal workshops or training provided to customers	11	11	0	11	0	11	0

This page intentionally left blank.

Activity: Water Resources Investigations

Subactivity: Cooperative Water Program

Subactivity	2005 Actual	2006 Enacted	2007 Fixed Cost & Related Changes [a/]	2007 Program Changes	2007 Budget Request	Change from 2006
Cooperative Water Program	62,337	62,833	+1,338	-2,000	62,171	-662
Total Requirements $000	**62,337**	**62,833**	**+1,338**	**-2,000**	**62,171**	**-662**
FTE [b/]	***789***	***780***	***0***	***-18***	***762***	***-18***

[a/] Fixed cost increases for this subactivity total $1,912, of which $1,338 will be budgeted and $574 will be absorbed.
[b/] The decrease of -18 FTE is matched by a decrease of -18 FTE in the reimbursable program, for a total decrease of -36 FTE.

Summary of FY 2007 Program Changes for Cooperative Water Program

Request Component	Amount	FTE
Program Changes		
• Interpretive studies	-2,000	-18
TOTAL	**-2,000**	**-18**

Justification of FY 2007 Program Changes

The 2007 request for the Cooperative Water (Coop) Program is $62,171,000 and 762 FTE, which is a program change of -$2,000,000 and -18 FTE.

Cooperative Interpretive Studies (-$2,000,000 and -18 FTE) — The interpretive studies portion of the Coop Program includes some turn-over each year as current projects end and new projects begin, according to the needs of the USGS and its non-Federal cooperators. The USGS will take this reduction from areas where projects are scheduled to end during FY 2006, so that projects do not have to be stopped before completion. Since the cooperators provide about two-thirds of the funding for the program, the content of projects is determined in consultation with those cooperators, and specific focus areas are often not known until workplans and joint funding agreements are established during the fiscal year. At the proposed funding level, the Coop Program will still be able to start $5–6 million in new projects in FY 2007.

Under the Department's Serving Communities—Advance Knowledge mission goal, this reduction will decrease the number of systematic analyses and investigations delivered to customers by -10. Since more than half the funds for the Coop Program are provided by the 1,400 State and local partner agencies, and since the program is highly customer driven, the reduction could also affect two end outcome measures under End Outcome Goal SEO.2:

- "Inform decisions through the application of science: Improved access to needed science information," and

- "Inform decisions through the application of science: Stakeholders reporting that information helped achieve goal."

Because of the cost-sharing requirements in the program's authorizing legislation, it is likely that State and local partners will withdraw funding of about $2 million, resulting in a real decrease to the program of $4 million. This loss of State and local partner funding will also result in an additional loss of -18 FTE, making the total FTE decrease for this program -36.

Program Performance Change Table

Total Performance Change		***-10 systematic analyses and investigations delivered to customers***			
	A	***B***	***C***	***D= B+C***	***E***
	Overall Performance Changes from 2006 to 2007				
Measure	**2006 Enacted Performance**	**2007 Base Performance Level**	**2007 Impact of Program Change on Performance**	**2007 Budget Request Performance**	**Out-year Impact of 2007 Program Change on Performance**
Systematic analyses and investigations delivered to customers	**138**	**136**	**-10**	**126**	**0**

Column B: The performance level expected to be achieved absent the program change (i.e., at the 2006 request level plus/minus funded fixed cost/related changes); this would reflect, for example, the impact of prior year funding changes, management efficiencies, absorption of fixed costs, and trend impacts.

Column E: The out-year impact is the change in performance level expected in 2008 and Beyond of ONLY the requested program budget change; it does <u>not</u> include the impact of receiving these funds again in a subsequent outyear.

Program Overview

The FY 2007 budget request for the Coop Program is $62,171,000.

As the primary Federal science agency for water-resource information, the USGS monitors the quantity and quality of water in the Nation's rivers and aquifers, assesses the sources and fate of contaminants in aquatic systems, develops tools to improve the application of hydrologic information, and ensures that its information and tools are available to all potential users. This broad, diverse mission cannot be accomplished effectively without the contributions of the Coop Program. For more than 100 years, the Coop Program has been a highly successful cost-sharing partnership between the USGS and water-resource agencies at the State, local, and tribal levels. Throughout its history, the program has made important contributions to meeting USGS mission requirements, developing meaningful partnerships, sharing Federal and non-Federal financial resources, and keeping the agency focused on everyday challenges facing water users across the country. The Coop Program has been highly successful because it:

- Combines Federal and non-Federal resources in addressing many of the Nation's most pressing water resource issues, resulting in great cost savings to both the Federal Government and the States,

- Conducts studies across the country in each of the 50 States, Puerto Rico, and U.S. Trust Territories, allowing the USGS to form a national picture of important water-resources issues and potential solutions,

- Uses standardized methods of data collection and analysis across the country, so that information and results of studies are comparable from one State to another, and so that knowledge gained from one study contributes significantly to understanding the hydrology in other parts of the country,

- Helps resolve inter-jurisdictional disputes by assessing conditions at State boundaries and by assuring all parties that the data and results of investigations are objective and are equally available to all parties, and

- Combines the utilization of USGS offices within the State with the much larger national infrastructure of the USGS. This infrastructure includes the National Water Quality Laboratory, the National Water Information System, the National Research Program (which provides new methods and consultation on difficult scientific issues), instrumentation testing facilities, and a national system of quality assurance.

The Coop Program is broken into three major components:

Data Collection Activities

(Estimates for FY 2005, $31.2 million; FY 2006, $31.4 million; FY 2007, $32.1 million)

Cooperatively funded hydrologic data collection activities are underway in every State, Guam, Puerto Rico, and the U.S. Virgin Islands. Over the past few years, the Coop Program has provided sole support or partial support for well over half of the sites where the USGS collects data on surface-water levels and flow, ground-water levels, and ground-water quality. In addition, the Coop Program supports collection of data on surface-water quality, which is becoming increasingly important to the States as they monitor total maximum daily loads (TMDLs), to comply with the requirements of the Clean Water Act.

All these data provide resource managers with the information they need to determine the suitability of water for various uses, identify trends in water quality, and evaluate the effects of various stresses on the Nation's ground water and surface water resources. Much of the data collected at USGS monitoring sites is provided free of charge on the Internet. This includes historical data, as well as real-time data, which are generally less than 4 hours old. The real-time data are used routinely by emergency management agencies, State and municipal agencies, businesses, irrigators, and recreational boaters and fishers.

In addition to providing information responsive to State or local needs, the Coop Program provides information that satisfies the needs of many Federal agencies. Some of these needs are:

- Forecasting floods,
- Managing surface-water supplies,
- Monitoring hydroelectric power production,
- Setting waste disposal limitations,
- Regulating industrial discharges,
- Designing highway structures,
- Measuring the downstream transport of pollutants or nutrients,
- Determining total maximum daily loads,
- Evaluating mine permits,
- Planning and evaluating land reclamation,
- Evaluating fish habitat,
- Quantifying Indian water rights, and
- Quantifying Federal reserved water rights.

Most of the USGS data collection stations serve multiple purposes and many are funded, wholly or in part, through joint-funding agreements. Normally, these stations, though funded by various organizations, are operated as part of an integrated network rather than as stand-alone entities. For this reason, cooperating organizations are billed on the basis of average station cost, rather than actual cost, which rarely can be precisely known. This procedure benefits these organizations and the USGS in at least two ways: administrative costs are reduced because financial transactions are simplified, and definitive cost information is available to all parties for planning purposes at the beginning of the fiscal year. This arrangement also assures that data collection in remote areas or areas which may be otherwise problematic (due to vandals, extreme flooding, lightning strikes) during a given period of time do not become so expensive that they must be dropped from the network.

Interpretive Studies

(Estimates for FY 2005, $24.9 million; FY 2006, $25.1 million; FY 2007, $23.7 million)

In addition to data collection activities, the Coop Program supports about 750 hydrologic studies each year. Water resource studies define, characterize, and evaluate the extent, quality, and availability of water resources. The results of these investigations are published and provided to State agencies, which use them as the basis for managing the water resources for which they are responsible. Also, these investigations provide information that can be synthesized and applied to a variety of hydrogeologic and climatic settings across the Nation, greatly expanding the usefulness and transferability of USGS study results nationwide.

Technical Support

(Estimates for FY 2005, $6.2 million; FY 2006, $6.3 million; FY 2007, $6.4 million)

The USGS has a long tradition of providing national and regional technical support for its geographically distributed water resources studies. This support provides quality control to assure the technical excellence of water resources field programs and provides a structured way of transferring new technology to USGS investigative and data activities that are primarily conducted in Water Science Centers in each State. Technical support also includes a formal way of establishing priorities for water resources research by the USGS and provides a mechanism to make water resources information available to other agencies, the scientific community, and the public.

In July 2005, Congress modified, clarified, and finalized report language that has a significant impact on the Coop Program. Accordingly the Program's 5-Year Plan will be updated and reviewed to conform to the new outline, format, and internal/external team approach.

FY 2007 Program Performance Estimates

The planned program activities listed below demonstrate the utility of USGS products that are counted under the "systematic analyses and investigations delivered to customers" output measure. The Program also contributes to the intermediate outcome measure "content and expanse of knowledge base" through its support for the national streamgaging network; however, accomplishments associated with the streamgaging network are shown in the write-up for the NSIP.

Interpretive Studies

High-Priority Issues for Coop Program Involvement — In consultation with local and regional managers, external cooperators, and the interagency Advisory Committee on Water Information, the USGS has identified seven water-related issues for FY 2006 and 2007 that closely align with USGS mission goals that most require USGS involvement at State and local levels. Issues emphasized include: hydrologic hazards; water quality; hydrologic data networks; water availability and use; wetlands, lakes, reservoirs, and estuaries; water resources issues in the coastal zone; and environmental effects on human health. Studies in these areas will be conducted in FY 2007; specific study locations and topics will be determined in consultation with the program's 1,400 State, local, municipal, and tribal cooperators.

National Synthesis — One of the major strengths of Coop Program is its ability to provide data and assessments on varied topics from across the country, which, when synthesized, can be useful in addressing broad, national mission goals. As recommended by the External Task Force that reviewed the Coop Program, the USGS plans to expand these efforts in FY 2007 by pre-planning selected synthesis products. The memorandum describes four topics for possible future national synthesis over the next few years. USGS State Water Science Centers are encouraged to explore the needs of cooperating agencies for addressing these issues and, to the extent that is mutually agreeable, follow the guidance that will be provided by the contact for each synthesis topic. Including this guidance in project planning will help enhance the capabilities of each State Water Science Center, promote the use of valid, standard approaches, and enhance future synthesis products. The topics for National Synthesis are:

- **Recharge to Ground-Water Systems —** Recharge is one of the most important components of water budgets, yet estimating recharge accurately remains problematic, requiring a variety of techniques in different parts of the country and at different scales. Enhancing our ability to evaluate different techniques in various settings would enable us to provide better guidance on matching the appropriate technique to a specific need for recharge information.

- **Fluvial Sediment —** The EPA has declared fluvial sediment the most prevalent impairment to the Nation's surface waters; as such, sediment is playing a major role in river restoration efforts and TMDL evaluations. The USGS Offices of Water Quality and Surface Water and the National Research Program continue their collaboration to identify methods, tools, and capabilities for sediment data collection and analysis that the USGS can bring to bear in support of stream restoration and TMDL projects. A variety of new technologies are creating opportunities for producing more accurate and more efficient estimates of sediment flux.

- **Changes in Flood Frequency —** Many urban areas are concerned about changes in flood frequencies resulting from land use changes, and the FEMA recently issued revised regulations for its flood insurance rate maps. For example, under the new regulations, communities may now include a delineation of the floodplain based on anticipated future conditions.

- **Synthesis of Water Quality Information —** As the NAWQA program begins a redesign of its surface-water quality data network, there are opportunities to combine water-quality data from networks established in the Coop Program with NAWQA data to develop a more integrated approach to water-quality monitoring nationwide within the USGS. Ground-water data could also be included in such a comprehensive nationwide

approach. The information from integrated monitoring networks could be used to more fully answer important questions about the Nation's water quality and trends.

- **Determination of Water Needs for Ecological Functions —** Several valuable collaborations of hydrologists and biologists have arisen in the Coop Program in recent years to help determine water needs to support healthy ecosystems. These studies pertain to both ground water and surface water, and sometimes to interconnected systems of both. Products of this work include data, research results, and tools such as models that can provide a scientific basis for critical decisions on allocation or reallocation of precious water resources. As this issue takes on greater importance nationally, the USGS will seek opportunities to synthesize geographically varied examples into a national summary.

FY 2006 Planned Program Performance

The planned program activities listed below demonstrate the utility of USGS products that are counted under the "systematic analyses and investigations delivered to customers" output measure. The Program also contributes to the intermediate outcome measure "content and expanse of knowledge base" through its support for the national streamgaging network; however, accomplishments associated with the streamgaging network are shown in the write-up for the NSIP.

Assessing Firm Yield for Drinking-Water Supply Reservoirs in Massachusetts — Three reports will comprise the results from 2005: one was published in 2005 and two will be published in 2006. Proposed work in 2007 includes additional modifications to the model that will incorporate uncertainty into estimates of firm yield, improve the calculation of the ground-water contribution to reservoir storage, and further validate the model results with observational data. The effects of drought, environmental flow requirements, and demand management on firm yield will also be evaluated. A user manual, release of the final compiled model, and an additional report are planned for 2009.

National Stakeholder Roundtable

The Second National Stakeholder Roundtable for the USGS Cooperative Water Program will be held in February 2006 in Austin, TX, convened by the Interstate Council on Water Policy (ICWP) in cooperation with other organizations.

Since the first Roundtable in March 2005, a coalition of organizations has continued discussions regarding the future of the program (for examples, see *http://www.icwp.org*).

Like the first meeting, this will be an opportunity for cooperators, data users, and others to hear the latest about the status of the program and to air their concerns and suggestions regarding the program to an audience that includes senior USGS leaders, as well as many other cooperators. At the meeting, the External Task Force to review the program will present their final report, along with the response from the USGS to the Task Force suggestions.

Barton Springs Ground-Water Characterization Project, Texas — The USGS investigation in this area is improving the resolution of water quality data for the Barton Springs portion of the Edwards Aquifer, and the USGS will interpret the data to expand the general understanding of the aquifer's response to natural and human-caused phenomena. Using stream discharge, spring discharge, and chemical data obtained in 2005 and 2006, USGS scientists will estimate quantitative balances of water, ions, and contaminants in the aquifer. The balances will be used to evaluate to what extent the water balance has changed since 1986 as a result of urbanization, where loading of different contaminants is occurring, and to what extent contaminants are being stored or attenuated within the aquifer. In 2006 the USGS will produce a Scientific Investigations Report, submit 1–3 articles for publication in journals such as the

Journal of Contaminant Hydrology, and present results of the project at several additional scientific and government meetings, including the Geological Society of America.

Coastal Georgia Sound Science Initiative — During FY 2006 final reports describing development of solute transport models for the Savannah-Hilton Head Island and Brunswick areas will be completed, together with a summary report describing results of model simulations of future water-management scenarios.

MTBE Contamination Involves Deep Public-Supply Wells in Southeast New Hampshire — Study results appeared in the January 2005 issue of Environmental Science and Technology. A follow-up study, underway in FY 2006, is assessing the occurrence of MTBE in 700 public and private wells statewide. Results of these studies are being used in a statewide program to assess risk of MTBE contamination in public wells and by the State Attorney General to support claims against 22 oil companies for damages to public water supplies in the State.

Evaluation of Streamflow Requirements for habitat Protection in Southern New England — In 2004, the USGS published a Water-Resources Investigations Report that evaluated streamflow requirements for habitat protection and assessed fish community composition near selected index streamgaging stations. A similar report will be published in FY 2006 that will use streamflow records from additional index stations to classify streams with different basin characteristics and in different regions of southern New England.

Ground-Water Ambient Monitoring and Assessment in California — During FY 2005 sampling was completed in 7 study units, and a report and fact sheet were published. Plans for FY 2006 include continued sampling, and publishing one or two additional reports.

Implementing a System for "Nowcasting" Bacteria Levels and Beach Advisories, Lake Erie, Ohio — Beach advisories and closings are made on the basis of measured concentrations of *Escherichia coli (E. coli)*. Beach managers, EPA, and the research community have long recognized that reliance on *E. coli* is often inadequate because concentrations of *E. coli* may change drastically between the time of sampling and reporting of results (18–24 hours). Statistical models can provide beach managers with a tool for more accurate and timely assessments of beach-water quality than the currently used methods. A statistical model typically uses easily and quickly measured surrogates, such as wave height and rainfall, to estimate *E. coli* concentrations or the probability of exceeding target concentrations and thus predict recreational water quality. Statistical models are being refined or developed for five Lake Erie beaches in Ohio by the USGS. In cooperation with the Cuyahoga County Board of Health, Cleveland Metroparks, and the Ohio Lake Erie Office, the USGS is testing the model from Huntington Beach to determine whether it is suitable as the basis for an Internet-based "nowcast" system to inform beachgoers of the current water quality on the beaches. Data collected to test and run the Huntington model include measurements of rainfall, turbidity, and wave heights, as well as measurements of *E. coli* concentrations in water. Final results will be presented in a journal article describing the development of models at Huntington and other beaches, and results of model verification at Huntington.

FY 2005 Program Performance Accomplishments

In FY 2005, more than 1,400 State, regional, local, and municipal agencies, and Native American Tribes participated in the Coop Program. These cooperators matched the $62,337,000 appropriated to the USGS, and contributed an additional $83,937,000, for total program funding of $208,611,000. The program accomplishments listed below demonstrate the

utility of USGS products that are counted under the "systematic analyses and investigations delivered to customers" output measure. The Program also contributes to the intermediate outcome measure "content and expanse of knowledge base" through its support for the national streamgaging network; however, accomplishments associated with the streamgaging network are shown in the write-up for the NSIP.

Assessing Firm Yield for Drinking-water Supply Reservoirs in Massachusetts — Growing demands on drinking-water supplies in Massachusetts have increased the likelihood that withdrawals could deplete available storage capacity in surface-water reservoirs, resulting in supply shortfalls. As demands increase, water suppliers and regulators have recognized the need to establish upper limits on the amount of water a reservoir can consistently supply, particularly if the reservoir were to experience a period of severe drought. This upper limit on reservoir yield is the "firm yield." To evaluate and manage current and future demands on drinking-water supply reservoirs in Massachusetts, the USGS, in cooperation with the Massachusetts Department of Environmental Protection and local drinking-water suppliers, has developed a model using a relational database and a convenient user interface that estimates this firm yield. In 2005, firm yields were calculated for 47 streamflow-dominated reservoirs representing 15 Massachusetts drinking-water supplies, and a full evaluation of the methodology to estimate firm yield was completed. Detailed firm-yield estimates were completed for reservoirs in the Ipswich River Basin. Also in 2005, the applicability of the model was expanded to include drinking-water-supply reservoirs that receive water from both surface-water and ground-water sources. Inclusion of the ground-water contribution to reservoir storage resulted in increased firm yields for all reservoirs whose shorelines were in contact with aquifer sediments. Three reports will comprise the results from 2005: one was published in 2005 and two will be published in 2006.

Coastal Georgia Sound Science Initiative — Rapid population growth, increased tourism, and sustained industrial activity have adversely affected coastal Georgia's water resources and limited the available water supply. Pumpage from the productive Upper Floridan limestone aquifer has resulted in several problems including substantial water-level declines, saltwater intrusion, and decreased ground-water inflow to springs, freshwater ponds, marshes, and wetlands, which could impact the balance of freshwater and saltwater in tidal rivers and estuaries. In FY 2005, the USGS completed calibration of ground-water flow and solute transport models, which were used to evaluate future water management scenarios for the coastal region of Georgia and South Carolina. Seven Scientific Investigations Reports describing results of offshore drilling, deep onshore drilling, ground-water flow model results, stream-aquifer interaction, impacts of a major industrial shutdown on ground-water conditions, hydraulic properties of the Floridan aquifer system, and the water-resources potential of dug seepage ponds were completed and distributed to customers. The Georgia Environmental Protection Division is using the results to formulate the final strategy for the coastal region, which is scheduled for January 2006.

Barton Springs Ground-water Characterization Project, Texas — The Barton Springs segment of the Edwards Aquifer, a karst ground-water system located in southern Travis and northern Hays counties, provides vital water resources to the

USGS Scientist Recognized in Texas

Dr. Barbara Mahler, USGS Research Hydrologist in Austin, TX, was selected by the Barton Springs/Edwards Aquifer Conservation District as the recipient of their 2005 Research Conservation Award. Dr. Mahler serves as project chief for the Barton Springs Ground-water Characterization Project. This award honors efforts that lead to improved understanding or advanced practices in areas such as groundwater, hydrogeology, water treatment, alternative water supplies, well drilling, or structural and non-structural best management practices to reduce erosion and non-point source pollution.

Baseline water quality and flow monitoring conducted during 2005 completed a full hydrologic year cycle of water-quality sampling. In addition, the USGS intensively sampled water quality over two storm events when the system was reacting rapidly to infiltrating surface water. Initial interpretation of results suggests that transport of manmade contaminants through the aquifer in response to storms is rapid, with peak concentrations arriving at the spring in less than 2 days. A potentially important new result is that the pesticide fipronil, which was recently placed on the market and whose use is increasing, has now been detected at low concentrations in the springs. Another is that detections of diazinon, sale of which was restricted December 2004, have greatly decreased. Statistical analysis of data indicates that there are four principal sources of water to the aquifer, the proportion of which changes as a function of climatic conditions. Preliminary results were presented to the Texas Department of Agriculture.

Characterization of Natural Flow Regimes for Rivers in Southern New England — Widespread development and associated increases in water withdrawals, streamflow regulation, runoff from impervious surfaces, and wastewater return flows have altered streamflows in many river systems in Massachusetts. Current strategies for managing or restoring ecological integrity in river systems require maintenance of streamflows within a natural pattern of flow variability. Streamflow records from active and discontinued stations on streams with minimal flow alterations are being used to characterize the natural flow regimes of streams in southern New England. In 2004, the USGS published a Water-Resources Investigations Report that evaluated streamflow requirements for habitat protection for riffle habitats and assessed fish community composition near selected index streamgaging stations. Streamflow requirements were compared to streamflow statistics describing the natural flow regime and streamflow variability for the index stations. Work completed in FY 2005 will support publication of a similar report in FY 2006 that will use streamflow records from additional index stations to classify streams with different basin characteristics and in different regions of southern New England.

Methyl-tert-Butyl Ether (MTBE) Contamination of Ground Water in New Hampshire — In New Hampshire, nearly half of the population is served by drinking water from public and private bedrock wells. In 2003, the USGS conducted a study of the occurrence of MTBE in public and private water-supply wells in Rockingham County, with the New Hampshire Department of Environmental Services. Study results appeared in the January 2005 issue of *Environmental Science and Technology.* A follow-up study, underway in FY 2006, is assessing the occurrence of MTBE in 700 public and private wells statewide. Preliminary results indicate that contamination rates are generally lower in the rest of the State than in Rockingham County, where RFG use in mandated. However, other non-RFG counties may have increased levels of MTBE contamination due their proximity to locations where RFG is sold. Results of these studies are being used in a statewide program to assess risk of MTBE contamination in public wells and by the State Attorney General to support claims against 22 oil companies for damages to public water supplies in the State.

Ground-Water Ambient Monitoring and Assessment (GAMA) in California — In response to a need for consistent statewide data on the quality of ground-water in California, the USGS has teamed up with State and Regional Water Boards, Department of Water Resources, Department of Health Services, Lawrence Livermore National Laboratory, regional water management entities, and county and local water agencies to improve statewide ground-water monitoring and facilitate the availability of information about groundwater quality to the public. A

key aspect of GAMA is interagency collaboration and cooperation with local water agencies and well owners. The data collected during the study include analyses for chemical constituents that are not normally available; these data will be especially useful for providing an early indication of potential water-quality problems. The data also will be used to identify the natural and human factors affecting ground-water quality. An understanding of these factors is important for the long term management and protection of California's ground-water resources. To organize the assessment, the 476 ground-water basins in the State were ranked by priority, and 116 high-priority basins were selected for monitoring, and were combined into 35 study units. These units represent more than 75 percent of the public-supply wells in California. In each unit, 60–120 public-supply wells will be sampled. Three types of water-quality assessments will be conducted for each study unit: (1) Status: the assessment of current ground-water quality; (2) Trends: the detection of changes in water quality; and (3) Understanding: the assessment of natural and human factors that affect ground-water quality. During FY 2005 sampling was completed in 7 study units, and a report (*http://water.usgs.gov/pubs/wri/wri034166/*) and a fact sheet (*http://water.usgs.gov/pubs/fs/2004/3088/*) were published.

Performance Overview

The Coop Program addresses the Department's Serving Communities strategic goal of advancing knowledge through scientific leadership and informing decisions through the application of science. There are no performance measures that can be tied exclusively to the Coop Program; however, in conjunction with the NSIP, Hydrologic Networks and Analysis, and an array of reimbursable projects funded by 800 partner agencies, the Coop Program contributes to all the measures listed below. In addition, the Coop Program contributes to the output measures for "number of real-time streamgages reporting in NWISWeb," "number of ground-water sites reporting in NWISWeb," and "number of water-quality sites reporting in NWISWeb." Newly established (FY 2005) PART measures also rely on the Coop Program, including those listed in the table below.

Measure	2005 Plan	2005 Actual	Change from 2005 Plan	2006 Enacted	2006 Change from 2005 Actual	2007 Request	2007 Change from 2006
SIM.2.1.01 content and expanse of knowledge base (% of proposed streamflow sites currently in operation that meet one or more Federal needs) **(PART) (SP)**	63%	61%	-2%	62%	+1%	62%	0%
# real-time streamgages reporting in NWISWeb	5,187	6,246	+1,059	6,165	-81	6,195	+30
% of WRD streamflow stations with 30 or more years of record **(PART)**	61%	58%	-3%	62%	+4%	63%	+1%
% of U.S. with ground water quality status and trends information to support resource management decisions **(PART)**	39%	39%	0%	45%	+6%	51%	+6%
% of U.S. with ground water availability status and trends information to support resource management decisions **(PART)**	7%	7%	0	8%	+1%	7%	-1%

Measure	2005 Plan	2005 Actual	Change from 2005 Plan	2006 Enacted	2006 Change from 2005 Actual	2007 Request	2007 Change from 2006
% of States with Web-based streamflow statistics tools to support water management decisions **(PART)**	11%	10% b/	-1%	18%	+8%	20%	+2%

This page intentionally left blank.

Activity: Water Resources Investigations

Subactivity: Water Resources Research Act Program

Subactivity	2005 Actual	2006 Enacted	2007 Fixed Cost & Related Changes	2007 Program Changes	2007 Budget Request	Change from 2006
Water Resources Research Act Program	6,409	6,404	0	-6,404	0	-6,404
Total Requirements $000	**6,409**	**6,404**	**0**	**-6,404**	**0**	**-6,404**
FTE	***2***	***2***	***0***	***-2***	***0***	***-2***

Summary of FY 2007 Program Changes for Water Resources Research Act Program

Request Component	Amount	FTE
Program Changes		
• Grants to State Water Research Institutes and associated program administration activities	-6,404	-2
TOTAL	**-6,404**	**-2**

Justification of FY 2007 Program Changes

The 2007 request for the Water Resources Research Act Program is $0 and 0 FTE, which is a program change of -$6,404,000 and -2 FTE.

Grants to the State Water Resources Research Institutes (-$6,404,000 and -2 FTE) — The proposed reduction eliminates USGS funding for each of the 54 State Water Resources Research Institutes. The reduction also eliminates USGS support for research projects under the national competitive grant program authorized by section 104(g) of the Water Resources Research Act. This USGS support amounts to less than 6 percent of their total funding. Most of the Institutes have been very successful in generating funding from non-USGS sources and no longer need USGS funding to continue operating.

Program Performance Change — Though the program contributes to the strategic goals of advancing knowledge in the hydrologic sciences, there are no performance measures specifically linked to this program change.

Program Overview

Section 104 of the Water Resources Research Act of 1984 (P.L. 98–242), as amended by P.L. 101–397, P.L. 104–147, and P.L. 106–374, establishes 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 currently 54 Institutes: one in each State, the District of Columbia, Puerto Rico, the Virgin Islands, and Guam, which also serves the Federated States of Micronesia and the Commonwealth of the Northern Mariana Islands.

This Program addresses the Department's Serving Communities strategic goal of advancing knowledge through scientific leadership and informing decisions through the application of science. A key indication of USGS performance in administering this Program is reflected in the end outcome measure for research: soundness of methodology, accuracy, and reliability of science (most of the research proposals are funded only after a competitive, peer review, selection process). Although the Water Resources Research Act does not give the USGS either the authority or the resources to peer review every project funded by this Program at the participating universities, review of these projects is conducted as part of each Institute's own peer review process. The Act requires each Institute to have a State advisory panel to recommend research priorities for the Institute, thus ensuring the relevance of its research. For the competitive grants, the USGS receives many more proposals each year than budget levels can support, so the proposals receive rigorous peer review before any funds are awarded. In addition, the Institutes are evaluated on a 5-year cycle, to determine their eligibility to continue receiving grants under the Program. One such evaluation occurred during FY 2004.

The Water Resources Research Act Program provides an institutional mechanism for promoting State, regional, and national coordination of water resources research and training and a network of Institutes to facilitate research coordination and information and technology transfer. With its matching requirements, it is also a key mechanism for promoting State investments in such research and training. In fact, the Institutes have developed a constituency and a Program that far exceeds that supported by their direct Federal appropriation. According to the results of a 2005 survey conducted by the National Institutes for Water Resources, in FY 2005, the Institutes collectively generated an additional $19 in support for each dollar appropriated to them under the USGS Program, with $10 coming from other Federal sources and $9 coming from non-Federal sources.

Each Institute operates a program of multi-year research, education, and information transfer projects focused on State and regional water resource priorities. In FY 2005, total Institute funding from all sources (USGS grant, plus 2:1 non-Federal matching funds, plus other sources of funding) supported more than 1,100 research projects involving researchers from at least 142 universities and colleges nationwide. Though the emphasis varies across the Nation, depending upon State and regional priorities, the most common topics were concerned with control of non-point source pollutants, understanding the fate and transport of chemical, biological, and microbial contaminants, and the impact of land use changes and Best Management Practices on water quality. The Institutes collaborated with over 500 Federal, State, and local agency offices and private sector organizations.

The 5-Year Plan for this program is being updated and reviewed to conform to the new outline, format, and internal/external team approach. The goal is for completion by the end of the third quarter in FY 2006.

FY 2006 Planned Program Performance

Grants will be awarded to the 54 State Water Resources Research Institutes. Research project abstracts and completion reports will be placed on the Internet at:

http://water.usgs.gov/wrri/projects.html, along with descriptions of the projects funded. It is expected that in FY 2006, the Institutes will support over 230 research and information transfer projects with their USGS grants. The programmatic priorities of the individual Institutes are developed in consultation with their State Advisory Committees and the individual research projects are selected through standard peer review and selection processes.

Under the National Competitive Grant Program, research proposals will be solicited on the topic of water availability. Proposals will be subjected to a competitive peer review and selection process with the assistance of a lead Institute. It is expected that about 60 proposals will be received and that about 10 matching grants will be awarded with the approximately $1 million available.

FY 2005 Program Performance Accomplishments

In FY 2005, the Institutes used their USGS grant and the required matching funds to support 234 research and information transfer projects.

The Institute Program is a primary source of training for water scientists and engineers. In FY 2005, more than 1,300 students received training by participation in Institute-supported research and information transfer projects. More than 600 of these students were supported by the USGS grants and matching funds. Students trained under this Program provide the talent needed to meet the mandates of the many new programs for water resources protection that have come into existence in recent years and to support the water management initiatives of Federal, State, and local agencies.

The Institutes make the results of their research available through workshops, conferences, seminars, publications, and communication with State and local agencies. Each year, the Institutes publish about 1,000 reports, nearly one-fourth of which are in refereed scientific journals. Also in FY 2005, the Institutes conducted over 270 conferences, seminars, and workshops for more than 14,000 participants. In addition, all of the Institutes maintain an Internet site through which they keep the public informed of their activities.

Selected accomplishments of the Institutes during FY 2005 follow:

Water Supply and Management — The Water Resources Research Institute of the University of North Carolina has developed a water supply management model that could reduce the cost of water supply to a 15-county region of North Carolina, where the State has imposed ground-water pumping restrictions. The model uses a regional approach to conjunctive ground-water and surface-water management, balancing the economies of scale of larger water supply treatment facilities, the diseconomies of scale of larger distribution systems, differing individual community water supply costs, and the use and cost of tradable ground-water pumping permits. The model indicates that the estimated $100 million of capital costs that would be incurred if each community in the region acted alone could be reduced by 40 percent through a regional approach using surface water systems and tradable ground-water pumping permits.

Training for Industry and Utilities — The Montana Water Center, in collaboration with the U.S. Environmental Protection Agency, developed three interactive training courses for the operators of small drinking water and wastewater systems. The courses, which can be run from the Internet or a CD-ROM, include more than 20 hours of training and are augmented with tests, math tutorials, and resource contacts for operators in every State. First-time operators can use these materials to train for certification exams, and working operators can use them to earn

continuing education credits. The course is very popular, with over 20,000 CD-ROMs distributed nationwide to date.

Training for Erosion and Sediment Control — The Tennessee Water Resources Research Center (TNWRRC), working with the Tennessee Department of Environment and Conservation and the Tennessee Department of Transportation, has developed a training program for planning, installation, and maintenance of erosion prevention and sediment controls at construction sites. Over the 4-year period, the TNWRRC has taken the lead in coordinating and conducting two levels of erosion prevention and sediment control training courses throughout the State and in developing the Tennessee Sediment and Erosion Control Handbook. To date, 4,445 people have been certified by examination for the Level 1 Fundamentals course presented at 77 different times and locations. Over 828 engineers and other professionals have taken the Level 2 design course and earned 11,592 professional development credit hours at 22 places and times. Details of both courses and associated activities for Tennessee's Erosion Prevention and Sediment Control Training and Certification Program for Construction Sites can be viewed on the Web at *http://www.tnepsc.org/.*

Stopping Salt Water Intrusion — The University of California Center for Water Resources developed a state-of-the-art ground-water model that simulates the complexity of ground-water flow and solute transport to evaluate alternative strategies for managing seawater intrusion barriers in the Southern California coastal plain. Three major barriers have been installed along the shoreline of Los Angeles to protect a 20 million acre-foot aquifer that provides 35 percent of the potable water supply for 3.2 million residents in the metropolitan area. The Los Angeles County Department of Public Works, in collaboration with the University's Center for Water Resources, will use the model to determine management strategies for the existing barriers, to identify sites for additional barriers, and to evaluate the cost-effectiveness of alternative strategies for addressing seawater intrusion.

Performance Overview

Though the program contributes to the strategic goals of advancing knowledge in the hydrologic sciences, there are no performance measures specifically linked to this program change.

Biological Research

Subactivity	2005 Actual	2006 Enacted	2007 Fixed Cost & Related Changes [a/]	2007 Program Changes	2007 Budget Request	Change from 2006
Biological Research and Monitoring	133,130	140,086	+2,036	-6,430	135,692	-4,394
FTE	*1,042*	*1,051*	*0*	*-12*	*1,039*	*-12*
Biological Information Management and Delivery	23,999	23,794	+173	-2,000	21,967	-1,827
FTE	*80*	*80*	*0*	*-7*	*73*	*-7*
Cooperative Research Units	14,570	14,664	+274	0	14,938	+274
FTE	*126*	*126*	*0*	*0*	*126*	*0*
Total Requirements $000	**171,699**	**178,544**	**+2,483**	**-8,430**	**172,597**	**-5,947**
FTE	***1,248***	***1,257***	***0***	***-19***	***1,238***	***-19***

[a/] Fixed cost increases for this activity total $3,547, of which $2,483 will be budgeted and $1,064 will be absorbed.

Activity Summary

The 2007 budget request for the Biological Research is $172,597,000 and 1,238 FTE, which is a net change of -$5,947,000 and -19 FTE from the 2006 enacted level. Additional information on program changes is provided in each subactivity section of this document.

The U.S. Geological Survey (USGS) Biological Research Activity generates and distributes information needed in the conservation and management of the Nation's biological resources. This program serves as the Department of the Interior's biological research arm and continues the strong traditions for management-oriented research developed within the Department's land management bureaus. Core biological research capability at 17 research centers and associated field stations, one technology center, and 40 Cooperative Research Units supports research on fish, wildlife, and habitats that is used by Federal and State government and nongovernmental organizations.

Use of Cost and Performance Information

Using Customer Input in Planning at the Southwest Biological Science Center (SBSC):

The SBSC is the newest of 18 biological science centers in the USGS and was created in 2002 to meet the need for a central point of contact for natural resource agencies struggling to obtain scientific information in the Southwestern United States. Achieving its mission requires feedback from stakeholders on their research needs, and the effectiveness and timeliness of USGS science products. The responses to the survey were utilized in the development of the SBSC Strategic Plan and Workforce Plan.

The USGS works closely with its partners and customers in defining priorities, developing science plans, and carrying out its biological research to support the needs of research management organizations. This focus on knowing and meeting partners' needs, establishing a goal for

partner satisfaction, and measuring performance toward reaching that goal has improved the quality of USGS products and services.

A list of science centers and field stations appears at the end of the discussion of the information subactivity. A list of cooperative research units appears in the discussion of that subactivity.

This program addresses the Department's Resource Protection strategic goal of improving the health of watersheds, landscapes, and marine resources; sustaining biological communities; and protecting lives, resources and property. This program also addresses the Department's Serving Communities strategic goal of advancing knowledge through scientific leadership and informing decisions through the applications of science.

USGS biologists work toward program goals in collaboration with other scientists, customers, and partners. Biologists combine their expertise with that of the other USGS disciplines in interagency ecosystem initiatives across the United States, from South Florida to the Pacific Northwest, where scientists are working together to understand, evaluate, and provide options for restoring fish and wildlife habitats and for better resource-management decisions.

Information generated by the Biological Research program also contributes to achieving improved management of the Nation's water resources, availability of maps and map data, and improved decisionmaking regarding land and water use. These goals are supported by the efforts conducted in three subactivities: Research and Monitoring, Information Management and Delivery, and Cooperative Research Units.

Congressional Directives

The FY 2006 Appropriations Act for the Department of the Interior and Related Agencies included the following directive for the USGS research program:

> "The managers understand that the multidisciplinary water study at Leetown Science Center is nearing completion. The Survey should provide a brief report to the House and Senate Committees on Appropriations by December 31, 2005, evaluating the research that has been conducted to date and outlining what, if any, issues remain to be addressed in order to finish the project."

To date, the report is undergoing review within the Department of the Interior.

Program Assessment Rating Tool (PART)

In FY 2005, for the FY 2007 budget, the OMB reviewed the Biological Research and Monitoring (BRM) program for the FY 2007 budget process found the program to be working effectively with partners and fulfilling its mission and rated the program moderately effective. New performance measures resulting from the PART are incorporated into the performance tables beginning on page J-31.

The following are comments from OMB:

- The program has met program goals. For example, 96 percent of customers are satisfied with usefulness of scientific and technical products.

- BRM has made progress coordinating research, but could take steps to improve accessibility of research and monitoring products. While BRM works collaboratively with other organizations, more formal coordination is lacking with the Biological Information Management and Delivery program and other Interior bureaus.
- BRM program reviews have not been adequate. While the program uses various methods for reviews, they have been by research area rather than biology-wide, and were not regularly implemented, or sufficiently independent.

The following recommendations were provided to improve the performance of the program:

- Developing a plan with the Biological Information program to maximize access to research and data and provide timely reports on the status and trends of the Nation's biological resources.
- Implementing regular, comprehensive, and independent reviews for all biological research, monitoring and information management activities.
- Developing performance measures with the U.S. Fish and Wildlife Service to improve coordination for conservation of fish and wildlife populations of management concern.

The USGS will draft an improvement plan over the coming months in collaboration with OMB to begin addressing these recommendations.

In FY 2005, for the FY 2007 budget, the OMB reviewed the Biological Information Management and Delivery Program (BIMD) program and found it to be working effectively with partners and fulfilling its mission. As a result, the BIMD was rated moderately effective. New performance measures resulting from the PART are shown in the performance tables beginning on page J-43.

The following are comments from OMB:

- BIMD has met past performance goals and developed new measures which are outcome oriented, and more clearly focused on improving access to information which is essential for conservation decisionmakers. For example, a measure was established to track development of conservation status maps that are needed to manage biological resources.
- The program has improved coordination across all program activities through development of a draft BIMD strategic plan. However, there needs to be more formal coordination with the Biological Research and Monitoring program.
- BIMD program reviews have not been adequate. While the program uses various methods for reviews, they have been by research area rather than biology-wide, and were not regularly implemented, or sufficiently independent.

The following recommendations were provided to improve the performance of the program:

- Developing a plan with Biological Research and Monitoring to maximize access to research and data and provide timely reports on the status and trends of the Nation's biological resources.

- Developing performance measures with the U.S. Fish and Wildlife Service to improve coordination for conservation of fish and wildlife populations of management concern.
- Implementing regular, comprehensive, and independent reviews for all biological research, monitoring and information management activities.

The USGS will draft an improvement plan over the coming months in collaboration with OMB to begin addressing these recommendations.

Workforce Planning

Continued success in providing the Nation with outstanding biological science depends on developing and maintaining a flexible, skilled workforce that can take advantage of science and business opportunities of the future. The Biological Resources discipline is currently reviewing occupations, along with retirement projections, to identify workforce gaps and future skill needs. From these data, this program will be able to assemble a comprehensive profile of its workforce and anticipate hiring needs as to meet future science needs of the USGS.

Subactivity Overview

Biological Research comprises of three subactivities:

Research and Monitoring — The USGS serves the biological research needs of Interior bureaus and others by providing scientific information through research, inventory, and monitoring investigations. Biological studies develop new methods and techniques to identify, observe, and manage fish and wildlife, including invasive species, and their habitats; inventory populations of animals, plants, and their habitats; and monitor changes in abundance, distribution, and health of biological resources through time. Interior land and resource managers use USGS biological science to maintain the health, diversity, and ecological balances of biological resources while meeting public needs, such as game harvests and the use of public lands and waters, all of which enable the managers to address the Department's strategic goals of improving the health of watersheds, landscapes, and marine resources; sustaining biological communities; and protecting lives, resources and property.

Use of Cost and Performance Information

Improving Administrative Services at the National Wildlife Health Center (NWHC):

The NWHC underwent an Administrative Review in April 2005. The survey results were helpful to the Administrative Review Panel for getting a sense of how the staff viewed the day-to-day operation of the Center. Two functions of the Center that the survey identified as needing attention included 1) timekeeping and 2) the travel authorization and voucher process. Based on the survey results, the panel gave special attention to these two functions and recommended specific changes which have been implemented by NWHC management.

USGS specialists also provide technical assistance to Interior bureaus and other customers in applying the information, methodologies, and tools developed by the USGS in addressing resource management problems. In a collaborative process, the USGS involves the users of scientific results by engaging them in the identification and prioritization of their information needs as research is planned. Interior bureaus and other customers and partners, where appropriate, are involved in an adaptive process to find solutions and develop new methods by testing research results in the field.

Information Management and Delivery — Science-based decisionmaking is a Department of the Interior priority, particularly as it pertains to the conservation, management, and use of the

Nation's natural resources. To facilitate this, the USGS is committed to making available the data and information that are critical to scientific discovery and application. Data sets, maps, and other information on products are vital to achieve this goal. This subactivity supports the Department's Serving Communities strategic goal of advancing knowledge through scientific leadership and informing decisions through the applications of science by increasing the quantity of biological information available by improving access to and interactions with biological data.

The USGS works in cooperation with many organizations across the country to provide critical information to partners, stakeholders, customers, and the general public. Through electronic infrastructures, 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.

Cooperative Research Units — This cooperative program allows government and nongovernmental entities with common interests and responsibilities for natural resource management to address biological resources issues collaboratively. Through this unique program, biologists from Federal and State governments and academia are able to work as a team and focus their expertise and creativity on the resolution of biological resources issues. This subactivity supports the Department's Resource Protection strategic goal of sustaining biological communities on Interior managed and influenced lands and waters by providing the natural-resource management community with scientific information and trained personnel to implement sound resource management to sustain biological communities.

Federal support of the Cooperative Research Units program is matched with State and university contributions of expertise, equipment, facilities, and project funding. Through university affiliations, Federal scientists train future natural resource professionals.

This page intentionally left blank.

Activity: Biological Research

Subactivity: Biological Research and Monitoring

Subactivity	2005 Actual	2006 Enacted	2007 Fixed Cost & Related Changes [a/]	2007 Program Changes	2007 Budget Request	Change from 2006
Biological Research and Monitoring	133,130	140,086	+2,036	-6,430	135,692	-4,394
Total Requirements $000	**133,130**	**140,086**	**+2,036**	**-6,430**	**135,692**	**-4,394**
FTE	***1,042***	***1,051***	***0***	***-12***	***1,039***	***-12***

[a/] Fixed cost increases for this subactivity total $2,910, of which $2,036 will be budgeted and $874 will be absorbed.

Summary of FY 2007 Program Changes for Biological Research and Monitoring

Request Component	Amount	FTE
Program Changes		
• Integrated Multi-Hazard Pilot Project - Wildfire Research	+300	+1
• NatureServe	+1,000	0
• Pacific Northwest Forest Program	-1,000	-6
• Biological Assistance to the National Water-Quality Assessment Program (NAWQA)	-594	-4
• Wildlife, Terrestrial and Endangered Resources	-509	-3
• Molecular Biology at Leetown	-788	0
• Mark Twain National Forest Lead Mining Study	-345	0
• Diamondback Terrapin Study	-197	0
• Pallid Sturgeon Research	-345	0
• Bear DNA Sampling in Montana	-394	0
• Multidisciplinary Water Study at Leetown	-197	0
• Great Lakes Science Center Boat Dock	-1,409	0
• Equipment at Anadromous Fish Lab	-148	0
• Tunison Lab Atlantic Salmon Research	-247	0
• Potomac Snakehead Program	-172	0
• Upper Midwest Environmental Sciences Center	-197	0
• Science Excellence with the U.S. Fish and Wildlife Service	-197	0
• Ivory-billed Woodpecker	-394	0
• Wetland Ecology Center w/ the Univ. of Missouri	-197	0
• One-time FY 2006 Supplemental Costs (Avian Influenza)	-400	0
TOTAL	**-6,430**	**-12**

Justification of FY 2007 Program Changes

The 2007 budget request for the Biological Research and Monitoring is $135,692,000 and 1,039 FTE, which is a program change of -$6,430,000 and -12 FTE.

The USGS proposes the following increases:

- **Integrated Multi-Hazard Demonstration Project - Wildfire Research (+$300,000 and +1 FTE) —** The Integrated Multi-Hazards Demonstration Project in Southern California, part of a multi-year initiative, will focus on integrating information and products about multiple hazards to improve the usefulness of this information in reducing loss of life and property from natural hazards, which supports the end outcome goal of "Protect lives, resources, and property" under the mission goal of Serving Communities. The development of integrated databases and the enhancement of information technology systems to track multiple hazards will facilitate more rapid communication and response to the user community, regardless of the timeframe of a natural disaster.

  One element of this integrated project would focus on wildfire research. New work on investigations on the role of fire suppression and fuels accumulation in chaparral ecosystems, specifically on the relation of wildfire intensity and severity to fuels accumulations affected by historical fire suppression, human fire ignitions during extreme weather conditions, and the interspersion of urban and wildland areas will build on current activities. An additional $100,000 would be redirected from lower priority fire activities to this initiative. The USGS would provide one workshop for customers in FY 2007.

- **NatureServe Funding (+1,000,000) —** Funding is provided for NatureServe as part of a broader strategy to improve delivery and access of information needed to support Department of the Interior bureaus in the fulfillment of their missions. The funding will support maintenance of the Natural Heritage database, an available database of nationally consistent species and ecosystem information needed for many forms of decision making.

  More broadly, program components of the Biological Resources discipline (such as the National Biological Information Infrastructure (NBII), Gap Analysis (GAP), and Status and Trends) will work with NatureServe and other partners to make information on the distribution of rare and endangered species and threatened ecosystems accessible by all Department of the Interior employees in versions that allow field offices to input their own data points and to analyze scenarios on the impacts of alternative management plans. This includes supporting analyses that can be applied to research and monitoring as well as natural resource management needs so that they can incorporate information from a variety of sources to understand the linkages between rare and endangered species and threatened ecosystems and the impacts and (or) effects of invasive species, diseases, climate change and natural hazards.

The USGS proposes to eliminate funding for the following lower priority studies in FY 2007:

- **Pacific Northwest Forest Plan (-$1,000,000 and -6 FTE) —** Eliminate or reduce the scope of lower priority studies of habitat requirements of select species in old-growth forest and riparian ecosystems, and reduce research support for long-term effectiveness monitoring of select management options designed to sustain biodiversity and ecosystem function. The proposed decrease would also reduce ongoing research focused on improving

understanding of the consequences of forest management for ecosystem functions, with particular emphasis on biogeochemical cycling.

- **Biological Assistance to the National Water-Quality Assessment Program (-$594,000 and -4 FTE) —** Lower priority studies that provide information on the impacts of chemical concentrations of substances such as mercury, pesticides, and nutrients found by the NAWQA program are eliminated.
- **Wildlife, Terrestrial & Endangered Resources (-$509,000 and -3 FTE) —** Reduce funding for lower priority research activities such as those related to migratory birds, marine mammals, and wildlife species.

The following reductions will end some unrequested earmarked projects. These projects do not address the highest priority science needs for biological research and monitoring. Ending these programs will allow the USGS to make the best use of its resources.

- **Molecular Biology at Leetown (-$788,000) —** Eliminate research on molecular biology at Leetown, WV, terminating fishery genetics research projects along the Northeast and Mid-Atlantic coast, in the Great Lakes and Finger Lakes, and in northern Appalachia.
- **Mark Twain National Forest Lead Mining (-$345,000) —** Eliminate a study to determine potential impacts of lead mining in the Mark Twain National Forest in Missouri in cooperation with the U.S. Forest Service.
- **Diamondback Terrapins Research (-$197,000) —** Discontinue a study of the decline of diamondback terrapins in the Chesapeake Bay that is coordinated with the Maryland Department of Natural Resources and the University of Maryland Cooperative Research Unit.
- **Pallid Sturgeon (-$345,000) —** Eliminate funds for pallid sturgeon research and discontinue scientific investigations to locate and monitor pallid sturgeon in the Missouri River Basin and document their habitat relationships and requirements for all life stages for population growth.
- **Bear DNA Sampling in Montana (-$394,000) —** A study related to grizzly bear DNA sampling will be completed in FY 2006.
- **Multidisciplinary Water Study at Leetown (-$197,000) —** Eliminate funds for a study of the quantity and quality of the Leetown Science Center's ground water supply.
- **Docking Facility Construction (-$1,409,000) —** Eliminate funding for a one-time earmark in FY 2006 for construction of a permanent docking facility for the USGS-owned research vessel *Kiyi*, of the Great Lakes Deepwater Fisheries Program.
- **Anadromous Fish Lab Equipment (-$148,000) —** Eliminate funds for a one-time earmark in FY 2006 to support the purchase of new equipment at the Anadromous Fish Lab to undertake state-of-the-art research in fish passage, fish migration, and related watershed science.
- **Tunison Lab Atlantic Salmon Research (-$247,000) —** End efforts to evaluate salmon strains in key Lake Ontario tributaries that are targeted for restoration and investigations of competition between Atlantic salmon and Pacific salmon in the tributaries, along with subsequent effects of competition on survival of reintroduced Atlantic salmon.
- **Potomac Snakehead Studies (-$172,000) —** Eliminate funds earmarked in FY 2006 for Potomac snakehead studies.

- **Analytical Method for Piscicidal Concentrations of Antimycin A at the Upper Midwest Environmental Sciences Center (-$197,000) —** End efforts begun in FY 2006 to develop an analytical method for piscicidal concentrations of antimycin A at the Upper Midwest Environmental Sciences Center.
- **Science Excellence Initiative (-$197,000) —** Eliminate funds earmarked in FY 2006 that support close coordination and joint funding between the USGS and the U.S. Fish and Wildlife Service (FWS) for the FWS science excellence initiative.
- **Ivory-billed Woodpecker (-$394,000) —** Reduce funds for the ivory-billed woodpecker, limiting USGS support to FWS recovery plans and limiting operational funds that are required to monitor and determine the distribution and status of this species.
- **Wetlands Ecology Center of Excellence (-$197,000) —** Reduce funding for a one-time earmark in FY 2006 to establish a Wetlands Ecology Center of Excellence, a partnership linking University of Missouri, Missouri Department of Conservation, the USGS, and other Federal, State, and private organizations interested in wetland research and conservation.

These decreases would result in 29 fewer systematic analyses and investigations in FY 2009 (there is a 2-year lag between initiating research and obtaining results). Results would also include 3 fewer formal workshops or training provided to customers in FY 2007. The reductions would also result in a decrease of -13 FTE.

The following proposed decrease is related to the FY 2006 avian influenza supplemental funding:

Avian Influenza Research Equipment (-$400,000) — Reduce funding for a one-time FY 2006 purchase of a robotic micro sample extractor and molecular biology workstation to process the large number of samples resulting from Highly Pathogenic Avian Influenza surveillance activities in Alaska and elsewhere.

Program Performance Change Table

Total Performance Change		*-29 systematic analyses and investigations - 2 workshops or training provided to customers*			
	A	*B*	*C*	*D= B+C*	*E*
	Overall Performance Changes from 2006 to 2007				
Measure	**2006 Enacted Performance**	**2007 Base Performance Level**	**2007 Impact of Program Change on Performance**	**2007 Budget Request Performance**	**Out-year Impact of 2007 Program Change on Performance**
Resource Protection – # of systematic analyses and investigations delivered to customers	**816**	**835**	**0**	**835**	**-29**
Resource Protection – # of workshops or training provided to customers	**58**	**58**	**-2**	**56**	**0**

Column B: The performance level expected to be achieved absent the program change (i.e., at the 2006 request level plus/minus funded fixed cost/related changes); this would reflect, for example, the impact of prior year funding changes, management efficiencies, absorption of fixed costs, and trend impacts.

Column E: The out-year impact is the change in performance level expected in 2008 and Beyond of ONLY the requested program budget change; it does not include the impact of receiving these funds again in a subsequent outyear.

Program Overview

The Biological Research and Monitoring subactivity generates specialized biological research and monitoring information needed to effectively manage and conserve biological resources. This program addresses the Department of the Interior Resource Protection strategic goal of improving the health of watersheds, landscapes, and marine resources and sustaining biological communities. The USGS conducts research and monitoring that focuses on understanding how ecosystems (diverse communities of living organisms interacting with one another and with the physical environment) are structured, function, and provide "ecosystem services." The Department manages vast Federal lands and the biological resources that inhabit them. The Department's land- and resource-management bureaus need the scientific understanding and the technical tools to wisely manage these lands and resources on a sustainable basis. The Biological Research and Monitoring subactivity provides science information for resource managers needs.

This program also addresses the Department's Serving Communities strategic goal of protecting lives, resources and property. The rapid spread of highly pathogenic avian influenza across Asia and into Europe, resulting in both avian and human mortality, has demonstrated the need for better wildlife disease surveillance and management programs. The USGS addresses the Department's Serving Communities strategic goal of protecting lives, resources and property by responding to the growing threat to human health and wildlife populations presented by the highly pathogenic form of the avian influenza virus by initiating an early detection effort in partnership with the U.S. Fish and Wildlife Service, the National Park Service, the USDA Animal and Plant Health Inspection Service, the Centers for Disease Control and Prevention, and State agencies.

The USGS also tracks outputs including the number of systematic analyses and investigations delivered to customers and the number of workshops/training with USGS sponsorship or participation to transfer results to customers and partners. New performance measures resulting from the PART are incorporated into the performance tables beginning on page J-31.

In FY 2008, under the end outcome goals of improving the health of watersheds, landscapes, and marine resources; sustaining biological communities; and protecting lives, resources and property, the USGS expects to deliver to its customers about 815 systematic analyses and investigations and 87 formal workshops/training courses.

There is a 2-year lag between initiating research and obtaining results (systematic analyses and investigations). For example, additional funds provided in FY 2005 will increase the number of systematic analyses or investigations delivered to customers in FY 2007.

Research is needed to reduce and avoid the costs of controlling and eradicating the rapidly growing number of invasive species being introduced into and spreading within the United States as a result of increasing global travel and commerce and increasing human impacts on lands and water. For example, the damage to wildlife, livestock, and public health from invasive fire ants, plus the cost of control, is estimated at $500 million annually in Texas alone. Diseases among wildlife can have profound impacts on both humans and wildlife. They can devastate regional wildlife populations, threaten the last remaining individuals of an endangered species, or spread from animals to humans, creating a public health hazard. Single outbreaks of a disease have killed more than 300,000 waterfowl. The spread of chronic wasting disease in deer and elk has alarmed the public and threatened State-hunting activities. USGS biological research seeks to understand the underlying causes of wildlife disease and disease emergence and to provide resource managers and decisionmakers with the tools needed to manage and prevent diseases that impact the Nation's natural resources.

Customers and Partners — The USGS national-level approach to managing biological and natural resource data and scientific information ensures the application of standards that foster opportunities for collaboration and cooperation. The USGS places a premium on partnerships at all levels of government and with nongovernmental entities, including the private sector. These partners use USGS-generated scientific data and information that contribute to the knowledge base, which then become available to Interior land and resource managers, and others.

The USGS works closely with its partners and customers in defining priorities, developing science plans, and carrying out its biological research to support the needs of research management organizations. Key partners in many of these endeavors include Interior bureaus, other Federal agencies, States, Tribes, and private organizations with regional and ecosystem-specific interests.

An example of such a partnership is the Science Support Partnership (SSP) program that addresses the priority science needs of the FWS. Since 2001, the USGS has undertaken nearly 300 projects in support of FWS local, regional, and national programs such as:

- Migratory bird management,
- Endangered species recovery,
- Freshwater fisheries restoration,
- Ecosystem-based management,

- Molecular and biotechnology tools for management,
- Coastal habitat conservation,
- Functional models for adaptive management,
- Fish and wildlife law enforcement, and
- National Wildlife Refuge System management.

The SSP program has provided tremendous benefits to FWS efforts in conserving the Nation's fish and wildlife resources.

The following table displays program-funding estimates for three fiscal years for the Biological Research and Monitoring subactivity.

Biological Research and Monitoring Program Areas (dollars in millions)			
Program	2005 Enacted	2006 Enacted	2007 Request
Status and Trends	18.4	19.3	19.8
Contaminant Biology	9.6	9.7	8.9
Fisheries: Aquatic and Endangered Resources	24.9	24.2	21.9
Wildlife: Terrestrial and Endangered Resources	39.9	45.1	43.9
Terrestrial, Freshwater, & Marine Ecosystems	30.2	31.5	31.0
Invasive Species	10.1	10.3	10.2
Total Biological Research & Monitoring	**133.1**	**140.1**	**135.7**

To better align projects with programs, the USGS, shifted $1.5 million of marine mammals projects from the Fisheries: Aquatic and Endangered Resources program to the Wildlife: Terrestrial and Endangered Resources program, and $0.5 million for toxicology projects from the Fisheries: Aquatic and Endangered Resources program to the Contaminant Biology program.

The following sections describe the Biological Research and Monitoring subactivity by program area:

Status and Trends of Biological Resources

(Estimates for FY 2005, $18.4 million; FY 2006, $19.3 million; FY 2007, $19.8 million)

To protect and conserve the living resources entrusted to their care, Federal land and resource managers must first understand the condition, or status, of those resources: what they are (inventory), where they are located (distribution), how many there are (abundance), and how they change over time (trend)—information only long-term, scientifically sound monitoring can produce. Long-term monitoring of the environment is fundamental to:

- Detecting changes that may signal degradation of natural systems,
- Assessing the effectiveness of management actions,
- Identifying new or emerging problems,
- Validating research results and models, and
- Promoting increased public understanding and appreciation of our living resources.

The USGS Status and Trends of Biological Resources program (for more information visit: *http://biology.usgs.gov/status_trends/index.html*) measures, predicts, assesses, and reports the status and trends of the Nation's biological resources to advance research, facilitate resource management and stewardship, and promote public understanding and appreciation of the Nation's living resources, with emphasis on Federal lands.

The Department of the Interior relies upon biological monitoring information to achieve its mission, measure its success in responding to trust resource and other legislative mandates, and determine its progress toward meeting the Department's Resource Protection goal of sustaining biological communities.

Program goals, as outlined in the program's 5-year plan, are to:

- Facilitate integrated monitoring from a variety of sources at multiple spatial and temporal scales to describe and track the abundance, distribution, productivity, and health of the Nation's plants, animals, and landscapes,
- Develop and evaluate inventory and monitoring methods, protocols, experimental designs, analytic tools, models, and technologies to measure biological status and trends,
- Collect, archive, and share critical, high-quality monitoring data in cooperation with partners to determine the status and trends of biological resources, and
- Produce and provide analyses and reports that synthesize information on the status and trends of the Nation's flora, fauna, and ecosystems and be responsive to the needs of the scientific community, land and resource managers, policymakers, and the public.

National Park Monitoring — USGS scientists assist national parks with inventory and monitoring protocol development and other monitoring-related research needs such as assistance with monitoring planning and design, statistical data analysis, and review/revision of existing protocols. USGS scientists and technical specialists address priority issues identified by the National Park Service that typically involve and benefit several parks and require multiyear efforts.

Park-Oriented Biological Support —The USGS and the National Park Service, through the Natural Resource Preservation Program, jointly support biological projects that provide exploratory research and technical assistance to national parks.

National Wildlife Refuge Monitoring — The Status and Trends of Biological Resources program is partnering with the National Wildlife Refuge System of the U.S. Fish and Wildlife Service with the goal of improving science-based management on refuges with focus on adaptive management.

Bird Banding Laboratory — Bird banding is a universal technique for studying the movement, survival, and behavior of birds. The Bird Banding Laboratory (BBL) provides high-quality banding data in a timely manner for use in developing effective bird conservation and management strategies throughout North America. A Federal Advisory Committee has been chartered to help the BBL achieve maximum success and relevancy to its banders and data users in the 21st century.

Breeding Bird Survey (BBS) — The North American Breeding Bird Survey (BBS) was launched in 1966, utilizing 600 roadside routes to obtain range-wide population data on breeding birds in the United States and Canada east of the Mississippi River. Today, the BBS provides the foundation for non-game, land bird conservation in North America with over 3,200 skilled volunteer participants sampling 3,000 routes annually across the continental United States and southern Canada.

Mammal Monitoring — USGS scientists play a major role in monitoring the status of mammal populations that extend from the Arctic to Yellowstone to the Florida Everglades.

Great Lakes — In coordination with the Fisheries: Aquatic and Endangered Resources program, USGS scientists conduct a regional deepwater science, large vessel program that complements other Interior activities with large-scale multiyear strategic investigations. The program provides long-term, consistent, lakewide assessment of forage fish stocks that support sport and commercial fish species, monitor invasive species for protection and restoration of the Great Lakes, and provide scientific and technological monitoring tools for aquatic species assessment and conservation in the Great Lakes.

Standards and Protocols — USGS scientists develop statistically valid, efficient, and feasible protocols that are relevant to the needs of resource managers for monitoring the abundance, distribution, productivity, and health of the Nation's plants, animals, and ecosystems.

Taxonomy, Systematics, and Museum Studies —The National Museum of Natural History is a major repository of scientific information used by USGS scientists to study natural variation in many groups of animals. Curation of North American vertebrate collections at the Smithsonian Institution provides stewardship of an important scientific database available to scientists from around the world.

Predictive Population Modeling — Through development of predictive population models, the Status and Trends program assists resource managers in making difficult decisions by reducing the uncertainty associated with population responses to habitat and environmental change allowing managers to project the likely outcome of various management alternatives on populations of plants and animals.

Science for Decision-Support Systems — Decision-support systems are computer-based tools that bridge the gap between quality information and management decisionmaking bringing the best scientific and human dimensions information to bear on specific natural resource issues.

Adaptive Management — This activity is a sequential process, decision-making process for continually improving management policies and practices by learning from the outcomes of previous decisions.

Human Dimensions and Socio-Economics — Human dimensions studies are used to better understand human-induced changes, determine the environmental conditions desired by local communities and users of natural resources, and develop information that assists decisionmakers in sustaining or restoring healthy ecosystems.

Contaminant Biology

(Estimates for FY 2005, $9.6 million; FY 2006, $9.7 million; FY 2007, $8.9 million)

The Contaminant Biology program provides high quality, objective scientific information on exposure and effects of environmental contaminants on the Nation's biotic resources and, in particular, the trust resources of the Department of the Interior. Toxicology and chemistry expertise, research, information, scientific interpretations, monitoring tools, and models are used by Interior and other agencies to prevent contamination; manage, protect, and restore contaminated Interior lands and trust resources; and fulfill recreational, statutory, and regulatory responsibilities. This program supports the Department's Resource Protection strategic goal of improving the health of watersheds and landscapes that are Interior managed or influenced.

This program conducts environmental toxicology research and plans to increase emphasis in development of molecular biology techniques related to contaminant mixtures; research to support restoration of contaminated habitat; development of toxicological and chemical data and methods for endocrine disruptors and emerging contaminants such as brominated flame retardants; comparative toxicity among species to improve reliability of criteria and standards for protecting species of concern; and completion of work in the Mark Twain National Forest.

Program goals, as outlined in the program's 5-year plan, are:

- Toxicology and Chemistry — Determine the causes, fate, exposure and effects of environmental contaminants. Develop and standardize biomarkers, molecular biology methods and techniques and other analytical and toxicological methods,
- Contaminated Habitats — Develop the scientific basis for assessment, restoration, and monitoring of habitats that are contaminated by mining, agriculture, urban wastewater, industry, and chemical control agents. Develop the toxicological basis to remediate and prevent contamination effects of chemical controls for invasive species, fire, and other hazards, and
- Integration of Ecological Stressors — Improve the scientific basis for evaluating the effect of multiple stressors, at all levels of biological organization and at multiple temporal or spatial scales.

Fisheries: Aquatic and Endangered Resources

(Estimates for FY 2005, $24.9 million; FY 2006, $24.2 million; FY 2007, $21.9 million)

Research conducted in the Fisheries: Aquatic and Endangered Resources (FAER) program centers on the determination of factors affecting the growth, health, diversity, and survival of fish and other native aquatic fauna, and aquatic community structure and function. Based on the genetics, life history, behavior, and habitat requirements of aquatic organisms, USGS scientists provide the scientific information needed by aquatic resource managers to develop and evaluate methods for restoring and managing aquatic populations. High quality scientific information about the distribution of species of concern and their habitats, and the biological integrity of

multijurisdictional aquatic systems are provided to resource managers to support adaptive management of the Nation's aquatic species and habitats. High priority is given to studies that directly assist other Interior agencies and national, international, State, and tribal efforts to manage inter-jurisdictional fishery and aquatic resources. USGS expertise in genetics, fish health and diseases, aquatic animal drug and chemical research, native and endangered fishes, other freshwater organisms, and aquatic habitats provides long-term research support, quick response, and technical assistance in support of the Department's Resource Protection strategic goal of sustaining biological communities.

The FAER 5-year strategic plan has been developed through an extensive collaborative effort to predict and identify the aquatic biological information needs of our partners and customers, and to posture USGS science to respond to ongoing and future challenges. The plan describes the current and future roles of the FAER program and projected coordinated research with USGS disciplines and programs, Interior partners, and other natural resource managers.

Program goals, as outlined in the program's 5-year plan, are to:

- Provide scientific information about the diversity, life history and species interactions that affect the condition and dynamics of aquatic communities,
- Provide scientific information about factors and processes that affect aquatic organism health in support of survival, protection, conservation and recovery,
- Quantify and describe functional relationships among aquatic species and habitats to provide information to conserve or restore aquatic community structure and function,
- Provide science support for natural resource managers by investigating the factors that contribute to the conservation and recovery of aquatic species at risk,
- Develop research and technology tools to provide the scientific basis for developing adaptive management strategies and evaluating their effectiveness for restoration efforts to sustain aquatic resources, and
- Provide research support and technical assistance to Interior bureaus, other Federal and State government agencies, Tribes, and non-governmental organizations to support natural resource management problem solving and decisionmaking.

Reasons for aquatic species decline include health effects such as disease, changes in the availability and quality of water, habitat loss, invasive species, and contaminants. Restoration of declining populations depends on critical science information provided by an integrated program of research to determine the biology of individual aquatic species and the ecological relationships between those species and their habitats. The USGS is providing resource managers with science-based tools for addressing these issues through improved systematic analyses, data collection, analysis and modeling focused on linking biological, physical, and chemical factors with others contributing to alterations in species composition and health. Most USGS endangered species research supports recovery of species already having legal status under the Endangered Species Act of 1973, as amended. To help managers achieve the goals of recovery plans, USGS scientists investigate the life history requirements of listed species and factors limiting their populations. Better knowledge of both critical requirements and limiting factors is needed for managers to act effectively to promote restoration of populations.

USGS scientists investigate fish species and aquatic organism diversity in large freshwater lakes, large rivers and major tributaries, estuaries and nearshore areas. Important sport and commercial species such as salmon, steelhead, and sturgeon, as well as forage and prey

species are studied to provide fishery managers with information to help mitigate the impact of aquatic diseases, barriers, and habitat loss. USGS scientists operate a Bio-Level III aquatics laboratory to investigate the heritability and spread of aquatic pathogens and diseases. This unique capability allows scientists to study, develop, and use advanced genetic and molecular tools to detect and identify introduced or invasive aquatic diseases, fishes, or other aquatic organisms that imperil the Nation's aquatic resources. USGS scientists develop and adapt advanced research tools such as remote sensing, hydroacoustics and geospatial technologies to characterize aquatic populations and the community dynamics of large lakes, reservoirs, impounded and free-flowing stretches of major rivers, estuaries, and coastal areas.

Klamath Basin — Interdisciplinary research of the USGS Biological Resources and Water Resources disciplines in the Klamath Basin focuses on determining the effects of changing water availability, water quality, climate, and management actions on population dynamics and required aquatic habitat of important endangered fishes, and on ecological responses of wetlands and the watershed.

High Priority Fisheries Research for the U.S Fish and Wildlife Service (FWS) — The USGS continues to address critical research needs of the FWS in support of imperiled and at-risk species, inventory and monitoring programs, and fisheries and aquatic resources management. High priority fisheries research for the FWS provided by the science support partnership is determined annually by FWS science needs.

Quick Response Program – Fisheries Issues — Studies undertaken by this program involve scientific research that is short-term and provides critical scientific information about aquatic species and aquatic habitats required for making credible and effective adaptive management decisions.

Endangered Fish and Aquatic Species — USGS endangered species research provides biological information needed to restore currently listed populations, support delisting wherever possible, or preclude future listings by clarifying species' status or suggesting timely preventive actions.

Fish and Aquatic Species at Risk — Species-at-Risk activities lead to conservation options and actions that reduce the need for listing species as threatened or endangered.

Fish Passage — Fish passage projects focuses on the physiological, behavioral, and hydraulic phenomena that determine the successful navigation of barriers by fish and other at-risk aquatic species and the efficiency of artificial structures designed to allow passage through or around obstacles.

Great Lakes — In coordination with the Status and Trend program, USGS scientific research, in support of interjurisdictional management of the Great Lakes fish and aquatic resources, facilitates information transfer across jurisdictional boundaries to promote ecosystem level adaptive management, conservation, and restoration in the Great Lakes basin. Studies focus on genetics, life history, trophic interactions, health, habitat requirements, and ecology of deepwater and near shore fisheries and aquatic resources in the Great Lakes and its tributaries.

Chemical and Drug Approval and Registration — The USGS collaborates with the U.S. Fish and Wildlife Service, the USDA Agricultural Research Service, the States acting through the International Association of Fish and Wildlife Agencies and private drug sponsors to conduct

research required by the Federal Food and Drug Administration, Center for Veterinary Medicine to gain approval for fishery management drugs and chemicals.

Coastal Fisheries — USGS scientists study how coastal and estuarine fish and other aquatic species are affected by changes in their habitat and interactions with other resident and migratory species to provide aquatic resource managers with information needed to conserve and restore important aquatic resources.

Fish Biology — The USGS fishery research program examines the biology, genetic diversity, and health, all phases of the life cycles of fish and other aquatic organisms, and their habitat requirements to develop research to answer the science information needs of fishery managers to aid the development of techniques to restore fish populations.

Fish Genetics — Research in fish and aquatic organism genetics characterizes the diversity, variability, and taxonomic status of individuals, stocks, strains, and populations to provide natural resource managers with the ability to identify native, cultured, introduced, and invasive fish and aquatic organisms to provide information for the development of science-based conservation and restoration strategies for aquatic resources.

Fish Disease — Fish disease research focuses on development of new techniques for the detection and identification of emerging pathogens and causative agents, disease resistance and immunology, and understanding the role of stress and environmental factors upon disease outbreaks, severity, and cycles.

Native Mussels — USGS native mussels research activities determine their life histories, hosts, distribution and abundance, and identify how invasive species and environmental degradation of streams, rivers, and lakes are affecting mussel populations.

Large Rivers — USGS research related to water availability and the unique aquatic resources and conditions found in America's large rivers, such as the Colorado, Missouri, Mississippi, and Columbia, is providing vital information on fish community structure and function, aquatic community dynamics and function, critical habitat, hydrology and hydraulics of the rivers, sediments, and water quality.

Wildlife: Terrestrial and Endangered Resources

(Estimates for FY 2005, $39.9 million; FY 2006, $45.1 million;
FY 2007, $43.9 million)

Research conducted in the Wildlife: Terrestrial and Endangered Resources program focuses on meeting the wildlife-related information needs of Interior's natural resource management bureaus and other partners as authorized by law. This program supports investigations to determine factors influencing the distribution, abundance, and condition of wildlife populations and communities. Studies also focus on developing the tools and methods needed to prevent and manage disease in free-ranging wildlife and to evaluate the effects of disease on wildlife populations. This program supports the Department's Resource Protection strategic goal of sustaining biological communities.

Program goals, as outlined in the program's 5-year plan, are to:

- Provide the scientific foundation for the conservation of terrestrial plants, wildlife, and habitats by developing the basic biological information that partners need to formulate adaptive management strategies,
- Provide tools and techniques for effective science-based management, such as predictive models, decision support systems, and expert systems,
- Identify the factors that contribute to and (or) limit the conservation and recovery efforts for terrestrial plant and wildlife species-at-risk,
- Institute an adaptive science approach to support the adaptive management of terrestrial plants and wildlife and provide technical assistance to natural resource managers, and
- Continue to build additional research capabilities, expertise, and to meet the emerging needs of USGS partners as wildlife issues take on new importance in today's society.

Reversing the rapid loss of biological diversity remains one of the greatest challenges to natural resource managers. The reasons for species decline are numerous and include habitat loss, habitat degradation, competition with invasive species, environmental contaminants, and disease, among others. Restoring declining wildlife populations thus depends on an integrated program of research to develop critical information on the biology of individual species and the ecological relationships among those species, their communities, and their habitats. Through investigations that link physical, chemical, and biological factors impacting species composition and health, the USGS provides land and resource managers with the tools needed to address these issues.

Imperiled species research focuses on identifying factors responsible for the decline of threatened and endangered species populations, and assisting in the development of management plans and methods to restore depleted populations and to prevent further declines. USGS imperiled species research supports recovery of species already having legal status under the Endangered Species Act of 1973, as amended, as well as those in long-term population decline but not yet listed. To help managers achieve the goals of recovery plans, USGS scientists investigate the life requirements of imperiled species and factors limiting their populations. Better knowledge of both requirements and limitations is needed for managers to act effectively to promote restoration of populations.

Cooperative studies among the USGS National Wildlife Health Center, other USGS science centers, the southeastern cooperative wildlife disease study, State natural resource agencies, and the International Association of Fish and Wildlife Agencies are now underway to determine causes and impacts of wildlife diseases such as avian influenza, West Nile Virus, and chronic wasting disease. In addition, efforts have begun to examine interactions between wildlife and human diseases. This work is being conducted in partnership with other Federal agencies, such as the Department of Health and Human Services and the U.S. Department of Agriculture.

High Priority Wildlife Research for the U.S. Fish and Wildlife Service (FWS) — The USGS develops tools and technology such as inventory and monitoring protocols to assist wildlife refuges to measure the effects of land management practices on habitats of declining and at-risk species, and to determine the needs for habitat conservation planning. The USGS also conducts two subprograms to provide unforeseeable research or technical assistance support requested by the FWS. Studies undertaken by these subprograms involve short-term, scientific research and provide critical information required for making credible and effective resource management decisions:

- **FWS Science Support Partnership —** USGS Science Centers and Cooperative Research Units work collaboratively with the FWS to address FWS mission-critical science needs.
- **Quick Response Program —** This activity provides unforeseen short-term research on technical assistance needs requested by the FWS.

Endangered Wildlife and Terrestrial Species — USGS endangered species research provides biological information needed to restore currently listed populations, support delisting wherever possible, or preclude future listings by clarifying species' status or suggesting timely preventive actions.

Wildlife and Terrestrial Species at Risk — Species-at-Risk activities lead to conservation options and actions that reduce the need for listing species as threatened or endangered.

Migratory Birds — USGS research efforts on migratory birds are international in scope and are coordinated with the U.S. Fish and Wildlife Service, State fish and wildlife agencies, and the Canadian and Mexican wildlife agencies. Migratory bird research includes projects on individual species, communities, habitat relationships, and applied work for increasing the number and diversity of birds.

Natural Resource Preservation Program (NRPP) — USGS biologists conduct short-term, tactical research to meet the natural resource management needs of the National Park Service. NRPP funds help fill gaps in applied biological research in the Nation's national parks and allow the USGS to address research needs significant to park resource managers.

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 on such diseases as highly pathogenic avian influenza, West Nile Virus, and chronic wasting disease.

- **Highly Pathogenic Avian Influenza —** In response to the growing threat to human health and wildlife populations presented by the highly pathogenic form of the avian influenza virus, the USGS has initiated an early detection effort in partnership with the FWS, NPS, USDA Animal and Plant Health Inspection Service, the Centers for Disease Control and Prevention, and State agencies. The USGS conducts sampling of live birds, hunter-taken birds, and environmental materials for the virus, as well as increasing its response and analytical capability associated with migratory bird mortality events. These activities are being conducted as part of a coordinated, interagency program to deal with the highly pathogenic avian influenza in North America.

- **West Nile Virus —** The USGS assists the Centers for Disease Control and Prevention and State and Federal agencies in the national West Nile Virus Surveillance program through viral testing of wildlife specimens, primarily birds, at diagnostic laboratories such as the USGS National Wildlife Health Center. The USGS also collaborates with these agencies to document the geographic spread of the virus across the United States and to increase the understanding of the U.S. epidemic since it was first discovered in New York City in 1999. Concurrently, the USGS is working cooperatively with State and Federal natural resource and wildlife agencies to investigate regional wildlife mortality events (die-offs) potentially associated with West Nile Virus.

- **Chronic Wasting Disease —** The USGS, along with the U.S. Department of Agriculture and a number of State and Federal agencies, is involved in critical research and information sharing on chronic wasting disease (CWD). CWD is a fatal disease affecting elk and deer and belongs to the same family as mad cow disease in cattle and scrapie in sheep. Originally observed in only captive animals, it has recently been discovered in wild deer populations in Wisconsin, Colorado, Wyoming, Illinois, Nebraska, Utah, South Dakota, and New Mexico. States are looking to the USGS to provide research, technical assistance, and other forms of support to combat CWD. To help meet the need, USGS scientists are investigating how CWD is transmitted, what conditions lead to disease outbreaks, and how to manage outbreaks once they occur. In addition, the Disease Information Node of National Biological Information Infrastructure has developed a CWD Data Clearinghouse that provides a means for State and Federal agencies to share CWD-related data quickly and securely.

Amphibian Research and Monitoring — The USGS leads a coordinated effort extending beyond Interior bureaus to include other Federal, State, and academic partners, to determine the status of amphibian populations nationwide and investigate potential causative factors for their decline.

Alaska Research — Federal public lands in the State represent an overwhelming landscape (equivalent in size to the entire Eastern Seaboard from Maine through Florida). Nearly 88 percent of all national wildlife refuge lands and 65 percent of all national park lands are in Alaska. The Biological Science Office of the Alaska Science Center is responsible for research in support of trust lands and waters (including those of the NPS, FWS, BLM, and MMS) and Interior trust species (including migratory birds, marine mammals, and anadromous fish) in Alaska, providing scientific information essential for resource management decisions.

Terrestrial, Freshwater, and Marine Ecosystems

(Estimates for FY 2005, $30.2 million; FY 2006, $31.5 million; FY 2007, $31.0 million)

The USGS ecosystems research program supports diverse research activities focused on understanding factors controlling the structure, function, composition, and condition of terrestrial, freshwater, and marine ecosystems; their variability in space and time; and the "ecosystem services" they provide to benefit human communities and economies. Investigations identify, explain, and predict ecological impacts of human and natural disturbances on ecosystems and their component biological species and processes, including impacts of climate variability and change, natural hazards such as hurricanes and wildfire, and human management and land use practices. Research results provide the basis for the adaptive, sustainable management of ecosystems and natural resources, development of forecasting models and decision support tools that integrate ecological knowledge with management options, and development of frameworks and approaches for restoring impaired ecosystems. Research activities also focus on developing understanding and indices of ecosystem sensitivity to change and vulnerability to specific stressors, and provide information to mitigate adverse effects on ecosystems and biological communities.

Studies of ecosystem productivity, food-web relationships and energy flow, cycling of nutrients and other biogeochemical processes, and the diversity of biological communities are examples of ecosystem research. Topical areas for ecosystem research include the ecology of wetland, lake and river, forest, arid land, arctic, grassland, coral reef, and outer continental shelf

ecosystems; disturbances and landscape ecology; modeling ecological systems and quantifying ecosystem services; restoration ecology; fire ecology; and global change studies. In addition to the scientific community, primary customers for research information and knowledge developed by the ecosystems program include land and resource managers and decision and policymakers within Interior and other Federal and State land management and regulatory agencies, as well as NGOs and the public. This program supports the Department's Resource Protection strategic goal of improving health of watersheds, landscapes, and marine resources.

The current goals of the ecosystems program, which will be revised as the program's 5-year plan is completed in FY 2006, are as follows:

- Quantify and understand factors influencing patterns of temporal and spatial variability in key ecosystem components and processes,
- Model factors controlling ecosystem patterns at various scales and develop decision support systems which integrate this information with management options,
- Develop indices of ecosystem sensitivity to change and vulnerability to potential sttressors, and tools to predict ecosystem responses to environmental change,
- Devise restoration and adaptive management frameworks for impaired ecosystems, and
- Identify long-term research areas representative of US ecosystems of interest to Interior land managers

Science on the DOI Landscape — The Science on the DOI Landscape initiative continues to be a successful collaboration between each Region and the regional Department offices. Department bureaus have collaborated with USGS in project planning and implementation by leveraging funds or in-kind services to make this venture a true partnership. Although issues vary among regions and Department bureaus, the common theme among all of the projects is recognition of Department priority needs and quick response in providing information to answer questions and issues posed by Department bureaus.

Coastal Habitats, Wetlands, and Adjacent Uplands — USGS scientists conduct research to investigate coastal (including the Great Lakes) wetland structure and function to assess the resilience of wetland functions and the ecosystem services they provide to natural hazards and human activities, to predict changes in functions and ecosystem services in response to future environmental changes, to determine restoration and sustainable management practices for these systems, and to evaluate the effectiveness of current management actions.

Fire Ecology — The USGS conducts fire ecology research to understand the effects of wildland fire on ecosystem structure and function, and on other ecological attributes such as wildlife habitat. Research is also directed at understanding fire history and fire regimes; interactions of fire with invasive species (e.g., cheatgrass) and climate variability; fire relations with vegetation structure and effectiveness of fuels treatments; and development of guidelines for restoring and rehabilitating fire-impacted ecosystems and watersheds.

Outer Continental Shelf Marine Environmental Studies — USGS research supports the needs of the Minerals Management Service (MMS) for information on long-term ecological effects of offshore oil and gas exploration and production, including effects of active and decommissioned production platforms, and of sand and gravel dredging activities for beach nourishment, on fish and deep sea corals, and on the condition, composition, and vulnerability of biological communities in areas of potential or new production or dredging.

Coral Reefs — The USGS conducts research on issues facing resource managers including understanding conditions needed for productive and healthy reef communities, terrestrial contributions to reef health and disease in support of the Coral Reef Task Force, and evaluating human activities and management options and how they influence reef integrity and biodiversity.

Rangelands and Grasslands — The USGS conducts studies on native grasslands and managed rangelands to assess ecosystem condition, determine spatial patterns of rare plants, and evaluate native plant diversity and species richness as impacted by past management and invasive species.

Deserts and Arid Lands — In the Southwest, USGS scientists are investigating the effects of natural and human disturbances on discrete soil units and the biota they support, including native soil biological crusts and their role in protecting soils.

Prairie Wetlands — USGS researchers are investigating factors influencing the use of restored wetlands by birds, amphibians, and macroinvertebrates, and quantifying recovery of non-wildlife functions such as carbon sequestration and on landscape scale, interactions of wetland biota with hydrology, geochemistry, and sedimentation in fragmented grassland landscapes.

Forested Wetlands — USGS research focuses on wetland regeneration and restoration in the southeastern United States, including site selection and preparation; forest mix and biodiversity enhancements; planting and community structure; management procedures and monitoring providing information for managing forested wetland flora and fauna and to quantify the role forested wetlands play in nutrient cycling and retention and in carbon sequestration.

Pacific Northwest Forest Program — USGS research is designed to meet the information needs of public forest managers as established by the Pacific Northwest Forest Plan and subsequent judicial and executive decisions. Research identifies essential habitats and requirements of key species and resource management options for sustaining biodiversity and ecosystem function.

Global Change — USGS global change research seeks to develop understanding of the consequences of global change processes, including climate change and variability, for ecosystems and their component biota and processes. Studies, funded for 3-5 years based on a competitive review process, seek to determine the response of ecosystems to climate change and to assess future global climate change impacts.

Invasive Species

(Estimates for FY 2005, $10.1 million; FY 2006, $10.3 million;
FY 2007, $10.2 million)

Non-indigenous 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 have begun to spread rapidly in U.S. ecosystems and pose increasing threats to lands and waters managed by the Department of the Interior. They harm native ecosystems and are contributing factors in the listing of 40 percent of threatened and endangered species. The economic costs associated with invasive species exceed $100 billion per year. This program supports the Department's Resource Protection strategic goal of sustaining biological communities.

The goals of the Invasive Species Program address:

- Prevention,
- Early Detection and Rapid Assessment of New Invaders,
- Monitoring and Forecasting of Established Invaders,
- Effects of Invasive Species,
- Control and Management, and
- Information Systems (in cooperation with Biological Information Management and Delivery subactivity).

Program goals, as outlined in the program's 5-year plan, are to:

- Conduct research on priority pathways,
- Develop innovative control methods,
- Develop a national forecasting system for invasive species, and
- Maintain a National Invasive Species Information Network.

The Department is also continuing its participation in an interagency performance budget on invasive species that is coordinated through the National Invasive Species Council (NISC). The Department's bureaus work in partnership with other Federal agencies, State, local, and tribal governments, and private sources to perform the seven functions of invasive species management: prevention, early detection and rapid response, control and management, restoration, research, education and public awareness, and leadership and international cooperation.

The USGS plays an important role in Federal efforts to combat invasive species in natural and semi-natural areas through early detection and assessment of newly established invaders, monitoring of invading populations, improving understanding of the ecology of invaders and factors in the resistance of habitats to invasion, and development and testing of prevention and alternative management and control approaches. USGS research on invasive species includes all significant groups of invasive organisms in terrestrial and aquatic ecosystems.

The USGS plays a significant role in implementing the National Invasive Species Management Plan (Plan), developed by the NISC, as called for in the Presidential Executive Order on invasive species. To meet the goals of the Plan, the USGS Invasive Species program provides management-oriented research and delivers information needed to prevent, detect, control, and eradicate invasive species and to restore impaired ecosystems. Facilitating these efforts is the National Institute for Invasive Species Science, a growing consortium of partnerships between government and non-governmental organizations that is administratively housed in the USGS Fort Collins Science Center in Colorado. USGS researchers are leading or cooperating in efforts to integrate the capabilities of the USGS and partners, including Federal and State resource agencies, to 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. An important focus is on developing models for predicting the probable spread and impacts of invaders, in cooperation with NASA Goddard Space Flight

Center, the USGS EROS Data Center, and others.
(http://www.nrel.colostate.edu/projects/niiss/niiss.html)

To ensure the strategic allocation of resources to combat invasive species, the NISC, co-chaired by the Secretary of the Interior, the Department of Agriculture, and the Department of Commerce, developed the first interagency example of a performance-based budget. Based on common goal statements, strategies, actions, and performance measures, the NISC selected priority topical and geographical areas of focus, and member agencies developed coordinated budget requests to address these. The Department participates in the development of this interagency performance budget on invasive species which links spending levels with levels of performance.

Hawaiian Invaders — USGS research focuses on the ecology and control of highly invasive plants (e.g., miconia, faya tree, strawberry guava, Kahili ginger), including exploration and testing for biological control agents; animals (e.g., Argentine ant, yellow jackets, brown tree snake on Guam); wildlife disease organisms; and methods for reducing the impacts of invasive species on the region's unique native flora and fauna.

Weeds in the West — The USGS is conducting a multiscale, integrative program for mapping infestations and accurately monitoring the spread of invasive plants (i.e., weeds) in western forests and rangelands, improving methods for predicting areas most vulnerable to invasions, and assessing the effects of management practices and natural disturbances on invasions. The USGS is assessing the effects of invasions on ecosystems and native species (e.g., fire ecologists are determining how invasive species alter the frequency and intensity of wild fires) and providing improved methods for reducing the adverse impacts of invasive weeds and for restoring public range lands affected by weed invasions.

Invasives in the East — The USGS conducts research on invasive species that threaten ecosystems and native species in the eastern United States including terrestrial and aquatic surveys of non-indigenous species in eastern parks and wildlife refuges, studies of pathways for establishment and spread of invasive species, research on the impacts of invasive species and factors in invasions, and development of methods to control or eliminate invasive species to promote healthy native communities that are resistant to invasion.

Great Lakes Invaders — USGS research supports cooperative efforts in the Great Lakes region to prevent and control the spread of invasive fish, such as the round goby and sea lamprey, reduce the pervasive impacts of zebra mussels on U.S. waterways, and manage or mitigate the adverse ecological and economic impacts of the invaders.

FY 2007 Program Performance Estimates

The 2007 budget request for the Biological Research and Monitoring subactivity is $135,692,000 and 1,039 FTE.

Under the Resource Protection strategic goal, changes result from additional funding provided in FY 2005. There is a 2-year lag between initiating research and obtaining results. Additional funds provided in FY 2005 are increasing the number of systematic analyses or investigations delivered to customers in FY 2007 by 4.

Under the Resource Protection strategic goal, the FY 2007 proposed decreases would result in 29 fewer systematic analyses or investigations delivered to customers in FY 2009 and 3 fewer formal workshops and training provided to customers in FY 2007.

Under the Resource Protection strategic goal, the proposed increase for the Multi-Hazards Pilot Initiative — Wildfire Research would result in one workshop provided to customers in FY 2007.

The following program accomplishments listed below demonstrate the utility of "systematic analyses and investigations delivered to customers" and "number of formal workshops or training provided to customers."

Program: Fisheries: Aquatic and Endangered Resources; Contaminant Biology; Terrestrial, Marine, and Freshwater Ecosystems; Invasive Species; Status and Trends
Project Name: USGS Research Support for Regional Collaboration in the Great Lakes
Project Description: The 2004 Executive Order "Establishment of Great Lakes Interagency Task Force and Promotion of a Regional Collaboration" was designed to establish a regional collaboration of national significance for the Great Lakes. The USGS has responded by supporting local and regional efforts to address environmental challenges and by refocusing Great Lakes science strategies to address nationally significant environmental and natural resource issues. Great Lakes Basin-wide studies of life history, trophic interactions, health, genetics, habitat requirements and the ecology of deepwater and near shore fisheries will be conducted. These studies will determine the effects of changing environmental conditions and invasive species on native species, food webs, and critical habitats for young fishes. In FY 2007, new accomplishments in support of important management issues of natural resource agencies will include characterization of critical ecosystem components for improved ecosystem health and function, development of models and risk assessments of food web disruptions by invasive species or contaminants, and development of restoration strategies for native species and habitats.

Program: Terrestrial, Freshwater, and Marine Ecosystems
Project Name: Fire Science
Project Description: The USGS, in support of the Wildland Fire Leadership Council (WFLC) and Interior management bureaus, conducts fire ecology research to understand effects of wildland fire on wildlife habitat and ecosystem structure, function, sustainability, and restoration. Emphasis is on the role of fire in the restoration of rangelands and shrublands, and the effectiveness of fire/vegetation treatments in the control of invasive plants; how the frequency, intensity, and geographic scope of fires influence the distribution and abundance of key wildlife species; and restoration and rehabilitation of watersheds following wildfire. Research will meet fire science information needs identified by the National Fire Plan, WFLC, and the Interior Office of Wildland Fire Coordination, and will include development of an interdisciplinary strategic vision for future USGS wildland fire research that addresses identified needs in pre-fire risk assessment, fire ecology and wildfire effects, post-fire restoration and rehabilitation, and fire incident response and operations support. Results of this research are critical to understanding and mapping fire risk, planning effective fuels management, planning post-fire recovery to minimize future fire risk, and developing emergency response plans.

Program: Invasive Species
Project Name: Effective Methods to Restore Prairie Grasslands Invaded by Leafy Spurge
Project Description: Leafy spurge is an invasive exotic weed that reduces rangeland productivity, degrades wildlife habitat, displaces native species, and reduces land values in more than 5 million acres of land in 35 States and the prairie provinces of Canada. The USGS

works with the National Park Service, the U.S. Fish and Wildlife Service, the University of Minnesota, and USDA-Animal Plant Health Inspection Service to develop post-control restoration techniques that encourage the return of native species and ecosystem function to invaded grasslands. USGS research has focused on determining the ecological effects of leafy spurge infestations and evaluating the effectiveness of the controls used by Interior land managers. In 2007, the USGS will continue to work with Interior land managers to test a rapid assessment tool that can be used to identify high priority areas for leafy spurge control and native prairie restoration. Effective restoration is an important step in the overall control strategy for leafy spurge as it increases the landscape's resistance to future invasions, and restores rangeland health and economic value. New research in FY 2007 will focus on developing methods to restore soil biota so that it favors healthy communities of native species and provides resistance to infestation by nonnative plants Specific areas of research will focus on how leafy spurge has modified beneficial or antagonistic microorganisms in the soil and development of restoration methods that make tactical use of selected native species to recondition soil and increase effective restoration of previously infested sites. This research will contribute to the long-term performance of the Invasive Species Program by increasing scientific information and decision support models to improve management of leafy spurge.

FY 2006 Planned Program Performance

Under the Resource Protection strategic goal, changes result from additional funding provided in FY 2004. There is a 2-year lag between initiating research and obtaining results. Additional funds provided in FY 2004 are increasing the number of systematic analyses or investigations delivered to customers in FY 2006 by 9.

Under the Serving Communities strategic goal, additional funds in FY 2006 for avian influenza research will increase the number of formal workshops and training provided to customers in FY 2006 by 3 and the number of systematic analyses or investigations delivered to customers in FY 2008 by 3.

The USGS conducts periodic program reviews to evaluate the relevance, significance, effectiveness, and productivity of ongoing scientific activities and to set goals, objectives, and priorities for future work. Program reviews are to be conducted every 5 years. The Biological Research and Monitoring program plans to review its Status and Trends program in FY 2006.

The following program accomplishments listed below demonstrate the utility of "systematic analyses and investigations delivered to customers" and "number of formal workshops or training provided to customers."

Program: Contaminant Biology
Project Name: What is Normal? Answers for Endocrine Disruption in Fish
Project Description: In FY 2006, the USGS will publish the results of a large national reconnaissance investigation of endocrine biomarkers in fish. The USGS measured multiple markers of reproductive function in largemouth bass and common carp in over 3,500 fish at over 47 sites to determine their suitability for assessing reproductive/endocrine function in studies nationwide. The investigation summarized variation in biological markers by season, species, size, gender, land use, water flow regimes, and geographic region. The Internet-based report will provide Interior, and other Federal and State agencies with valuable baseline data for distinguishing region-specific "normal" and "abnormal" endocrine measurements for a range of site conditions.

Program: Wildlife: Terrestrial and Endangered Resources
Project Name: Development and Implementation of the Avian Influenza Surveillance Program
Project Description: Wild migratory birds, particularly waterfowl, are natural hosts of avian influenza viruses. A Highly Pathogenic Avian Influenza (HPAI) strain that has become endemic in poultry in Southeast Asia, has spread to Russia and Eastern Europe, and has killed at least 62 humans. The strain has also caused mortality in numerous species of migratory birds in Asia. HPIA has not been detected in humans, poultry, or wild birds in North America; however, Alaska and corresponding areas of the Russian Far East are a unique area where migratory bird species mix during migrations to and from breeding and wintering grounds. Thus, if HPAI is carried to North America in migratory birds, the virus would most likely arrive first in Alaska. The USGS, in cooperation with the FWS, began targeted surveillance monitoring for HPAI in wild birds in Alaska in 2005, collecting samples from 520 birds of 10 species and focusing on species that are known to migrate through the Russian Far East and Southeast Asia. Analyses of these samples are underway. Because humans are susceptible to HPAI, there is intense interest in developing a surveillance system before the virus enters North America. A national interagency working group was formed to develop a surveillance and detection strategy that calls for sampling wild, live-caught birds; birds found during mortality events; domestic and sentinel bird species; and birds harvested by sport and subsistence hunters.

The USGS received $3.67 million in FY 2006 for highly pathogenic avian influenza research. The first phase of the accelerated program is scheduled for Alaska in 2006 and involves the USGS, the FWS, the Alaska Department of Fish and Game, the University of Alaska-Fairbanks, and the Department of Agriculture. In addition, a steering committee was formed to plan a workshop on avian influenza for winter 2006. The purpose of the workshop is to begin planning for the 2006 field season by establishing standard operating procedures for sampling and analysis, and to coordinate sampling efforts for the field season.

Program: Terrestrial, Freshwater, and Marine Ecosystems
Project Name: Conservation and Carbon Sequestration in Natural and Restored Wetlands
Project Description: In the Prairie Pothole Region (PPR) and in the Lower Mississippi Valley (LMV), restoration of wetlands and adjacent upland habitats provide habitats for fish and wildlife, and also have an important effect on storage or sequestration of carbon and emissions of greenhouse gases in the United States. Mitigation of greenhouse gas emissions through terrestrial carbon sequestration is currently a national priority. Ongoing research by the USGS in evaluating Interior wetland restoration activities in the PPR and the LMV will quantify the influence of land-use change on greenhouse gas relationships, identify environmental factors controlling carbon sequestration and greenhouse gas emissions, and provide recommendations and decision support tools to maximize greenhouse gas benefits that are consistent with Interior goals for habitat conservation and restoration. Initial results documented that prairie pothole wetlands are carbon sinks in North America, and that agriculture, the dominant land use in the region, has caused most of these wetlands to shift from sinks to sources of atmospheric CO_2. The research also demonstrated that wetland restoration has over twice the potential as no-till agriculture to sequester atmospheric CO_2 although wetlands only occupy about 17 percent of the Prairie Pothole Region. This is the first paper to describe the size of the carbon sink attributable to wetlands in North America. Continuing research will quantify impacts of Interior and USDA programs on carbon sequestration and GHG offsets derived from restored wetlands and adjacent grasslands. The overall goal of this work will be to collect scientific information on GHG fluxes necessary to facilitate development of carbon-based markets that contribute to wetland conservation goals. Information derived from this research will be used by numerous partners and stakeholders interested in development of market-based solutions to offset GHG

emissions, including Interior, USDA, the North Dakota Farmers Union, and the Plains CO_2 Reduction (PCOR) Partnership managed by the Energy and Environmental Research Center.

FY 2005 Program Performance Accomplishments

In some instances, actual performance exceeded the USGS plan in FY 2005 for the number of systematic analyses and investigations provided to customers, and the number of formal workshops or training provided to customers. During the FY 2005 PART process, the USGS worked on standardizing definitions and consistency in their application. Effectively, the measures were rebaselined and outyear targets will be adjusted accordingly. However, the process will need another year to test before the USGS can become confident in predicting results.

The Forest and Rangeland Ecosystem Science Center (FRESC) underwent an administrative review in April 2005. In support of this review, FRESC employees participated in a survey that documented satisfaction with various aspects of administrative services. Although reported satisfaction was in general very high, employees submitted numerous suggestions for improvement. The review team is currently preparing a report and findings and recommendations to enhance administrative services at the FRESC.

The following program accomplishments listed below demonstrate the utility of "systematic analyses and investigations delivered to customers" and "number of formal workshops or training provided to customers."

Program: Status and Trends of Biological Resources
Project Name: Breeding Bird Survey - Forty Years of Science-based Avian Conservation
Project Description: Counting the birds since 1966, the North American Breeding Bird Survey (BBS) is widely recognized as the foundation of non-game, avian conservation in the United States and Canada. Using a scientifically rigorous, roadside sampling protocol, the BBS provides long-term, large-scale population trend data for over 400 bird species, which are used, along with other indicators, by the U.S. Fish and Wildlife Service, the Canadian Wildlife Service, State conservation agencies, Partners in Flight, and the North American Bird Conservation Initiative to set national and regional avian conservation priorities. Over 2,400 highly skilled observers sample 3,000 routes annually, representing more than a two-fold increase in BBS participation since the program began. Cumulatively, 7,800 people, mostly all volunteers, have participated in the BBS. In sampling over 82,000 routes, traveling over 4.1 million miles — a distance equivalent to eight roundtrips to the moon! — observers have identified and counted over 66 million birds representing 680 species.

Program: Fisheries: Aquatic and Endangered Resources
Project Name: Klamath Basin Water Management and At-Risk Fishes
Project Description: The Coho salmon and two sucker species remain on the Threatened and Endangered Species list in the Klamath Basin. The decline of these species is related to water availability in conjunction with loss of suitable habitat, poor water-quality conditions, and inadequate supplies of water to meet the needs of fish and irrigated agriculture. Drought conditions from 2001 through 2005 have made the water shortage particularly acute. Cessation of water to irrigators in 2001 in the Bureau of Reclamation's (BOR) Klamath Project and fish kills in 2002 focused national attention on the Klamath River. A Cabinet-level Klamath Basin Working Group was formed to look for short- and long-term solutions to water availability challenges in the basin. A multidisciplinary team of scientists from the USGS in collaboration with the BOR, the FWS, and other Federal, State, and tribal agencies, are investigating how

water quality influences the behavior, distribution, and survival of suckers in Upper Klamath Lake. Intensive data collection has documented lake water-quality conditions and sucker movement before, during, and after a sucker die off. The USGS and the FWS are using these data to assess how acute water-quality conditions develop, what might be done to lessen or mitigate their impacts on fish, and whether water-quality refuge areas are important for the survival of suckers. The FWS, BOR, and the Klamath Tribes rely on this scientific information in their efforts to restore critical habitats and recover these populations to healthy levels in collaboration with interagency efforts to meet the needs of fish, wildlife refuge areas, and irrigated agriculture.

Program: Invasive Species
Project Name: Development of Innovative Management/Control Techniques for Asian Carp
Project Description: Bighead and silver carp were imported into the United States in the early 1970s for use in aquaculture production of food fishes and biological control of plankton in aquaculture ponds, reservoirs, and sewage treatment lagoons. The carp escaped confinement and are now well established with reproducing populations in much of the Mississippi River Basin. Asian carp have the potential to compete with native fishes, disrupt aquatic food webs, and transmit disease pathogens. In FY 2005, the USGS completed a Biological Synopsis and Environmental Risk Assessment summarizing the biology and current and potential distribution of the genus Hypophthalmitchys. The assessment presented the current state of knowledge regarding the potential ecological impacts associated with the spread of these carp, control measures, and applicable regulations. The FWS uses this information as part of its evaluation of silver and bighead carp under the Injurious Wildlife provisions of the Lacey Act. USGS scientists also recently completed toxicity tests to determine the sensitivity of silver and bighead carp to potential chemical control agents, rotenone and antimycin, and evaluated the efficacy of several alarm and sex pheromones to attract or repel Asian carp. These tools will allow State and Federal managers to manage established silver and bighead populations and to curb the spread of these fish through the Chicago Sanitary and Ship Canal and other interbasin waterways.

Performance Overview

The Biological Research and Monitoring subactivity addresses the Department of the Interior Resource Protection strategic goals of improving the health of watersheds, landscapes, and marine resources; sustaining biological communities; and the Serving Communities strategic goal of protecting lives, resources and property.

The following table highlights important performance measures for the Biological Research and Monitoring subactivity:

Measure	2005 Plan	2005 Actual	Change from 2005 Plan	2006 Enacted	2006 Change from 2005 Actual	2007 Request	2007 Change from 2006
X% of targeted science products that are used by partners for species, habitat, and land management and/or regulatory decision-making **(PART)**	60%	60%	0	60%	0	65%	+5%
X% improvement in detectability limits for selected, high priority environmentally available chemical analyses **(PART)**	NA	NA	NA	Baseline	NA	12%	NA

Measure	2005 Plan	2005 Actual	Change from 2005 Plan	2006 Enacted	2006 Change from 2005 Actual	2007 Request	2007 Change from 2006
Customer Satisfaction: X% satisfaction with scientific and technical products and assistance for improving health of watersheds, landscapes and marine resources **(PART)**	≥90%	96%	NA	≥90%	NA	≥90%	0
Customer Satisfaction: X% satisfaction with scientific and technical products and assistance for sustaining biological communities **(PART)**	≥90%	87%	NA	≥90%	NA	≥90%	0
X% of targeted invasive species for which scientific information and decision support models are available to improve early detection (including risk assessments) and invasive species management **(PART)**	51.6%	51.6%	0	51.6%	0	52.5%	+0.9%
X% of North American migratory birds for which scientific information on their status (species distribution and number) and trend are available to inform and improve conservation **(PART)**	26%	26%	0	26%	0	26%	0
X% of targeted fish and aquatic populations for which information is available regarding limiting factors, including migratory barriers, critical habitat for at-risk species, and effects of disturbance (fire, flood, nutrient enrichment **(PART)**	31%	31%	0	31%	0	37%	+6%
Increase long-term trend precision (decrease bias) for existing species monitored through the Breeding Bird Survey to enable a detection of 50% population decline of relevant species within 20 years **(PART)**	0.0008	0.0008	0	0.0008	0	0.0008	0
Improve the X% of focal migratory bird species for which scientific information is available to support resource management decisionmaking **(PART)**	UNK	UNK	0	UNK	0	UNK	0
# systematic analyses & investigations provided to customers	753	1,314	+561	842	-472	865	+23
# of workshops and training provided to customers	55	247	+192	68	-179	68	0
Average cost per sample for selected, high priority environmentally available chemical analysis **(PART Eff Measure)**	700	700	0	700	0	680	-20

Activity: Biological Research

Subactivity: Biological Information Management and Delivery

Subactivity	2005 Actual	2006 Enacted	2007 Fixed Cost & Related Changes [a/]	2007 Program Changes	2007 Budget Request	Change from 2006
Biological Information Management and Delivery	23,999	23,794	+173	-2,000	21,967	-1,827
Total Requirements $000	**23,999**	**23,794**	**+173**	**-2,000**	**21,967**	**-1,827**
FTE	***80***	***80***	***0***	***-7***	***73***	***-7***

[a/] Fixed cost increases for this subactivity total $246, of which $173 will be budgeted and $73 will be absorbed.

Summary of FY 2007 Program Change for Biological Information Management and Delivery

Request Component	Amount	FTE
Program Changes		
• National Biological Information Infrastructure (NBII)	-2,000	-7
TOTAL	**-2,000**	**-7**

Justification of FY 2007 Program Change

The 2007 budget request for the Biological Information Management and Delivery is $21,967,000 and 73 FTE, which is a program change of -$2,000,000 and -7 FTE.

The USGS proposes the following decrease to help insure the availability of resources to mitigate natural hazards and conduct Earth observation and monitoring.

National Biological Information Infrastructure (-$2,000,000 and -7 FTE) — The USGS proposes to reduce funding for 7 of 14 nodes. The USGS would preserve access to data currently served through these nodes by transferring some of the data to the USGS Center for Biological Informatics. However, the USGS would be unable to increase the amount of data associated with some issue areas. The USGS would ensure that there is no impact to data and information critical to hurricane restoration efforts.

The impact of the proposed reductions on the individual nodes is shown in the table below.

(Dollars in thousands)

NBII Node	Current Funding	Proposed Reduction
Northeast Information Node	450	-350
Mid-Atlantic Information Node	460	-230
Southern Appalachian Information Node	1,900	-1,000
Central Southwest/Gulf Coast Information Node	910	-200
Mountain-Prairie Information Node	140	-40
California Information Node	190	-90
Pacific Northwest Information Node	190	-90
Total Proposed Reduction		-2,000

Results of this proposal would include 6 fewer training/workshop events in FY 2007. The reductions would also result in a decrease of 7 FTE.

Program Performance Change Table

Total Performance Change:		***-6 workshops and training***			
	A	***B***	***C***	***D= B+C***	***E***
	Overall Performance Changes from 2006 to 2007				
Measure	**2006 Enacted Performance**	**2007 Base Performance Level**	**2007 Impact of Program Change on Performance**	**2007 Budget Request Performance**	**Out-year Impact of 2007 Program Change on Performance**
Serving Communities – # of workshops or training provided to customers	**22**	**22**	**-6**	**16**	**0**

Column B: The performance level expected to be achieved absent the program change (i.e., at the 2006 request level plus/minus funded fixed cost/related changes); this would reflect, for example, the impact of prior year funding changes, management efficiencies, absorption of fixed costs, and trend impacts.

Column E: The out-year impact is the change in performance level expected in 2008 and Beyond of ONLY the requested program budget change; it does not include the impact of receiving these funds again in a subsequent outyear.

Program Overview

The Biological Information Management and Delivery activities are performed through the USGS Biological Informatics program. The mission of this program is to create the informatics framework, provide scientific content, and develop the public and private partnerships needed for the understanding and stewardship of our Nation's biological resources. The Biological Informatics program provides access to information for science-based decisionmaking, particularly as it pertains to the conservation, management, and use of the Nation's natural resources. In addition, the program develops and makes available tools, models, visualizations, and applications to aid policy and resource managers in the analysis and synthesis of scientific data to support decisionmaking. The program works in cooperation with many organizations throughout the United States and the world to provide biological information to partners, stakeholders, customers, and the general public. Through electronic infrastructures, the

program delivers relevant data and information faster and in more interoperable formats than in the past, leading to better stewardship of the Nation's natural resources.

This program addresses the Department's Serving Communities strategic goal of advancing knowledge through scientific leadership and informing decisions through the application of science. The USGS plays a vital role in making biological data and information more accessible and useable. Key indications of USGS performance are reflected in the intermediate outcome measures for improving the information base, information management and technical assistance. New performance measures resulting from the PART are incorporated into the performance tables beginning on page J - 43.

The program's progress is assessed by metrics that are reported through the Government Performance and Results Act reporting structure, and within several executive level reporting and oversight strategies including OMB's Program Assessment and Rating Tool (PART) and the Capital Asset Plan and Business Case (Exhibit 300). Tracked activities include efficiencies such as the number of cumulative gigabytes managed, outputs such as the number of NBII Clearinghouse metadata records available, and the number of systematic analyses delivered to customers, and outcomes such as percent of U.S. land with land characterization and species distribution information available for resource management decision making updated in the last 5 years.

Program Components

The core and interdependent components of the Biological Informatics program have been specifically designed to integrate information across geographic and political scales (local to global) and biological levels of organization (genomes to biomes).

The following are the core components of the Biological Information Management and Delivery subactivity.

- *Landscapes, Stewardship, and Species Distributions.* The Gap Analysis Program (GAP) generates databases on native vertebrate species distributions and natural land cover types to provide State, regional, and national conservation assessments.
- *Biosystematics and Nomenclature.* The Integrated Taxonomic Information System (ITIS) is under development to provide an authoritative source of species names and their hierarchical classification. The completed portions serve as a taxonomic standard for other program components and the global community, enabling the comparison of biodiversity data sets at all biological levels.
- *Genomes to Biomes.* The National Biological Information Infrastructure (NBII) continues development to provide the biological community and others with a fully digital, interactive, distributed system that provides scientifically reliable biological data and information and a suite of tools for analysis, synthesis, and forecasting. Network-wide methods and standards for organizing content to enhance the retrieval, integration, and use of information are a key component of the NBII.

The program works collaboratively with others to ensure that it is building a store of high quality data and information that can be used to address resource management issues. To that end, the program engages USGS science centers, non-governmental organizations, museums, universities, international organizations, and other partners in the creation of data content and resources to address resource management needs.

Program goals, as outlined in the program's 5-year plan, are to:

- Increase the availability and usefulness of biological resources data and information (content),
- Implement technologies and tools to integrate, analyze, visualize, and apply biological information to natural resource issues (tools),
- Develop, apply, and promote the adoption of standard practices, protocols, and techniques to enhance knowledge discovery and retrieval from various resources (infrastructure),
- Facilitate information science research that supports the advancement of biological informatics capabilities (research), and
- Apply innovative technologies and best practices to improve the development, description, and dissemination of biological information to customers (customers).

Customers and Partners — The USGS national-level approach to managing biological and natural resource data and scientific information ensures the application of standards that foster opportunities for collaboration and cooperation. The USGS places a premium on partnerships at all levels of government and with nongovernmental entities, including the private sector. These partners use USGS-generated scientific data and information that contributes to the knowledge base, which then becomes available to Interior land and resource managers, and others.

For example, each node of the National Biological Information Infrastructure (NBII) is developed through the collaboration of the partners and customers involved with that node. All together, NBII has over 250 partner organizations and agencies that help define the direction both of individual nodes and of the NBII as a whole.

National Biological Information Infrastructure (NBII) — The NBII is a tool for making biological data, information, and associated tools and technologies more accessible for customers and partners to use in making informed decisions regarding resource management, environmental considerations, disease vectors, control of invasive species, and other issues.

The NBII uses the capabilities of the Web and other advanced technologies to establish a distributed "federation" of biological data and information sources through which users can find biological information, retrieve it, and apply it to resource management questions. Partners and customers that take part in this effort include government agencies at all levels, private sector organizations, natural history museums, libraries, academic institutions, international scientific organizations, and the public.

The USGS works with many public and private partners in implementing the NBII to:

- Develop a nationwide network of NBII "nodes" focused on geographic and thematic perspectives,
- Expand the overall content of the NBII, and
- Develop and apply new information tools and technologies.

The NBII is a series of regional and thematic nodes. Regional nodes focus on and provide services within a particular geographic area of the country. Within a region, activities address

broad biological themes and issues that are uniquely regional. Currently, NBII has initiated eight regional nodes.

The thematic nodes of NBII are responsible for coordinating data and information within the scope of their assigned science focus areas at a national level. In doing so, they both initiate data gathering activities and coordinate relevant local data sets from the regional nodes. They also place a high priority on developing tools to allow users to interact with data from diverse sources. Currently, NBII has initiated four thematic nodes.

In addition to regional and thematic nodes which approach the task of making data and information accessible from geographic and topical perspectives, effort also is aimed at developing the infrastructure that underlies the data and information network. This infrastructure consists not only of the hardware and software required to make the network run. It also consists of the standards that must be implemented to make network-wide interoperability possible. As the node structure grows, a robust infrastructure becomes more and more critical so that necessary products and services may be provided to all nodes and not duplicated at node locations. This infrastructure, used by all nodes, enables network-wide search, access, and retrieval, and sharing of tools.

Gap Analysis — The Gap Analysis Program (GAP) provides broad geographic information on the status of species and their habitats and identifies the degree to which native animal and plant species are represented in the present-day mix of conservation lands (those species not adequately represented constitute conservation "gaps"). Currently, GAP products are available for most of the country. These products include digital databases describing statewide land-cover assemblages, distributions of mammals, birds, reptiles, and amphibians, and characterizations of land stewardship. The current emphasis of the program is on completing GAP projects in the few States where data are not available, updating selected regions of the country with state-of-the-art methods and technologies, organizing new aquatic projects, and developing partnerships with data users to facilitate use of GAP information in land-management decisions.

The USGS continues to emphasize GAP research and the development of applications to better serve the needs of Interior's land management bureaus, including the U.S. Fish and Wildlife Service, the Bureau of Land Management, and other agencies such as the U.S. Forest Service. New mechanisms being implemented to facilitate access to GAP products include regional views, species information at regional and national scales, and user-defined online mapping.

Integrated Taxonomic Information System (ITIS) — The USGS leads and works with other Federal agencies (including the Environmental Protection Agency, USDA Agricultural Research Service, USDA Natural Resources Conservation Service, National Oceanic and Atmospheric Administration, Smithsonian Institution, National Science Foundation, and the National Park Service), organizations, institutions, and taxonomic specialists across the United States and internationally to develop and operate the largest taxonomic thesaurus and database of its kind in the world. The ITIS provides an accepted scientific name (with a unique Taxonomic Serial Number) as the "common denominator" for accessing information on such topics as biodiversity, invasive species, declining amphibians, migratory birds, fishery stocks, pollinators, agricultural pests, and emerging diseases. The ITIS supports the development of the only comprehensive national taxonomic database that provides free access (directly over the Internet) to standard scientific names for all U.S. plant and animal species.

FY 2007 Program Performance Estimates

The 2007 budget request for the Biological Information Management and Delivery subactivity is $21,967,000 and 73 FTE.

The USGS conducts periodic program reviews to evaluate the relevance, significance, effectiveness, and productivity of ongoing scientific activities and to set goals, objectives, and priorities for future work. Program reviews are to be conducted every 5 years. The Biological Informatics program will be reviewed in FY 2007.

Under the Serving Communities strategic goal, the metrics for the number of clearinghouse records shown in the performance tables are cumulative. Previous records will be maintained and an estimated 500 additional records will be added in FY 2007. Estimate is based on history, adjusted for expected funding levels.

Under the Serving Communities strategic goal, the FY 2007 proposed decrease of $2,000,000 for the NBII would result in 6 fewer training/workshop events in FY 2007. The reductions would also result in a decrease of 7 FTE.

Regional Gap Analyses of Northwest and Southeast United States — In FY 2007, the Gap Analysis Program (GAP) will work to update land cover and use data in two regions of the United States, the Northwest and Southeast. The vegetation data developed by GAP are used for conservation planning, such as in State Comprehensive Wildlife plans, and for species modeling, such as needed by the FWS Joint Venture program. The regional focus of these updates will also allow State conservation and land management agencies and Federal land managers to better plan land use across State boundaries. For FY 2007, all seven mapping zones will be completed in the Southeast, and two mapping zones will be completed in Northwest. This supports the PART measure "% of U.S. land with land characterization and species distribution information available for resource management decision-making updated in the last 5 years."

National Framework for Invasive Species Early Detection and Rapid Response — In FY 2007, the Biological Informatics program will continue to develop the Department of the Interior's national framework for invasive species early detection, rapid assessment and response. The framework was created to respond to the growing threats and impacts of invasive species throughout the United States, and to help identify and coordinate current efforts to combat invasions by non-native species into the United States. Following an extensive survey and workshop to be conducted in FY 2006 of Federal, State, academic, and nongovernmental organizations to determine what components of the developing framework are currently underserved, this program will begin to develop tools and coordination efforts to address these gaps in the framework. This will build the framework toward its ultimate goal of promoting the timely forecasting, identification, reporting, verification, and removal of invasive species threats before they become widespread. This initiative will support the GPRA measure "Total number of cumulative gigabytes of data managed," and the PART measure "Amount of invasive species data available online via the NBII, to assist in modeling and forecasting the spread of invasives."

2006 Planned Program Performance

The FY 2006 revised performance plan anticipates the normal annual increase in number of metadata records (500) and links (2,500) over FY 2005 actual performance.

The NBII achieved certification and accreditation (C&A) in FY 2003 and was recertified in July 2004. Support for C&A of specific science program information technology comes from the NBII program and from the Enterprise Information program.

As the NBII reaches the next phase of maturity, the program has now begun to focus on the integration of the nodes into a coherent network. Beginning in FY 2006, both bottom-up (local/regional) challenges are being addressed at regional levels, and they are being integrated through a series of top-down (nationally-articulated) priorities. Through this effort, NBII's online network-wide presence is becoming more and more transparent (i.e., network-wide search, retrieval and access to data and tools across nodes without user knowledge or intervention.) The current technology being utilized enables an integrated, seamless infrastructure with no technological duplication of effort.

The table below details FY 2006 funding for the nodes within the NBII.

Node	Geographic Coverage	FY 2006 Funding ($000)
California Information Node	CA	190
Central Southwest/Gulf Coast	AR, LA, OK, TX	910
Mid-Atlantic Information Node	DE, MD, PA, VA, WV	460
Mountain-Prairie Info Node	KS, MT, NB, ND, SD, WY	140
Northeast Information Node	CT, ME, MA, NH, NJ, NY, RI, VT	450
Pacific Basin Information Node	HI	800
Pacific Northwest Information Node	ID, OR, WA	190
Southern Appalachian Info Node	AL, KY, MS, TN	1,900
Bird Conservation Node	National (Thematic)	180
Fisheries & Aquatic Resources	National (Thematic)	360
Invasive Species	National (Thematic)	910
Wildlife Disease	National (Thematic)	230
Knowledge Integration	Infrastructure	250
Network Standards & Technology	Infrastructure	250

In addition to the nodes, the NBII program uses funds to provide prototype activities designed as startup nodes in regions not yet covered and funds opportunities to respond to special information needs of partners and customers.

The following program activities demonstrate the utility of "number of cumulative gigabytes managed," and "number of cumulative NBII Clearinghouse metadata records."

Restoring and Repairing Coastal Wetlands — The topic of coastal wetlands is much in the news following the devastation wreaked by hurricanes in the 2005 season. But even prior to these forceful natural events, U.S. coastal wetlands have been the subject of scientific scrutiny as these important habitats are increasingly depleted through both natural and human intervention. Wetlands represent some of the most productive habitats in the world, and their preservation is paramount to many species. To that end, the NBII Central Southwest/Gulf Coast Information Node has initiated a project to assist scientists in geospatially visualizing wetland status before and after mitigation efforts. This mapping application will show wetland location

and distribution of estuarine and freshwater wetland habitats. Partners in this project include the U.S. Fish and Wildlife Service's Texas Coastal program, the National Oceanic and Atmospheric Administration Fisheries Galveston Laboratory, the Texas Parks and Wildlife Department, the Galveston Bay Estuary program, the Galveston Bay Foundation, the Houston Advanced Research Center, the USGS National Wetlands Research Center, and the USGS Center for Biological Informatics. Partners will work together to identify, manage and update relevant data sets for inclusion in this Web-based mapping application.

One-Stop Access to Biological Maps and Data Enabled by the NBII Geospatial Program — Lack of online access to maps and data related to biology and ecology presents a barrier to resource managers faced with making science-based decisions. These managers require instant access to data and tools that must be available with little or no downloading, translating, or geospatial processing requirements. In FY 2005, the NBII infrastructure team designed and installed the basic components of the Geospatial Interoperability Framework architecture, supporting the Geospatial One Stop E-Government initiative and focusing specifically on meeting the needs of the biological community. These tools are based on standards that allow instant visualization of data through a Catalog of Interactive Biological Data and Maps and a map viewer tool. Together, these components created an environment that brought NBII users from finding data sets through metadata repositories to finding and using data with instant, online interactive mapping. Not only does this framework allow for instant visualization of maps and data, it does so without requiring additional investments in technology by the users. In FY 2006, the NBII will focus on building an intuitive searching capability using geospatial terms and concepts. This will be incorporated into the core of all of NBII resources. Users will be able to discover resources, and more importantly, interact with those resources that are not explicitly described geospatially. For example, a search of "plants within Virginia" will not only return species descriptions, range maps, and other relevant resources for plants, but can also return resources about plant species that might occur based on similar habitats to those found in Virginia. This intuitive search capability brings to the NBII network information not traditionally returned from search engines without such geospatial intelligence. Through its partnership with USGS National Map program, the NBII has been able to leverage online access to catalogs of live maps and data. And as the biology and ecology channel steward for Geospatial One-Stop, NBII will make all of these resources available to the larger community.

Gap Analysis Program — The GAP has completed a five-State (Nevada, Utah, Colorado, New Mexico, and Arizona) project to update land cover data, animal distribution models, and other GAP-related data in the Southwestern United States. Completion of this data set marks the most extensive update of GAP data to date. As this Southwestern GAP project came to a close, the GAP began similar efforts in the Pacific Northwest. In areas of the country where recent data sets have been developed, such as the Midwest and the Southeast, the GAP has initiated projects to take existing products and data and consolidate them into regional databases. This makes data and information more accessible and useful to Federal and State resource managers and other users when analyzing data across State boundaries. Furthermore, State and local planners use decision-support systems and other technologies developed by the GAP to protect and manage resources. Aquatic projects are underway in Hawaii, the Great Lakes region, the Southeastern United States, and in most of the Missouri River drainage. These projects have completed the initial data collection phase and have started the second phase of modeling and analysis. The initial data consolidation phases and classification of aquatic habitats has begun in the Lower Colorado River, Puget Sound, and the Delaware River Basin. This supports the PART measure "content and expanse of knowledge: 83 percent of surface

area with temporal and spatial monitoring, research, and assessment/data coverage to meet land use planning and monitoring requirements."

2005 Program Performance Accomplishments

Under the Serving Communities strategic goal, partnerships resulted in greater-than-expected increases in the number of metadata records submitted to the NBII Clearinghouse and the number of biological partnership links in FY 2005.

Combining Fire and Water – Meeting the Information Needs of the Southwest — Resolving complex issues related to fire, water, and ecosystem health in the Southwest depends on identifying and using the best available scientific information. Unfortunately, the needed information, databases, and tools are often scattered among a variety of agencies, making them time intensive to locate and easy to overlook. The National Biological Information Infrastructure has produced the Water and Fire Environmental Resources (WAFER) application which serves metadata about water and wildfire data sets from Federal, State, local, and tribal agencies. Data sets cover information related to fire events, fire history, prescribed burn opportunities and plans, fuel treatments, fire risk, current and historical drought conditions, climate history, weather conditions, daily stream flows, storm events and lightning strikes, surface and groundwater locations and depth, and aquifer and watershed boundaries and conditions. Users can access metadata records via a full-text search capability or an interactive map viewer. Also the map viewer data layer is served according to a standard that makes it portable, allowing users to add it as a GIS (Geospatial Information System) layer in their own software. NBII-WAFER was developed by the Fort Collins (Colorado) Science Center in partnership with the New Mexico State University Laboratory. NBII worked with the Southwest Strategy (SWS) to identify and prioritize key issues associated with information needs in the region, which includes Arizona, Colorado, Nevada, New Mexico, and Utah. The SWS *(http://www.swstrategy.org/)* is a consortium of Federal, State, tribal, and local agencies that facilitates scientifically based approaches to resolve resource conservation and management issues. NBII-WAFER enables resource managers, policymakers, landowners, and other decisionmakers to quickly identify data sets that meet their individual needs and inform their planning and management decisions. This project addresses the program goal of increasing the availability and usefulness of biological data, and the accompanying measure of increased content in NBII reflecting program and partner priorities.

Consolidated U.S. GAP Data Set Makes Integrating and Using GAP Data Faster and Easier — Land and resource managers are continually faced with making important decisions that have a direct impact on species, land use, and conservation. In addition, scientists, managers and others who are concerned about the environment need access to data and information on where species and natural communities occur and how they are being managed for their long-term survival. To inform these stewardship decisions, the Gap Analysis program (GAP) collects, analyzes, and reports data on mammal, bird, amphibian and reptile species distribution, vegetation, and conservation status. GAP 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 the conservation fabric. These data have been available through printed reports and on CDs on a State-by-State basis, with 36 State projects complete and more to be completed this year. Together, these State data results cover 83 percent of the United States. The shear volume of this data, and the availability in 36 separate pieces, demanded better discovery and visualization tools to allow managers and others a simple means of finding and viewing the data from GAP. The introduction of GAP data online allows

users to integrate GAP data across State boundaries, creating a single data set that is the most complete biodiversity characterization available in the United States This supports the PART measure "content and expanse of knowledge: 83 percent of surface area with temporal and spatial monitoring, research, and assessment/data coverage to meet land use planning and monitoring requirements." This Web-based tool is available at *http://gapanalysis.nbii.gov*.

Integrated Taxonomic Information System (ITIS) Nears One Half Million Names — ITIS is the premier automated and authoritative source for scientific names for North America and the world. ITIS has become the de facto taxonomic authority in the United States, Mexico, and Canada and, with its partner Species 2000, has produced the de facto world authority in the Catalogue of Life. In FY 2005, ITIS added or edited more than 70,000 scientific names to its database and reached a content level of nearly 500,000 names. ITIS now has current taxonomic and geographic information for all North American vertebrate groups (mammals, fishes, reptiles, amphibians, and birds). In addition, several groups with worldwide treatment have been added, including amphibians, fishes, and several invertebrate groups. In FY 2006 and FY 2007 ITIS plans to complete the North American fauna and flora. Key partners and collaborators include the Smithsonian Institution, the Environmental Protection Agency, the National Oceanic and Atmospheric Administration, U.S. Department of Agriculture, the National Science Foundation, the National Park Service, Conabio (Mexico), Agriculture and Agri-foods Canada, Species 2000, and the Global Biodiversity Information Facility. Key customers include resource managers, scientists, libraries, museums and the public. ITIS is readily available through the National Biological Information Infrastructure and the Catalogue of Life is available via CD.

It's Easier Than Ever to Follow the Birds — In 2005, the NBII Bird Conservation Node continued to support the development of Web sites, tools, and applications that increase access to data on North American birds and facilitate integration of the data across geographic scales. This year, the NBII Bird Conservation Node made available online the North American Breeding Bird Atlas (BBA) Viewer and BBA Explorer, providing access to results from multiple State and provincial Breeding Bird Atlas projects. These atlases are population surveys that assess the distribution of breeding birds based on a "block" system, with blocks about 2 to 3 miles on a side. To discover whether a species nests in your local area, a breeding bird atlas is often the best source of information. If you don't own the published atlas or want to look at data from multiple atlas projects, you now have help. The BBA Viewer is a mapping application that allows users to map species results from multiple Breeding Bird Atlases in North America for the first time. In addition to these maps, the BBA Explorer Web site allows users to learn about methods used in each Breeding Bird Atlas project, and to retrieve Atlas project results in a tabular form by species, block, or region (e.g., by county). These tools are part of a suite of tools, including BBA Manager, that facilitate data management and display of BBA results. As of May 2005, the BBA tools contained data for 16 States and one Canadian province. The tools were developed through a collaborative effort among the following partners: the USGS Patuxent Wildlife Research Center, the USGS Center for Biological Informatics, the U.S. Fish and Wildlife Service.

Performance Overview

The Biological Information Management and Delivery subactivity addresses the Department's Serving Communities strategic goal of advancing knowledge through scientific leadership and informing decisions through the application of science.

The following table highlights important performance measures for the Biological Information Management and Delivery subactivity:

Measure	2005 Plan	2005 Actual	Change from 2005 Plan	2006 Enacted	2006 Change from 2005 Actual	2007 Request	2007 Change from 2006
Improve access to needed science information (# of cumulative biological partnership links **(BUR)**	38,500	76,155	+37,655	83,770	+7,615	87,959	+4,189
Customer Satisfaction: X% satisfaction with scientific and technical products and assistance**(SP)**	≥80%	92%	NA	≥80%	NA	≥80%	0
X% of surface area with temporal and spatial monitoring, research, and assessment/data coverage to meet land use planning and monitoring requirements **(SP BIMD) (PART)** (# of square miles assessed by Gap analysis)	83%	83%	0	83%	0	84%	+1%
X% of US land with land characterization and species distribution information available for resource management decision-making updated in the last 5 years **(BIMD PART)**	23.3%	23.3%	0	28.3%	+5%	34.0%	+5.7%
X% of North American migratory birds for which scientific information on their status (species distribution and number) and trends are available in a standardized and exchangeable format, to improve conservation plans of federal and state agencies **(BIMD PART)**	20%	20%	0	25%	+5%	30%	+5%
X% of North American amphibians and reptiles for which scientific information on their status (species distribution) are available in a standardized and exchangeable format, to improve conservation plans of Federal and State agencies **(BIMD PART)**	90%	90%	0	91%	+1%	92%	+1%
X% of North American mammals for which scientific information on their status (species distribution) are available in a standardized and exchangeable format, to improve conservation plans of Federal and State agencies **(BIMD PART)**	93%	93%	0	94%	+1%	94%	0

Measure	2005 Plan	2005 Actual	Change from 2005 Plan	2006 Enacted	2006 Change from 2005 Actual	2007 Request	2007 Change from 2006
X% of US federally-listed threatened and endangered or indicator fish species for which scientific information on A species status is available in a standardized and exchangeable format to improve conservation plans of federal and state agencies **(BIMD PART)**	7.5%	7.5%	0	12.5%	+5%	17.5%	+5%
# of cumulative gigabytes managed **(Biology) (PART)**	380	791.25	+411.25	800	+8.75	820	+20
Amount of fire-related data and information available online via the NBII, to assist land managers in fire management decision making **(BIMD PART)**	1.5 gb	1.5 gb	0	2.0 gb	+0.5 gb	2.5 gb	+0.5 gb
X% of Natural History Museum specimen data records available online via the NBII, to assist researchers in identifying and addressing threats to human and animal health **(BIMD PART)**	17%	17%	0	25%	+8%	29%	+4%
# of cumulative NBII Clearinghouse metadata records **(BIMD) (PART)**	8,000	17,937	+9,937	18,000	+63	18,500	+500
Amount of invasive species data and information available online via the NBII, to assist in modeling and forecasting the spread of invasives **(BIMD PART)**	800 mb	800 mb	0	900 mb	+100 mb	920 mb	+20 mb
Average cost per gigabyte of data available through servers under Program control **(BIMD PART Eff Measure)**	$63,000	$63,000	0	$60,000	-$3,000	$55,000	-$5,000
# of NBII nodes **(BIMD) (PART)**	14	14	0	14	0	14	0
# of Natural History Museum specimen data records available online via the NBII, to assist researchers in identifying and addressing threats to human and animal health **(BUR)**	20 million	20 million	0	30 million	+10 million	35 million	+5 million
# systematic analyses & investigations delivered to customers	36	52	+16	36	-16	36	0
# of workshops and training provided to customers	22	23	+1	22	-1	16	-6

Science Centers and Field Stations Summary

Center Name	Location	FY 2005[1/] Estimate ($000)	FY 2006[1/] Estimate ($000)	FY 2007[1/] Estimate ($000)
Center for Biological Informatics	**Lakewood, CO**	**6,725**	**6,542**	**6,607**
Program Description: The Center facilitates access to and use of biological data and information through leadership in establishing standards, developing information products, and using information technologies. The Center supports such programs as GAP Analysis, the USGS/National Park Service Vegetation Mapping, and the National Biological Information Infrastructure.				
Upper Midwest Environmental Science Center	**LaCrosse, WI**	**3,628**	**3,873**	**3,676**
Program Description: The Center provides scientific leadership in a variety of areas including river ecology, restoration of degraded habitats, development of chemicals for fishery management, declining species, invasive aquatic species impacts and control, contaminants, and development of decision support models. The Center has lead responsibility for the Upper Midwest Amphibian Research and Monitoring Initiative and the Long Term Resource Monitoring Program on the Upper Mississippi River. Scientists at the Center anticipate emerging problems and information gaps and provide the leadership and the commitment to action needed for effective resource management.				
Field Stations: N/A				
Leetown Science Center	**Leetown, WV**	**7,901**	**7,825**	**7,725**
Program Description: The Center conducts research to provide land and resource managers information needed to restore, enhance, maintain, and protect biological resources and their supporting systems.				
Field Stations:				
Aquatic Ecology Laboratory	Leetown, WV	1,842	1,707	1,707
Fish Health Research Laboratory	Leetown, WV	1,197	1,110	1,110
Southern Appalachian Field Laboratory	Knoxville, TN	397	368	368
Great Smoky Mountain Field Station	Gatlinburg, TN	32	30	30
Northern Appalachian Research Laboratory	Wellsboro, PA	1,059	982	982
Conte Anadromous Fish Research Laboratory	Turners Falls, MA	1,511	1,521	1,521
Orono Field Station	Orono, ME	111	104	104
Columbus Field Station	Columbus, OH	131	121	121
Restoration Technology Laboratory	Leetown, WV	353	328	328
National Wildlife Health Center	**Madison, WI**	**4,752**	**4,700**	**4,700**
Program Description: The Center provides national and international leadership for addressing health issues involving wildlife resources under Interior's stewardship and to foster partnerships with others to address wildlife health as a component of ecosystem health.				
Field Stations:				
Honolulu Field Station	Honolulu, HI	181	181	181

Center Name	Location	FY 2005[1/] Estimate ($000)	FY 2006[1/] Estimate ($000)	FY 2007[1/] Estimate ($000)
Patuxent Wildlife Research Center	**Laurel, MD**	**13,054**	**13,301**	**13,301**
Program Description: The Center focuses on wildlife research and management, specializing in wildlife conservation, especially in such areas as waterfowl harvest management, wildlife habitat improvement, the effects of environmental contaminants, endangered species conservation, migratory bird management, and wildlife population analysis.				
Field Stations:				
Orono	Orono, ME	170	169	169
Athens	Athens, GA	949	966	966
Vicksburg	Vicksburg, MS	420	355	355
Narragansett	Narragansett, RI	453	507	507
Smithsonian	Washington, DC	1420	1515	1515
Syracuse	Syracuse, NY	137	142	0
Blacksburg	Blacksburg, VA	162	164	164
Biological Science Office of the Florida Integrated Science Center (formerly the Florida Caribbean Science Center)	**Gainesville, FL**	**5,420**	**5,675**	**5,675**
Program Description: The Center provides natural resource managers with scientific information needed for effective conservation with emphasis on biological resources of the Florida peninsula, the Southeastern States, and the Caribbean region. The Center focuses on coastal and marine ecology, ecosystems restoration ecology, invasive species, and biological diversity.				
Field Stations:				
Northeast Laboratory	Gainesville, FL	0	0	0
South Florida Field Stations	Miami/Homestead/ Ochopee, FL	1,018	1,066	1,066
Virgin Islands Field Station	St. John, U.S. Virgin Islands	166	174	174
Center for Coastal Geology and Regional Marine Studies	St. Petersburg, FL	864	905	905
Great Lakes Science Center	**Ann Arbor, MI**	**7,530**	**9,401**	**7,680**
Program Description: The Center meets the Nation's need for scientific information for restoring, enhancing, managing, and protecting the living resources and their habitats in the Great Lakes Basin Ecosystem. This mission is accomplished with scientific knowledge gained through quality research, inventory and monitoring, and information transfer.				
Field Stations:				
Lake Superior Biological Station	Ashland, WI	705	2,134	719
Lake Ontario Biological Station	Oswego, NY	366	373	373
Lake Erie Biological Station	Sandusky, OH	548	558	558
Cheboygan Vessel Base	Cheboygan, MI	334	340	340
Munising Biological Station	Munising, MI	107	109	109
Lake Michigan Ecological Research Station	Porter, IN	488	498	498
Hammond Bay Biological Station	Hammond Bay, MI	38	38	38
Tunison Lab. of Aquatic Science	Cortland, NY	654	917	667

Center Name	Location	FY 2005[1] Estimate ($000)	FY 2006[1] Estimate ($000)	FY 2007[1] Estimate ($000)
Fort Collins Science Center (formerly the Midcontinent Ecological Science Center)	**Fort Collins, CO**	**7,799**	**8,217**	**8,464**
Program Description: The Center conducts research and develops technical applications to assist land managers in understanding and managing biological resources, habitats and ecosystems. The Center is home to the National Institute of Invasive Species Science. The Center conducts research related to species & habitats, aquatic systems, riparian ecology, global change, fire ecology, and herbivore ecosystems in support of Department of the Interior bureaus and the International Center for Applied Ecology.				
Field Stations:				
Arid Lands Field Station	Albuquerque, NM	745	666	700
Jemez Mountain Field Station	Los Alamos, NM	142	146	154
Northern Prairie Wildlife Research Center	**Jamestown, ND**	**4.490**	**4,510**	**4,510**
Program Description: The Center develops research information on the quantitative ecological requirements for sustainable wildlife populations primarily in grasslands and wetlands, determines the distribution of flora and fauna, and identifies consequences of habitat loss, management, and restoration.				
Field Stations: N/A				
Columbia Environmental Research Center	**Columbia, MO**	**7,277**	**6,815**	**6,815**
Program Description: The Center provides scientific information and data needed to address national and international environmental contaminant issues, and effects of habitat alterations on aquatic and terrestrial ecosystems.				
Field Stations:				
Texas Gulf Coast	Corpus Christi, TX	418	419	419
Texas Gulf Coast	College Station, TX	142	142	142
Padre Island Field Station	Padre Island, TX	48	48	0
International Falls Field Station	International Falls, MN	98	98	98
Yankton Field Station	Yankton, SD	123	110	110
Jackson Field Station	Jackson, WY	130	137	137
National Wetlands Research Center	**Lafayette, LA**	**4,843**	**4,883**	**4,883**
Program Description: The Center conducts research to address loss of wetlands in coastal systems, the changes in fresh and estuarine systems because of changes in water quality, and the resulting effects on birds.				
Field Stations:				
Corpus Christi Field Station	Corpus Christi, TX	170	170	170
Baton Rouge Field Station	Baton Rouge, LA	106	106	106

Center Name	Location	FY 2005[1] Estimate ($000)	FY 2006[1] Estimate ($000)	FY 2007[1] Estimate ($000)
Northern Rocky Mountain Science Center	**Bozeman, MT**	**3,001**	**2,913**	**1,968**
Program Description: The Center conducts research to provide land and resource managers information needed to restore, enhance, maintain, and protect natural resources of the Rocky Mountain ecosystems.				
Field Stations:				
Glacier Field Station	West Glacier, MT	339	333	333
Missoula Field Station	Missoula, MT	96	96	96
Western Fisheries Research Center	**Seattle, WA**	**3,649**	**3,695**	**3,584**
Program Description: The Center provides scientific research and technical assistance to support the best possible stewardship of the natural resources, emphasizing fish populations and aquatic ecosystems of the West.				
Field Stations:				
WFRC Seattle Lab	Seattle, WA	2,062	1,933	1,875
Columbia River Research Lab	Cook, WA	387	387	375
Reno Field Station	Reno, NV	272	272	264
Dixon Field Station	Dixon, CA	241	241	234
Klamath Falls Field Station	Klamath Falls, OR	531	706	685
Marrowstone Marine Station	Nordland, WA	156	156	151
Biological Science Office of the Alaska Science Center	**Anchorage, AK**	**6,500**	**6,517**	**6,566**
Program Description: The Center provides biological information and research findings to resource managers, policymakers, and the public to support sound management of biological resources and ecosystems in Alaska. The Center's research focuses on arctic and subarctic ecosystems, marine mammal ecology, migratory birds, and terrestrial mammal ecology. The Center has duty stations in various locations that do not have independent budgets.				
Pacific Island Ecosystems Research Center	**Honolulu, HI**	**2,985**	**2,988**	**2,991**
Program Description: The Center conducts research to provide managers of terrestrial and marine resources information needed to restore, enhance, maintain, and protect biological resources and their supporting ecosystems in the Pacific Basin.				
Field Stations:				
Kilauea Field Station	Hawaii National Park, Hawaii, HI	1,690	1,775	1,860
Haleakala Field Station	Makawao, Maui, HI	378	397	416
Manoa Field Station	Honolulu, Oahu, HI	45	47	49
Western Ecological Research Center	**Davis, CA**	**6,427**	**6,532**	**6,832**
Program Description: The Center provides biological information and research findings to resource managers, policymakers, and the public to support sound management of biological resources and ecosystems in California, Nevada, Arizona, and Utah. The Center's research focuses on work related to endangered species, waterfowl, amphibians, fire ecology, global change, and other ecological issues.				
Field Stations:				
Santa Cruz Field Station	Santa Cruz, CA	923	938	938
Piedras Blacas Field Station	San Simeon, CA	-	-	-
Dixon Field Station	Dixon, CA	829	842	842
Davis Station	Davis, CA	143	145	145

Center Name	Location	FY 2005[1] Estimate ($000)	FY 2006[1] Estimate ($000)	FY 2007[1] Estimate ($000)
Western Ecological Research Center Field Stations (continued):				
San Diego Field Station	San Diego, CA	1,131	1,149	1,299
Kern Field Station	Delano, CA	-	-	-
Channel Island Field Station	Ventura, CA	297	302	302
Point Reyes Field Station	Point Reyes, CA	215	219	219
Redwood Field Station	Arcata, CA	181	184	184
Sequoia-Kings Station	Tree Rivers, CA	511	519	669
Yosemite Field Station	Portal, CA	378	384	384
Golden Gate Field Station	Sausalito, CA	-	-	-
San Francisco Bay Field Station	Vallejo, CA	606	616	616
Nevada Field Station	Las Vegas, NV	-	-	-
Box Springs Field Station	Riverside, CA	259	264	264
Canyon Crest Field Station	Riverside, CA	-	-	-
Las Vegas Field Station	Las Vegas, NV	954	970	970
Forest and Rangeland Ecosystem Science Center	**Corvallis, OR**	**5,642**	**5,778**	**4,778**
Program Description: The Center provides scientific understanding and technology to support sound management and conservation of forest and rangeland ecosystems in the Pacific Northwest and Intermountain West.				
Field Stations:				
Regional Ecosystem Office	Portland, OR	175	182	189
Olympic Field Station	Port Angeles, WA	326	339	352
Snake River Field Station	Boise, ID	1,679	1,833	1,891
University of Washington Field Station	Seattle, WA	0	45	47
Southwest Biological Science Center	**Flagstaff, AZ**	**1,982**	**2,006**	**2,066**
Program Description: The Center conducts research and provides technical support to assist land managers with resource management and stewardship throughout the Southwest. Research focuses on arid-lands ecology, invasive species, ecosystem restoration, climate change, endangered species, wildlife-human interactions, inventory and monitoring, and other ecological issues. The Center also includes the Grand Canyon Monitoring and Research Station, which studies the effects of the operation of Glen Canyon Dam on downstream resources within the Colorado River Ecosystem.				
Field Stations:				
Grand Canyon Monitoring and Research Center	Flagstaff, AZ	0 (funded by receipts from power revenue)	0 (funded by receipts from power revenue)	0 (funded by receipts from power revenue)
Sonoran Field Station	Tucson, AZ	762	710	731
Colorado Plateau Field Station	Flagstaff, AZ	647	688	709
Canyonlands Field Station	Moab, UT	573	608	626

[1]/ Science Center and Field Station funding are estimates and do not include cyclical funds.

This page intentionally left blank.

Activity: Biological Research

Subactivity: Cooperative Research Units

Subactivity	2005 Actual	2006 Enacted	2007 Fixed Cost & Related Changes [a/]	2007 Program Changes	2007 Budget Request	Change from 2006
Cooperative Research Units	14,570	14,664	+274	0	14,938	+274
Total Requirements $000	14,570	14,664	+274	0	14,938	+274
FTE	***126***	***126***	***0***	***0***	***126***	***0***

[a/] Fixed cost increases for this subactivity total $391, of which $274 will be budgeted and $117 will be absorbed.

The FY 2007 budget request for the Cooperative Research Units program is $14,938,000 and 126 FTE. The USGS proposes no program or FTE changes for this program.

Program Overview

The Cooperative Research Units program is a unique cooperative partnership among Federal and State governments and academia, and provides one of the strongest partnership links between the USGS and Federal and State management agencies.

This program addresses the Department's Resource Protection strategic goal of sustaining biological communities by providing the natural resource management community with scientific information and trained personnel to implement sound resource management policies and practices. The USGS also tracks outputs including the number of systematic analyses and investigations delivered to customers and the number of workshops/training with USGS sponsorship or participation to transfer results to customers and partners.

In FY 2008, under the end outcome goal of sustaining biological communities, the USGS Cooperative Research Units program expects to deliver to its customers about 325 systematic analyses and investigations and 25 formal workshops/training courses regarding improve the information base, information management, and technical assistance.

Federal scientists stationed at universities (1) help identify and respond to natural resource information needs through the pooling of resources among agencies, (2) participate in the advanced scientific training of university graduate students, and, (3) provide Federal and other natural resource managers access to university expertise and facilities through geographically dispersed science organization of the Units. Federal support of the Cooperative Research Units is multiplied by State and university cooperator contributions of expertise, equipment, facilities, and project funding, thereby enhancing the program's cost-effectiveness. Through university affiliations, Unit scientists train future natural resource professionals and provide opportunities through graduate education to diversify the Federal workforce.

The USGS Cooperative Research Unit program is comprised of 40 Cooperative Research Units located at leading universities in 38 States, with a headquarters office in Reston, VA. The overall goal of the program is to maintain cooperative partnerships with Federal and State agencies to address mutual needs of all partners in a cost effective manner.

Funds appropriated to the Cooperative Research Unit program are used to staff, support, and manage USGS participation in this Federal partnership with States and universities. Ninety-one percent of FY 2005 program dollars were allocated to staff salaries and benefits, a number that is fairly typical for the program over time. The other 9 percent was used for national operations (rents, postage, travel, equipment, and moving expenses). The research and technical assistance activities of individual Units are supported by reimbursable funds from Federal, State, and local governments and nongovernment organizations. Each Cooperative Research Unit is directed by a Coordinating Committee of Federal, State, university, and nongovernment representatives. Each Coordinating Committee establishes the goals and expectations for each Unit within the program's mission of research, education, and technical assistance. The mix of priorities is established locally and changes annually based on the local needs of the cooperators and funding available from cooperators and program partners including Interior.

The following table lists cooperative research units by State:

Cooperative Research Units Locations

Alabama	Auburn University
Alaska	University of Alaska
Arizona	University of Arizona
Arkansas	University of Arkansas, Fayetteville
California	Humboldt State University
Colorado	Colorado State University
Florida	University of Florida
Georgia	University of Georgia
Hawaii	University of Hawaii
Idaho	University of Idaho
Iowa	Iowa State University
Kansas	Kansas State University
Louisiana	Louisiana State University
Maine	University of Maine
Maryland	University of Maryland, Eastern Shore
Massachusetts	University of Massachusetts
Minnesota	University of Minnesota
Mississippi	Mississippi State University
Missouri	University of Missouri
Montana	Montana State University (Fish Unit) University of Montana (Wildlife Unit)
Nebraska	University of Nebraska
New Mexico	New Mexico State University
New York	Cornell University
North Carolina	North Carolina University
Oklahoma	Okalahoma State University
Oregon	Oregon State University

Pennsylvania	Pennsylvania State University
South Carolina	Clemson University
South Dakota	South Dakota State University
Tennessee	Tennessee Tech University
Texas	Texas Tech University
Utah	Utah State University
Vermont	University of Vermont
Virginia	Virginia Polytechnic University
Washington	University of Washington
West Virginia	West Virginia University
Wisconsin	University of Wisconsin, Stevens Point (Fish Unit) University of Wisconsin, Madison (Wildlife Unit)
Wyoming	University of Wyoming

The Unit program is highly productive in scientific, academic, and outreach activities. Through affiliations with host universities, Unit scientists directly advise and mentor graduate students. Activities also involve Unit sponsorship of undergraduate and graduate education programs for minorities that are underrepresented in the Federal workforce. These efforts focus on minority student recruitment and career training in natural resources and include USGS programs for minority students at the University of Arizona and The National Cooperative Fisheries Scholars program at the University of Arkansas-Pine Bluff.

The USGS participates in annual program reviews at the local level and receives feedback from reviews and activities of a National Cooperator's Coalition (NCC) consisting of non-Federal program cooperators and other interested parties.

The following are the program goals of the Cooperative Research Units:

- Sustain a national network of Federal/State/university partnerships pursuant to the Cooperative Research Units Act, with a legislated mission of research, education, and technical assistance on issues related to fish, wildlife, ecology, and natural resources.
- Sustain a quality-driven, customer-oriented, network of expertise for research, teaching, and technical assistance that is responsive to the resource information needs of State resource agencies and host universities participating in the Cooperative Research Units program.
- Maintain science capabilities that are responsive to the resource management information needs of bureaus in the Department of the Interior and provide Department bureaus with access to these capabilities.
- Enhance and support science programs in the USGS by providing coordination and access to research capabilities at 40 host universities.

2007 Program Performance Estimates

The 2007 budget request for the Cooperative Research Units (CRU) subactivity is $14,938,000 and 126 FTE. To address the goals listed above, the CRU is planning the activities for FY 2007 as shown below.

The following program accomplishments listed below demonstrate the utility of "systematic analyses and investigations delivered to customers" and "number of formal workshops or training provided to customers."

In FY 2007, Unit scientists will continue to work directly with resource managers to identify and address information needs through research and technical assistance.

Meetings with Federal, State, university, and other cooperators from each of the Cooperative Research Units will be held to review Unit finances, performance, local program direction, and contributions of each cooperator to the operations of each Unit.

Continue development of E-Government capabilities to improve administrative and management efficiencies and to provide better access to CRU project information.

2006 Planned Program Performance

The following program accomplishments listed below demonstrate the utility of "systematic analyses and investigations delivered to customers" and "number of formal workshops or training provided to customers."

Meetings with Federal, State, university, and other cooperators from each of the Cooperative Research Units will be held to review Unit finances, performance, local program direction, and contributions of each cooperator to the operations of each Unit.

New customer feedback mechanisms will be developed and initiated to quantify satisfaction with program products.

Assess the impact of the retirements of senior scientific personnel on program productivity with a 5-year time horizon and improve projections of future program performance.

Build new capabilities for training minorities for careers in natural resources

Continue development of E-Government capabilities and improve availability of program information to other USGS programs as well as the conservation community through electronic means.

2005 Program Performance Accomplishments

The following program accomplishments listed below demonstrate the utility of "systematic analyses and investigations delivered to customers" and "number of formal workshops or training provided to customers."

All FY 2005 planned program goals as specified in the FY 2006 Budget Justifications were met as follows:

The USGS CRU national program office actively worked to maintain the Federal-State-university partnerships that support 40 Cooperative Fish and Wildlife Research Units. Meetings and correspondence were exchanged and management actions taken to address concerns and to identify opportunities.

Meetings were held with Federal, State, university, and other cooperators from all 40 of the Cooperative Research Units to review Unit finances, performance, local program direction, and contributions of each cooperator to the operations of each Unit. A national meeting of program cooperators (the NCC) was held in March, 2005.

In FY 2005, the program staffed the assistant unit leader-fish position at Nebraska and the Unit Leader position at Montana-Wildlife.

The USGS reviewed, renegotiated, and became signatories to four cooperative agreements for the operation of Cooperative Fish and Wildlife Research Units (10 percent of all Unit agreements).

The content and format of the programs report to cooperators was revised to display current work and productivity more effectively, and to program trend data. The report was delivered to cooperators within 6 months of the end of the fiscal year.

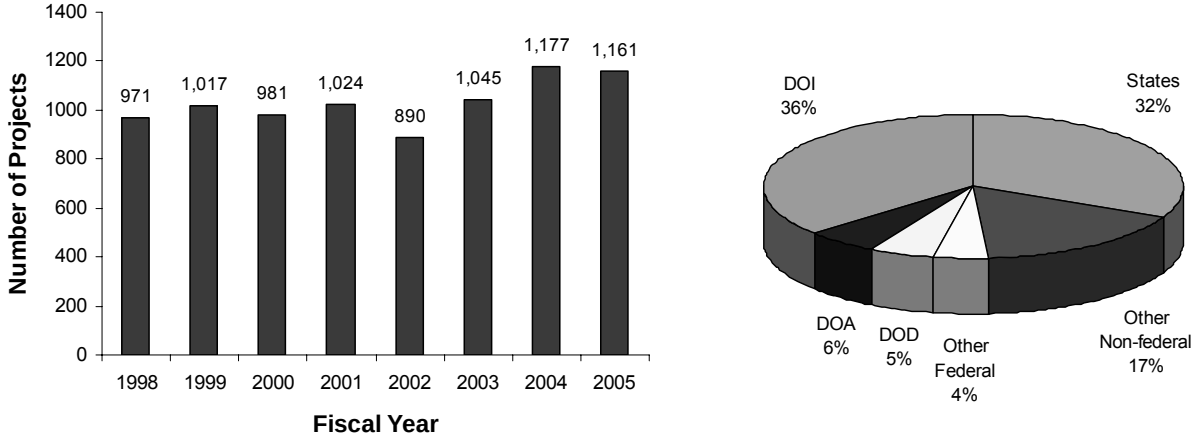
A functional centralized database for Research Work Orders was developed and integrated into standard procedures, linking work descriptions with contracting actions.

Program management conducted a workshop with cooperators and Unit scientists and developed draft strategic plan construct to serve as the basis for the program's Strategic Plan.

The program appointed a committee to and received a report on Unit options for increasing opportunities for groups typically underrepresented in the natural resource profession. Action was initiated with cooperators to review a current agreement for potential updating to facilitate greater educational opportunities for minorities in natural resource sciences.

The Unit program is highly productive in scientific, academic, and outreach activities. Through affiliations with host universities, Unit scientists directly advised and mentored 683 graduate students in FY 2005, in line with prior years, 125 of these students received graduate degrees in FY 2005.

During FY 2005, Unit scientists, affiliates, and students published approximately 236 scientific papers, submitted more than 144 reports to management agencies, and presented more than 661 papers and workshops to natural resource professional societies and agencies. In total, 1,161 research projects were active in FY 2005, with 138 Federal projects completed and over 103 new projects initiated in response to Federal agency needs. Unit projects covered a wide range of disciplines, including biodiversity, invasive species, anadromous fish and migratory bird management, habitat management and restoration, wildlife diseases, fire ecology, environmental contaminants, assessment of imperiled species, population modeling and conservation genetics.



Number of projects by year and funding sources for projects active during FY 2005.

The Cooperative Research Units provide needed research and technical assistance to numerous management agencies on issues related to fish, wildlife and other natural resources. Special emphasis is placed on assisting bureaus within the Department of the Interior and State agency cooperators. During FY 2005, Federal and affiliated university scientists and their students were actively engaged in more than 1,100 research projects, of which approximately 36% benefited five bureaus within the Department of the Interior and 32 percent benefited State agencies. Many of these projects also benefited more than one organization. Below is a summary of the projects Unit scientists completed for our Federal, State and Non-Federal partners in FY 2005.

Department of the Interior Partnerships

In fiscal year 2005, Unit scientists conducted 490 research projects for the Department of the Interior, including 212 for the USGS, 180 for the U.S. Fish and Wildlife Service, 59 for the National Park Service, 30 for the Bureau of Land Management, and 9 for the Bureau of Reclamation. Those projects covered a wide spectrum of research topics including population status of threatened and endangered species, wildlife and aquatic diseases, invasive species, impacts of environmental contaminants, response of animals to human activities, survey design, and landscape ecology. The following projects were completed in FY 2005 and exemplify the types of research investigations Unit scientists conducted for Interior.

- **California Cooperative Fish and Wildlife Research Unit —** Constructed the first-ever comprehensive map of Marbled Murrelet nests in California and identified the bird's behavioral response to human visitor activity. Results are being used by the National Park Service to manage visitor use in proximity to nest sites and to support recovery of the threatened murrelet.
- **Maine Cooperative Fish and Wildlife Research Unit —** Determined how to better model the distribution of vertebrate species by including not only primary habitat types as a model component, but also the proximity and juxtaposition of associated habitats. These new models provide more accurate predictions on where animals occur across large landscapes, thus providing multiple Federal and State resources agencies with improved tools for planning and management at the landscape level.

- **New Mexico Cooperative Fish and Wildlife Research Unit —** Assessed the impact of visitor traffic and forest structure on the ability of bighorn sheep to reach their summer mineral lick site at Sheep Lakes in Colorado's Rocky Mountain National Park. The National Park Service will use the results to improve its management of pedestrian and vehicular traffic along Fall River Road and to reduce visual obstruction along the sheep's forested route.
- **South Dakota Cooperative Fish and Wildlife Research Unit —** Conducted one of the first limnological studies on Angostura Reservoir in the Black Hills of South Dakota. Found that alterations in the population size of algae are attributed mostly to zooplankton grazing pressure, rather than nutrient concentrations. The findings will help the Bureau of Reclamation provide high quality water to reservoir user groups.
- **Washington Cooperative Fish and Wildlife Research Unit —** Determined how exposure to the surfactant nonylphenol, a chemical commonly used as a detergent and emulsifier, affects the ability of juvenile Pacific salmon to adapt to seawater. The U.S. Fish and Wildlife Service will use the findings to improve the quality of freshwater habitat for juvenile Pacific salmon with the goal of reducing smolt mortality during the fish's transition to seawater.

State Agency Partnerships

The Cooperative Research Units conducted approximately 430 investigations for their State cooperators in FY 2005. While many of those projects addressed the management needs for game animals and sportfish, numerous others explored the population dynamics of non-game species, studied the epidemiology of biological diseases, evaluated the efficacy of biological monitoring techniques, and identified ways to evaluate and improve wildlife and aquatic habitats. The following projects were completed in FY 2005 and serve as just a sample of the projects conducted for State cooperators.

- **Mississippi Cooperative Fish and Wildlife Research Unit —** From over 1,800 mourning doves banded at Hell Creek Wildlife Management Area, Mississippi, documented the survival rate and dispersal behavior for various sex and age groups of mourning doves. Weekly observations indicated that adult doves have a higher survival rate compared to juveniles and that adult males are more likely than females to disperse greater distances from their nesting site. The Mississippi Department of Wildlife, Fisheries and Parks is using the data to revise its harvest management strategies for mourning doves.
- **Montana Cooperative Fishery Research Unit —** Determined the location of the bacterial coldwater disease pathogen in a Montana hatchery system, how it was transmitted and what factors caused disease outbreaks. The findings are being used to reduce the frequency and intensity of disease outbreaks in Montana Department of Fish, Wildlife and Parks hatcheries.
- **North Carolina Cooperative Fish and Wildlife Research Unit —** Used a combination of field sampling, hydroacoustics, and bioenergetics modeling to examine striped bass growth rates, condition, age and size structure, and diet composition and abundance. The North Carolina Wildlife Resources Commission will use the results for managing reservoir populations of striped bass and their prey species.
- **Texas Cooperative Fish and Wildlife Research Unit —** Assessed the distribution and nesting habitat overlap of Ferruginous hawks and Swainson's hawks in the Texas

Panhandle. The Texas Parks and Wildlife Department is using the information to improve the way in which it works with private landowners to enhance non-game wildlife habitat on agricultural lands.

Other Federal and Non-Federal Partnerships

The Cooperative Research Units also conducted research projects for the U. S. Department of Agriculture (75), Department of Defense (69), National Oceanic Atmospheric Administration (42), Environmental Protection Agency (10) and non-Federal conservation entities (229) in FY 2005. Those projects focused on various topics, such as controlling the spread of invasive species, resolving human-wildlife conflicts, identifying the population dynamics and habitat associations of marine mammals, and understanding the basic life history and habitat requirements of animals that occupy non-Interior lands. The following projects were completed in FY 2005 and are representative of the projects CRU conducts for other organizations.

- **Oklahoma Fish and Wildlife Research Cooperative Unit —** Evaluated the extent to which small mammals and birds contribute to the expanding range of the invasive eastern redcedar. Birds were identified as the most likely the dominant disperser of redcedar seeds. Results of the study will help the Environmental Protection Agency develop risk management strategies that may limit the economic and environmental damage redcedar causes in grassland communities.
- **Virginia Cooperative Fish and Wildlife Research Unit —** Identified movement patterns and home range dynamics of over 350 black bears in the Alleghany Mountains of western Virginia from 1994-2004. The data were used to locate areas and habitats that were important to the bears on a seasonal basis. In partnership with the Virginia Department of Game and Inland Fisheries, the U.S. Forest Service will use the results to enhance black bear management on the George Washington and Jefferson National forests and Virginia's Wildlife Management Areas.
- **Washington Cooperative Fish and Wildlife Research Unit —** Estimated survival rates of the critically endangered western North Pacific population of gray whales. While the estimated annual survival rate for non-calf whales was high, the calf annual survival rate was lower than expected. The National Marine Fisheries Service, International Whaling Committee, and conservation-oriented organizations will use the results to establish recovery strategies for the gray whale population.
- **Wisconsin Cooperative Wildlife Research Unit —** Documented the importance of grassland habitat at Fort McCoy, Wisconsin, to birds. Observed 62 bird species using the military installation, including 12 species of concern to the conservation community, and discovered that predation limited the reproductive success of select sparrows. The Department of Defense will use the database to enhance its conservation efforts of grassland birds at Fort McCoy, including identifying ways to reduce nest predation.

Performance Overview

The Cooperative Research Units subactivity addresses the Department's Resource Protection strategic goal of sustaining biological communities.

The following table highlights important performance measures for the Cooperative Research Units subactivity:

Measure	2005 Plan	2005 Actual	Change from 2005 Plan	2006 Enacted	2006 Change from 2005 Actual	2007 Request	2007 Change from 2006
X% of CRU students that work on subsequent fish and wildlife science advance degrees or obtain employment in the fish and wildlife or other natural resources field, within targeted dates post-graduation **(CRU) (BUR)**	UNK	UNK	0	Baseline	NA	TBD	NA
X% of targeted science products that are used by Cooperators and partners for species, habitat, or land management and/or regulatory decision making within targeted dates following study completion **(CRU) (BUR)**	UNK	UNK	0	Baseline	NA	TBD	NA
# of students complete degree requirements for MS, PhD, and post doctoral program under the direction and mentorship of Unit Scientists **(CRU) (BUR)**	100	100	0	100	0	95	-5
# systematic analyses & investigations provided to customers	294	236	-58	235	-1	225	-10
# of workshops and training provided to customers	25	25	0	18	-7	15	-3

This page intentionally left blank.

Enterprise Information

Subactivity	2005 Actual	2006 Enacted [a/]	2007 Fixed Cost & Related Changes [b/]	2007 Program Changes	2007 Budget Request	Change from 2006
Enterprise Information Security and Technology	22,714	24,866	+309	+797	25,972	+1,106
FTE	*73*	*73*		*-3*	*70*	*-3*
Enterprise Information Resources	16,989	16,900	+225	-489	16,636	-264
FTE	*92*	*91*		*-3*	*88*	*-3*
National Geospatial Program	4,670	4,628	+65,164	-1,170	68,622	+63,994
FTE	*12*	*12*	*+303*	*-20*	*295*	*+283*
Total Requirements $000	**44,373**	**46,394**	**65,698**	**-862**	**111,230**	**+64,836**
FTE	***177***	***176***	***+303***	***-26***	***453***	***+277***

a/ National Geospatial Program FTE count for 2005 and 2006 was formerly included in Federal Geographic Data Coordination.
b/ Fixed cost increases for this activity total $1,997, of which $1,397 will be budgeted and $600 will be absorbed. Changes for this activity include an increase of $64,301 for the budget restructure which moves CTM to the National Geospatial Program.

Activity Summary

The 2007 budget request for the Enterprise Information Activity $111,230,000 and 453 FTE, which is a net change of +$64,836,000 and +277 FTE from the 2006 enacted level. Additional information on program changes is provided in each subactivity of this document.

The Enterprise Information (EI) Activity serves as the focal point for the bureau's information-related resources and activities; information technology infrastructures (networks, hardware and software); information and communications policies and standards; and information services (such as libraries, information centers, and the USGS presence on the Internet). A robust information architecture and comprehensive information security are key components of the integrated information environment. Within the integrated information environment, diverse and distributed databases, geospatial data assets, and information are accessed and used seamlessly by scientists, collaborators, customers, and the public to address complex natural science issues. The EI strengthens scientific inquiry within USGS and the broader natural science community by having

Use of Cost and Performance Information

Taxpayer Dollars Leveraged 73 percent by Partnering – The USGS saved taxpayers nearly $8 million in 2005 by coordinating its purchase of high resolution imagery with other government agencies. Instead of paying full price for imagery over 49 urban areas, USGS coordinated with others to jointly purchase data, enabling a 73 percent discount.

Cost Benefit Study Projects a Net $2.05 Billion in Benefits for *The National Map* – USGS scientists analyzed the overall costs and benefits to society of *The National Map*, which provides the Nation with spatial map data that are current, integrated, consistent, complete, and more accessible than in previous formats. The Cost Benefit Analysis measures the value of scientific applications that have utilized the geospatial data of *The National Map.*

a more efficient and less complex path to relevant USGS information in all forms – and enhanced access to services that deliver science information that can easily be understood, shared, and applied.

The EI is responsible for planning and monitoring the bureau's investment in geospatial information and IT, information security and management, information policy and standards, and information science. The duties, functions, and responsibilities of a Chief Information Officer are fulfilled in USGS by the Geospatial Information Officer (GIO), who also serves administratively as the Associate Director for Geospatial Information. The GIO is responsible for overall policy direction, management, and oversight of geospatial information, database, and coordination; computing systems acquisition, development, and integration; IT capital planning and investment management; information security; human capital for managing information resources; E-Government initiatives and innovation; strategic planning for information resources; enterprise architecture and advancing the Federal Enterprise Architecture (FEA); records management; privacy; and information collection, dissemination, access, and delivery. This suite of responsibilities is consistent with those of other Federal government agencies and leading private-sector entities in its comprehensive approach to information assets and is in accord with recommendations of the Government Accountability Office (GAO).

Budget Restructure — Prompted by National Research Council recommendations and by discussions with constituent groups on how to best serve their geospatial data needs, USGS geospatial data programs have been reorganized into a new National Geospatial Program (NGP). This realignment unifies *The National Map,* the Geospatial One-Stop (GOS) project, and coordination of the Federal Geographic Data Committee (FGDC) into a single program organization. Related activities under the management of NGP include emergency response support, The National Atlas, and Department of the Interior Enterprise Geographic Information Management. In 2005 and 2006, USGS worked with Interior, OMB, and Congress to align funding allocations and program management and oversight within the USGS. With the budget restructure proposed in the 2007 Budget Justification, most of the Cooperative Topographic Mapping (CTM) program and its funding will move from the Geographic Research, Investigations and Remote Sensing Activity to the Enterprise Information Activity to help create the new National Geospatial Program subactivity.

Geospatial Data Leadership — Joining USGS IT and geospatial assets into a single management portfolio led by the GIO has reaped several benefits: (1) It positions USGS as a national geospatial leader and knowledge broker in National Spatial Data Infrastructure (NSDI), (2) New regional geospatial information offices have enabled a stronger customer-based focus, (3) Geospatial IT activities are better coordinated across a greater range of projects and expertise (such as development of the Geospatial Modernization Blueprint along with the geospatial profile document for the FEA), (4) Opportunities for geospatial data partnering with State and local agencies have been expanded by adding IT specialists in the local offices, enabling and supporting closer ties to State-based geographic information councils and leveraging and aligning Federal strategies, plans, and resources with comparable State resources. Effective stewardship (and not ownership) of these USGS information assets has enabled citizens, agencies, and partners to tap reliable, timely, one-touch geographic display and access to a wealth of science knowledge, information, and data.

Program Assessment Rating Tool (PART) Evaluation

In FY 2004, the OMB PART for the FY 2006 Budget was applied to *The National Map*. OMB classified *The National Map* as a research and development program, scoring it at 90 percent

overall: 100 percent for program purpose and design, 100 percent for strategic planning, 100 percent for program management, and 80 percent for program results/accountability. Overall, the OMB rated *The National Map* as "effective." The score for the program is greatly improved from that assigned for the F 2004 Budget when the program was characterized as "results not demonstrated."

Workforce Planning

The GIO is conducting extensive workforce analysis to identify and support future needs. The GIO has undergone and will continue to execute skills assessments for information management and technology. Voluntary Separation Incentive Payments/Voluntary Early Retirement Authority (VSIP/VERA) and competitive sourcing under OMB Circular A–76 guidelines are tools that are being used to implement these future needs. As a follow-on to the 2004 USGS mapping workforce restructure, coupled with the USGS Director's decision from August 2004 to bring *The National Map* under the GIO, USGS has embarked on further steps toward organizational transformation. One of these steps included a 2005 competitive sourcing scoping and preliminary planning study, in which USGS carefully reviewed its geospatial data integration, access, and archive capabilities in light of rapidly changing mapping technologies. Technology has changed how USGS performs mapping activities and a large, field-based operation is no longer cost effective.

In January 2005, in an effort to further strengthen and align the geospatial data activities of USGS, the bureau created the National Geospatial Technical Operation Center (NGTOC), a single organization having a national capability and the potential to consolidate its four mapping centers (Reston, VA; Rolla, MO; Lakewood, CO; and Menlo Park, CA). The NGTOC was tasked with supporting all map production activities and technical services associated with the NGP, including the previous CTM program, management of the FGDC, GOS, and Interior's Enterprise Geospatial Information System. Services provided by NGTOC include geospatial data integration and quality assurance, cartographic production, contract management, software and applications development, and hosting of geospatial data and applications. In October 2005, Interior asked USGS to put on hold its A–76 study of NGTOC functions pending review of the consolidation of the NGTOC at the Denver Federal Center. An internal review of the decision process was undertaken in December 2005. The review team found "the process leading to the site selection for NGTOC was open, fair, and adequate to support the decision." In January 2006, Interior's Assistant Secretary for Water and Science concurred with this finding and the A–76 study was resumed.

The USGS created an Enterprise Publishing Network from a significant restructure of its workforce and business processes, using the High Performing Organization model. The restructuring achieved a unified bureau publishing policy, streamlined the publishing technical and business functions to ensure operational efficiencies accompanied by a significant reduction of staff and reduced of the number of operating locations by more than half. This is accomplished while maintaining the high quality of the scientific publications of USGS.

Further organizational transformation progress will also be made in 2006 and 2007 by a unified and efficient bureauwide Natural Science Network (NSN) to deliver science information and provide enhanced access to customers. These activities will include preparing a business strategy and, based on the strategy, decide whether competitive sourcing or an alternative strategy in 2007 would provide the best business and service model to USGS science programs as the external face to the public. Previous funding levels severely limited opportunities to update library and information delivery skills, acquire new skills needed for emerging

technologies, and implement realignment of positions within the existing library organization to provide the appropriate balance of skills and capabilities for supporting customer needs. The bureau was able to offer employee VSIP/VERA in 2005. The USGS information centers (Earth Science Information Centers) were consolidated with the USGS Library System to form the Science Information and Library Services component of NSN.

Enterprise Information Technology and Centralized Services — The 2007 budget for the Department includes programmatic increases for USGS totaling $1.5 million for projects and programs that are funded through the Working Capital Fund to support enterprise approaches that result in improved effectiveness and efficiency. These include the enterprise messaging system that will consolidate operations from independently operated bureau and office programs and result in the elimination of hundreds of servers and three messaging applications; a contracted effort to eliminate, over 3 years, the Department's backlog of nearly 2,000 appeals to Freedom of Information Act requests; and standardizing the applications used for geospatial information with the creation of an enterprise system that will improve the effective use of geographic information departmentwide.

Subactivity Overview

The Enterprise Information Activity comprises three subactivities that include:

Enterprise Information Security and Technology supports USGS information security and technology efforts. The information security component ensures compliance with all Federal information technology mandates and is responsible for the electronic security of and access to all USGS data and information assets. The telecommunications and computing infrastructure components support enterprise services network, directory services, technical support, enterprise architecture, email, and e-authentication.

Enterprise Information Resources guides and manages bureau-level systems and activities in information policy, information integration and delivery, and science education. The information integration and delivery component provides direction, coordination, and strategic planning of scientific data integration and management relating to Web-Internet services, science publishing, libraries, information centers, and enterprise-level coordination of educational activities and geographic information systems. The information resource management component supports compliance with statutory mandates and regulations for records archiving and management, privacy, Freedom of Information Act (FOIA), Section 508 of the Rehabilitation Act, E-Government Act, OMB Data Quality Guidelines, OMB Peer Review Requirements, Paperwork Reduction Act, and investment technology capital asset planning.

National Geospatial Program coordinates and provides leadership in geospatial activities that ensure the development, maintenance, and availability of geographic data and related geographic knowledge in support of the NSDI.

Activity: Enterprise Information

Subactivity: Enterprise Information Security and Technology

Subactivity	2005 Actual	2006 Enacted	2007 Fixed Costs & Related Changes[a/]	2007 Program Changes	2007 Budget Request	Change from 2006
Enterprise Information Security and Technology	22,714	24,866	+309	+797	25,972	+1,106
Total Requirements	**22,714**	**24,866**	**+309**	**+797**	**25,972**	**+1,106**
FTE	***73***	***73***	***0***	***-3***	***70***	***-3***

a/ Fixed cost increases for this subactivity total $441, of which $309 will be budgeted and $132 will be absorbed.

Summary of FY 2007 Program Changes for EI Security and Technology

Request Component	Amount	FTE
Program Changes		
• Departmental Working Capital Fund	+1,297	0
• Operational Efficiencies	-500	-3
TOTAL	**+797**	**-3**

Justification of 2007 Program Changes

The 2007 budget request for the Enterprise Information Security and Technology Subactivity is $25,972,000 and 70 FTE, which is a net program change of +$797,000 and -3 FTE.

Departmental Working Capital Fund (+$1,297,000 and 0 FTE) — Additional increases are requested for the centrally billed portion of the WCF related to Enterprise Services Network and Electronic Messaging System.

EI Security and Technology / Operational Efficiencies (-$500,000 and -3 FTE) — The proposed decrease achieves savings through economies of further IT centralization, consolidated software and hardware purchases, and workforce planning.

Program Performance Change — The departmental WCF increases do not affect USGS performance. Regarding the decreases for operational efficiencies, though the program contributes to the strategic goal of advancing knowledge through scientific information, there are no performance measures specifically linked to this program change.

Program Overview

The Enterprise Information Security and Technology (EIS&T) subactivity supports the USGS information security and technology efforts. The information security component ensures compliance with all Federal IT mandates and is responsible for the electronic security of and access to all USGS data and information assets. The telecommunications and computing infrastructure components support enterprise services network, directory services, technical support, enterprise architecture, email, and e-authentication.

Information Security

(Estimates for FY 2005, $5.4 million; FY 2006, $6.3 million; FY 2007, $6.4 million)

The information security component supports the USGS overall information security program, including compliance with the FISMA and other Federal laws directing IT, and is responsible for IT security operations to ensure the confidentiality, integrity, and availability of USGS data and information assets.

The USGS endorses the Department's direction to achieve rigorous IT security as the highest priority. Ensuring that networks and systems are secure and protecting the integrity of the data and information they house are two of the most critical issues facing the USGS. The USGS approach to improving its overall security posture is two-fold: (1) maintaining C&A of critical information systems, and (2) strengthening the overall IT security program of the bureau.

Acquiring, managing, and overseeing operational IT security technologies, tools, and procedures continue to provide significant long-term cost and operational efficiencies. This central approach to IT security offers both short- and long-term efficiencies in achieving an improved security posture.

Security Certification and Accreditation — The security C&A requirements dictate that all Federal high-risk IT systems are reviewed for security compliance based on OMB Circular A-130 requirements on a periodic basis. In addition to periodic re-certification and accreditation of USGS systems, it is necessary to continually monitor and maintain C&A status, as required by OMB. Although the source programs are required to fund re-certification and accreditation of IT systems, EIS&T supports USGS C&A activities under the direction of the C&A manager as well as funding contributions for specific needs.

Security Operations — The USGS carefully scrutinizes its network security systems, including monitoring and assessment of systems and networks to ensure constant security compliance, to identify potential vulnerabilities, to detect security intrusions, and to respond effectively to any and all IT security events and incidents. As part of this scrutiny, the USGS routinely tests its network for potential penetration vulnerabilities. This responsibility includes managing all IT security operations and implementing best-practices to ensure the confidentiality, integrity, and availability of USGS data and information assets.

Telecommunications

(Estimates for FY 2005, $6.4 million; FY 2006, $7.5 million; FY 2007, $8.6 million)

Enterprise Services Network — The Enterprise Services Network (ESN) consolidates all telecommunications networks into one integrated system. In 2007, USGS will have (1) passed the Connection Approval Process and will have connected for Internet 1 services at the five

Interior ESN Internet 1 nodes; (2) connected to the Intranet; and (3) started to "flattened" its networks to ESN. By the start of 2007, USGS will have completed connecting all field offices to the ESN, which previously had dedicated circuit connections, and all field offices will be monitored and managed by ESN with full 24x7x365 support.

Computing Infrastructure

(Estimates for FY 2005, $10.9 million; FY 2006, $11.0 million; FY 2007, $11.0 million)

Active Directory — Active Directory (AD) is a commercial off-the-shelf directory service that provides a consistent office automation infrastructure and a single point of access for systems administration.

IT Service Desk Consolidation — The consolidation of the help desk functions at the enterprise level into the IT Service Desk System will provide improvements and efficiencies in response time, problem resolution, and quality of technical support, while also relieving the individual science disciplines and offices from having to support and perform these functions independently. Under this strategy, the unified USGS IT Service Desk System will serve as a single point of contact for all IT customer support. The system will utilize specialized hardware and software and will primarily consist of IT support personnel across the USGS who will be formally linked together through organizational and matrix relationships to provide more consistent IT customer service. The heart of this system is a call center, referred to as a service desk. The service desk has primary responsibility for call resolution, call tracking, and customer satisfaction.

Enterprise Architecture — The USGS Enterprise Architecture (EA) builds upon the FEA and Interior Enterprise Architecture frameworks and identifies the unique requirements of USGS. These requirements include defining USGS scientific and administrative "lines of business" of high strategic value and identifying major USGS IT investment projects and business process re-engineering efforts that are planned or underway. The USGS EA team works closely with CPIC and the USGS Security C&A team to align USGS systems with investments and security.

Electronic Messaging System — The Electronic Messaging System (EMS) is a communication system that provides consistent collaborative email tools to all users.

E-Authentication — E-Authentication is one component of the Homeland Security Presidential Directive 12 (HSPD–12).

FY 2007 Program Performance Estimates

Information Security

The USGS will continue to rigorously maintain compliance with FISMA mandates for establishing and keeping the USGS electronic infrastructure secure and protected. The planned improvements to the USGS security infrastructure include: (1) improving IT security plans, (2) maintaining C&A of major IT systems, (3) enhancing computer incident response capabilities including reporting of security incidents to Federal Computer Incident Response Center, (4) conducting annual IT security awareness training of all USGS personnel and specialized training for employees with significant security responsibilities, and (5) establishing standard procedures for secure system configuration and operation to protect the confidentiality, integrity, and availability of the systems and the information they contain.

Formed in 2005, the USGS IT Security Steering Committee will continue to serve as the focal point for all IT security activities by overseeing policy formulation and appropriate review of policy, standards, and guidelines and by ensuring policies are consistently applied throughout USGS. This committee will also ensure that a correct balance is maintained between the requirements of IT security and the needs of scientific activities. Compliance with established standards and best practices will be measured by conducting management control and internal site reviews on a regular basis.

Security Certification and Accreditation — Systems scheduled for re-certification in 2007 include the Financial Management and Inventory Property Management Systems, Landsat Ground System, and infrastructure system categories. Additionally, previously certified and accredited systems will be monitored and assessed to ensure ongoing compliance with FISMA mandates. During 2007, USGS will continue to work closely with all its system owners to ensure that all requirements are met.

Security Operations — In 2007 USGS security operations will include (1) integrating penetration testing capabilities into the monthly assessment program for all its IT systems to ensure potential vulnerabilities are properly classified and corrected appropriate to the threat-level, (2) developing and implementing content management procedures to ensure that information is appropriately classified and managed in accordance with requirements for the separation of low-, medium-, and high-impact information, and (3) applying enhanced IT security controls and procedures to respond to prevailing threats to the confidentiality, integrity, and availability to USGS IT systems and the information they contain.

Telecommunications

Enterprise Services Network — During 2007, USGS will (1) provide Department Remote Access and VPN services to avoid duplicate expenditures and make the management of the remote access sites easier and (2) work with the Department to propose institutionalizing Internet 2 as a Department service, not just a USGS-provided service.

Computing Infrastructure

Active Directory — In 2007, the USGS AD project will have completed the infrastructure and science center phases of construction. This constitutes the majority of offices in the USGS. These migrations will continue to be consistent with the Interior IT Transformation Strategy. These migrations will enable the USGS to have a unified infrastructure and common desktop environment. The USGS will have also completed several parallel projects related to increased IT security, consistency, and administration. These projects include an architecture redesign of Domain Name Services and an implementation of common Patch and Virus Management and common Change and Configuration Management practice. The USGS IT infrastructure will have migrated from a decentralized distributed IT organization to one which is consistent, highly efficient, and recorded.

Enterprise Architecture — In 2007, USGS will continue to support and maintain the Department of the Interior Enterprise Architecture Repository (DEAR). A second major emphasis is the implementation of a Modernization Blueprint for the Geospatial Line of Business. The USGS architecture team will be working closely with the USGS IRB, Nation Geospatial Program Office, Unified Geospatial Enterprise Architecture Management Advisory

Council, FGDC, GOS, and Enterprise Geospatial Information Management in developing the USGS Geospatial Blueprint.

Electronic Messaging System — In 2007, the USGS will begin planning and migrating 13,000 email accounts to the Department's email system based on Microsoft Exchange. During this period, the USGS will need to concurrently run two email systems (Exchange and Lotus Notes) until migration is completed. The USGS will migrate user accounts based on site readiness. After the migration of email is completed, the USGS will begin evaluating the migration of other collaborative tools and the potential positive and negative impacts of this migration on the USGS users.

E-Authentication — In 2007 the USGS HSPD-12 E-Authentication team will (1) pursue single sign-on capabilities using smart cards, (2) pursue using the capabilities of smart cards to digitally sign official documents, (3) consider replacing existing Lotus electronic forms, and (4) pursue email encryption in Microsoft Exchange

FY 2006 Planned Program Performance

Information Security — USGS continues to emphasize the improvement of the IT Security Program as one of the bureau's highest overall priorities. The primary objectives for 2006 are: (1) improving the USGS IT security posture and compliance with Federal laws and regulations and Department and USGS policies and standards, (2) implementing best practices, and (3) supporting the USGS EI Program Five-Year Plan.

The USGS will ensure that effective information security practices are carried out by (1) publishing standards, guidelines, procedures, (2) providing general, role-based, and specialized IT security training, and (3) continuing to emphasis improved management, technical, and operational security controls. The transition of the security architecture to the ESN will continue, establishing a comprehensive network security infrastructure in the Department.

Security Certification and Accreditation — In 2006, USGS will remediate weaknesses identified in the C&A and Management Control Review processes. Seven systems are scheduled to be re-certified and accredited in 2006. Support contracts will be required for this work. Other planned activities include tests of contingency plans, additional C&A workshops, and compliance review.

Security Operations — Specific goals for 2006 include the following activities: (1) extending the proactive intrusion prevention technology to identify, log, alert, and automatically mitigate malicious network activities across the WAN, (2) integrating internal vulnerability assessment procedures to reduce potential vulnerabilities, (3) establishing a penetration test capability to ensure compliance with published standards, and (4) continuing initiatives for deployment of improved security controls using malicious code detection and mitigation profiles to enhance security for Web and ftp servers.

Enterprise Services Network — In 2006, USGS plans to continue the migration to the ESN with the bulk of the science centers managed by the ESN Network Operations and Security Center (NOSC) by the end of 2006. The transition of USGS science centers will be done regionally, starting with the Eastern Region and will be segmented into (1) monitoring science center network equipment (done automatically by ESN; USGS continues to make all

configuration changes), (2) managing science center network equipment (ESN does monitoring and makes all changes), and (3) optimizing connections with changes in circuit configurations. When complete, all sites will have 24x7 proactive network monitoring and will be fully managed to include router and switch configuration changes by the NOSC. Additionally, USGS will participate in the Remote Access and VPN trial, which will test the ESN Remote Access service. This test will use licenses from ESN's iPASS contract and will allow dial access connectivity. If successful, this newly provisioned ESN Remote Access service may replace the existing AT&T Remote Access service. This testing will be complete in second quarter 2006.

Additional planned accomplishments for FY 2006 include:

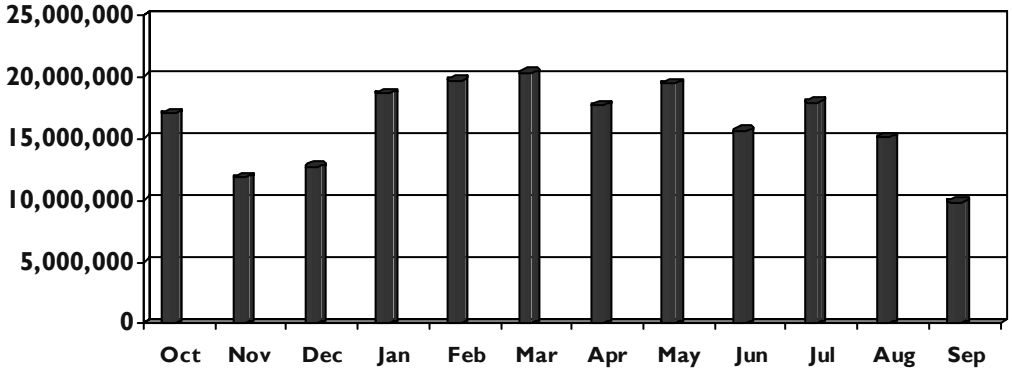
- Active Directory,
- IT Service Desk System,
- Enterprise Architecture,
- Modernization Blueprint,
- Electronic Messaging System, and
- E-Authentication

FY 2005 Program Performance Accomplishments

Security Certification and Accreditation — During 2005, USGS managed and maintained C&A status on all major system categories. These systems are composed of major application systems and general support systems. Four of the USGS systems were re-certified and accredited in 2005. Documentation for all system categories was reviewed for compliance based on Department and NIST requirements. Deficiencies identified were either corrected or scheduled to be corrected within the first quarter of 2006. The USGS established and executed three C&A training workshops, which focused on the creation of key documents in the C&A package.

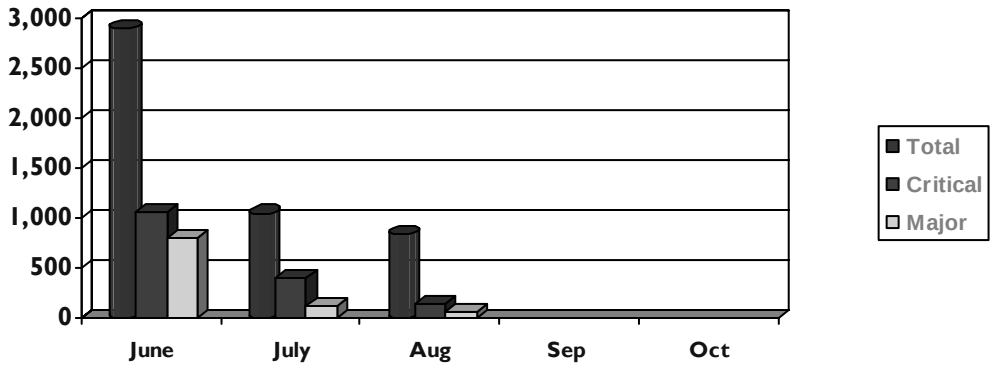
Security Operations — In 2005, USGS strengthened its security posture through deployment of intrusion prevention security systems to identify, log, alert, and automatically mitigate potentially malicious Internet and local-area activities. The USGS identified systems operating in the general network that have different security levels and moved these assets into separate security zones. The bureau's perimeter network is continually probed from potentially malicious Internet sources. The network security infrastructure is designed to intercept unauthorized attempted connections. The figure below shows 2005 monthly statistics for intercepted traffic at the USGS gateways.

FY 2005 Blocked Internet Probes



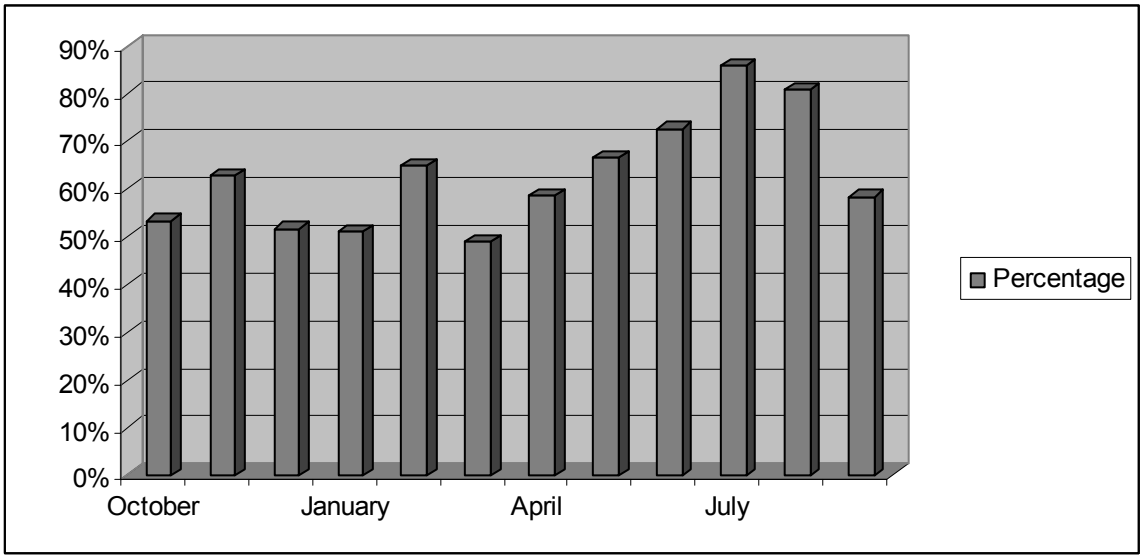
To provide increased capability in the assessment of IT assets, the technology used in assessing the vulnerability in USGS networks was improved in 2005. The improved technology provided management procedures for tracking and verifying correction of identified potential vulnerabilities. Beginning in June, the improved technology was used to assess monthly vulnerability status with Internet accessible servers. The figure below shows the first three month of operation and reflects the significant improvement in identified potential vulnerabilities each month. Each month, the identified vulnerability status is addressed and corrected with the objective of zero-vulnerabilities identified each month. Since new vulnerabilities are regularly identified, the assessment for and correction of vulnerabilities is an ongoing process.

FY 2005 Identified Potential Vulnerability



In response to significant increases in the delivery of unsolicited commercial email and SPAM, USGS continues to improve its automatic response capabilities for detection and quarantine of unwanted email. Enhancements continue to significantly contribute to the interception of infected and unwanted messages at the Internet gateway. In July and August more than 80 percent of messages posted from the Internet to USGS recipients were identified as either SPAM or virus infected, as shown in the figure below.

FY 2005 Messages blocked at the Internet Gateway



Enterprise Services Network — In 2005, USGS made progress in transitioning its backbone to the ESN and continued to support the migration of other Department bureaus to ESN. In December 2004, USGS connected to the ESN Intranet and, in February-March 2005, facilitated the establishment of four of the five ESN Internet nodes (these four nodes are on USGS premises). From March 2005 thru September 2005, USGS made steady progress in migrating USGS sites to ESN and in supporting the migration of other Department bureaus to ESN. Work included supporting the BLM migration in June, and NBC, MMS, NPS, and OSM migrations in the summer and early fall. During 2005, USGS moved all gateway equipment to include the Vancouver ESN-Alaska egress equipment to MCI monitoring, and by December 2005, this was fully managed by the Department. USGS technical support was critical to the successful migrations of these bureaus and the establishment of ESN-Alaska.

Telecommunications Connectivity During and After Hurricanes Katrina and Rita — From August 30 through the end of 2005, the telecommunications infrastructure and the USGS ability to sustain communications in the Gulf States area were severely tested by two major hurricanes. With Hurricane Katrina, USGS sites at Baton Rouge, LA; Lafayette, LA; Ruston, LA; Gulf Breeze, FL; Jackson, MS; and Stennis, MS, were affected. With Hurricane Rita, USGS sites at Houston, TX; Baton Rouge, LA; and Ruston, LA, were affected. From the time that Hurricane Katrina hit New Orleans on August 30 to the final telecommunications effects of Hurricane Rita on September 25, USGS telecommunications teams were taking all measures possible to maintain communications. During Hurricane

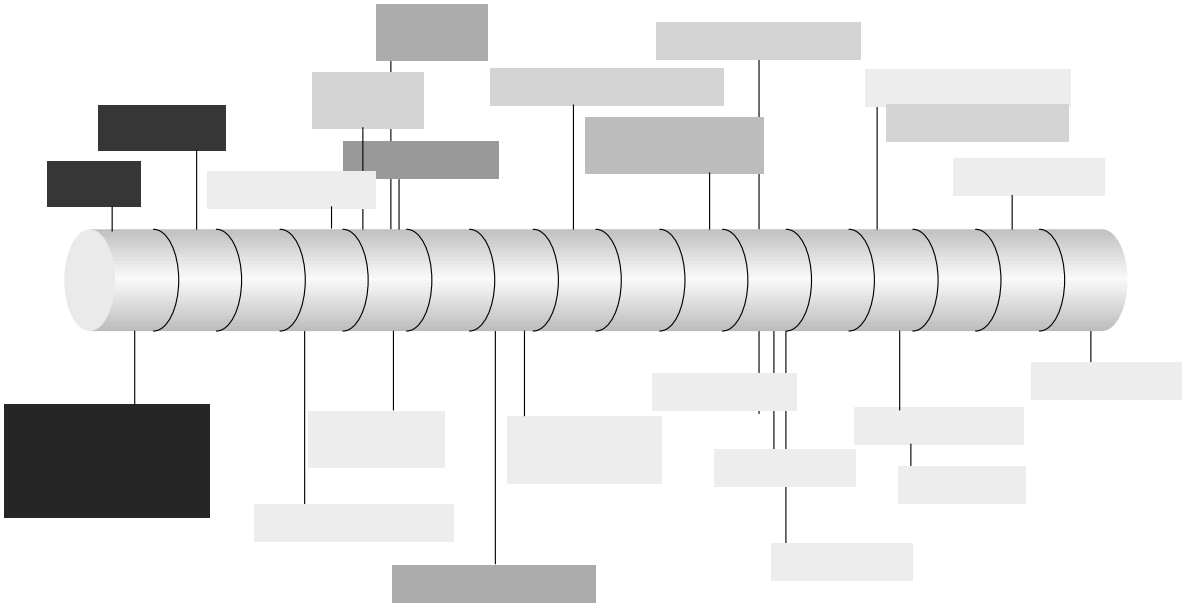
USGS Response to Hurricane Katrina — Telecom Facts

- Acquired new satellite service for communications.
- Used cable modems for service in Ruston, LA.
- Established high-speed Internet access via the University of Louisiana.
- Routed calls from USGS headquarters in Reston, VA, to a commercial service.
- Escalated service restoration level priority to restore service to Baton Rouge and Lafayette, LA.
- Staff traveled to Baton Rouge, LA, for on-site coordination for voice and data testing.

Katrina, telecommunications team members traveled to the Gulf States for on-site coordination for voice and data testing.

Some of these measures were preplanned, while other measures were developed in the aftermath of the hurricane events. Those lessons learned during Hurricane Katrina were then used in the preplanning for Hurricane Rita (and subsequent events). Preplanning included performing the following for the impacted area: (1) the deployment of Government Emergency Telecommunications (GETS) Cards, (2) the acquisition of satellite phones and their shipment to the impacted area, and (3) invoking the Telecommunications Services Priority system through the National Communications Service for selected data and voice circuits. The role of the GETS card is to provide specialized call processing in the event of congestion and (or) outages during an emergency because the GETS network has established capabilities to facilitate priority calling, including local exchanges and long distance networks.

Hurricane Katrina was such a massive event that much of the telecommunications infrastructure in New Orleans was severely damaged; several Bell South Local Area Exchange (LEC) Points of Presence were totally destroyed. USGS circuitry used the New Orleans Central Offices and the Bell South Local Area Exchange. Given this magnitude of outage, the USGS initiated several workarounds that included (1) acquiring internet service provider (ISP) satellite service using Hughes DirecWay service, (2) using cable modems for ISP service in Ruston, LA, (3) establishing and configuring network high-speed internet access via the University of Louisiana (because the University's service was routed thru Houston, TX, and was not impacted by the hurricane), (4) routing all phone calls from the USGS National Center inbound to the Gulf region over commercial service because FTS2001 MCI service was crippled, and (5) escalating MCI service restoration to the vice president level, which did help in finally restoring circuits to Baton Rouge and Lafayette. These workarounds provided basic communications services to the USGS sites.



The timeline from the time of the Hurricane Katrina to final circuit restoration is shown above. The timeline represents 15 days. Hurricane Rita outages were much shorter; only 3 days from event to full restoration.

Performance Overview

Measures	FY 2005 Plan	FY 2005 Actual	Change from 2005 Plan	FY 2006 Enacted	2006 Change from 2005	FY 2007 Plan	2007 Change from 2006
X% of time that all WAN and Internet access locations are up and running and accessible **(BUR EI)**	99%	99.217%	+.217%	98.992%	-.225%	98.992%	0
# of IT help desks operational in major USGS offices **(EI)**	4	5	+1	4	-1	4	0
X% of Internet hosts potentially vulnerable to unauthorized access **(EI**)	<1%	2.01%	NA	<1%	NA	<1%	0
X% of mission critical IT systems completing the IT security certification and accreditation process **(SP)**	100%	100%	0	100%	0	100%	0

Activity: Enterprise Information

Subactivity: Enterprise Information Resources

Subactivity	2005 Actual	2006 Enacted	2007 Fixed Costs & Related Changes[a/]	2007 Program Changes	2007 Budget Request	Change from 2006
Enterprise Information Resources	16,989	16,900	+225	-489	16,636	-264
Total Requirements	**16,989**	**16,900**	**+225**	**-489**	**16,636**	**-264**
FTE	***92***	***91***	***0***	***-3***	***88***	***-3***

a/ Fixed cost increases for this subactivity total $321, of which $225 will be budgeted and $96 will be absorbed.

Summary of FY 2007 Program Changes for EI Resources

Request Component	Amount	FTE
Program Changes		
• Departmental Working Capital Fund	+11	0
• Operational Efficiencies	-500	-3
TOTAL	**-489**	**-3**

Justification of 2007 Program Changes

The 2007 budget request for the Enterprise Information Resources Subactivity is $16,636,000 and 88 FTE, which is a net program change of -$489,000 and -3 FTE.

Departmental Working Capital Fund (+$11,000 and 0 FTE) — Additional increases are requested for the centrally billed portion of the WCF related to FOIA appeals.

EI Resources / Operational Efficiencies (-$500,000 and -3 FTE) — The proposed decrease achieves savings through further consolidation and integration of bureau-level science information delivery services and associated workforce planning.

Program Performance Change — The departmental WCF increases do not affect USGS performance. Regarding the decreases for operational efficiencies, though the program contributes to the strategic goal of advancing knowledge through scientific information, there are no performance measures specifically linked to this program change.

Program Overview

The Enterprise Information Resources (EIR) Subactivity guides and manages bureau-level systems and activities in information policy, information integration and delivery, and science education. The information integration and delivery component provides direction, coordination, and strategic planning of scientific data integration and management relating to Web-Internet services, science publishing, libraries, information centers, and enterprise-level coordination of educational activities and geographic information systems. The information resource management component supports compliance with statutory mandates and regulations for records archiving and management, privacy, Freedom of Information Act (FOIA), Section 508 of the Rehabilitation Act, E-Government Act, OMB Data Quality Guidelines, OMB Peer Review Requirements, Paperwork Reduction Act, and investment technology capital asset planning.

The USGS is committed to increasing efficiency and effectiveness of its scientific information integration and dissemination services through the Natural Science Network (NSN) of integrated information, science, and knowledge to ensure that the latest USGS science data are easily and quickly available to citizens, agencies, academia, and the private sector in accessible formats. The objective is to optimize each individual customer's ability to "find, get, and use" USGS information and products tailored to their specific requirements.

The USGS continues to focus on maturing its procedures and processes for CPIC, following GAO's IT Investment Management Maturity Model. The objectives are to maintain compliance with CPIC requirements from OMB and Interior, to ensure the bureau's overall IT investment portfolio supports USGS and Interior strategic goals and priorities, and to ensure that the Investment Review Board (IRB) follows established, repeatable processes for major IT investment selection, control and evaluation.

Information Integration and Delivery
(Estimates for FY 2005, $14.0 million; FY 2006, $13.9 million; FY 2007, $13.6 million)

Information Integration and Delivery activities focus on transforming existing functions and services to reflect the changing nature of USGS science and science products; achieve efficiencies in the accessibility, delivery, and integration of USGS information through enterprise-level approaches; employ innovative and cost-effective technologies; and utilize future skills planning and partnerships for a flexible and balanced workforce.

Information Centers and Library — The USGS information offices and library provide scientific and product information and technical assistance to a wide range of customers both internal and external, and to the natural science community as a whole. These offices use a variety of tools and capabilities to provide access to USGS science and identify sources of scientific information outside of the Survey. They also serve as a conduit for feedback between customers of USGS data and information and the USGS scientific and technical community.

Significant emphasis is now being placed on increasing digital library capabilities, including electronic library subscriptions and new technologies that enhance flexibility and accessibility to research information, in part due to the FY 2005 workforce buyout. In addition, the USGS information and library offices have been combined to create the Science Information and Library Service as part of the NSN development process to provide information and handle inquiries more efficiently.

Enterprise Publishing — Accurate, efficient, and timely reporting of its unbiased science are key factors enabling USGS to fulfill the role of a world leader in the natural sciences through scientific excellence and responsiveness to societal needs. Enterprise Publishing focuses on developing bureau-level policies and procedures to maintain the USGS reputation for quality and unbiased published science. This includes updated, bureauwide standards for peer and policy review of all information products. The USGS continues implementing an Enterprise Publishing Network (EPN). A complete EPN review will be conducted at the end of FY 2006. Final adjustments will be made to meet the performance goals as stated in the High Performing Organization (HPO) plan.

Enterprise Web — The USGS maintains approximately 300 public Web sites providing science information to a variety of customers. The Enterprise Web (EWeb) project is developing more efficient and consistent bureau-level tools and practices to ensure that these public Web sites are (1) secure, reliable, and easy to maintain and update and (2) carefully organized, designed, and equipped to allow customers to find, get, and use the vast array of USGS natural science data and information products quickly, efficiently, and in a manner that meets their needs.

Education — The USGS is engaged in a variety of educational activities at kindergarten through university levels by providing teaching materials, internships, and involvement in national educational conferences such as the National Science Teachers Association. In cooperation with other science agencies such as NASA, NOAA and NSF, the USGS works to help develop a future workforce to meet the needs of the earth sciences.

Enterprise Geographic Information Systems — The USGS is taking a departmentwide approach to managing Geographic Information Systems (GIS) technology and applications, through enterprise level purchase agreements and licensing, and bureau-wide training and technical support.

Information Resource Management

(Estimates for FY 2005, $2.9 million; FY 2006, $3.0 million; FY 2007, $3.0 million)

Information Resource Management activities focus on establishing, monitoring, and directing policy that enables the USGS to fulfill statutory and regulatory information resource requirements.

Complying with Statutory Mandates — Effective bureau compliance with Federal information mandates, particularly in the areas of records management, privacy, information accessibility, IT acquisition, and capital planning, is important for ensuring the security and reliability of USGS science information assets. Prior to bringing these responsibilities under EI, USGS had been handling these responsibilities on an "ad hoc" basis in individual science disciplines, programs, and offices. Creating a single bureau-level point of coordination and oversight has allowed USGS to develop an integrated, comprehensive, and proactive compliance program. One result of the consolidation is a more unified approach to policies and practices for peer review of USGS information products.

Capital Asset Planning and Investment Control — The USGS continues to mature its CPIC processes and procedures for planning and managing IT projects. This process complies with the Clinger-Cohen Act of 1996 and OMB Circulars A–11 and A–130, and establishes compliance with Level 2 of the GAO IT Investment Management maturity model. The USGS Associate Director for Geospatial Information was responsible for developing bureauwide policies and procedures to mature the IT CPIC process to Level 2 IT Investment Management

compliance. Capital asset IT investment business cases analysis is completed for all major proposed and existing information system projects. The CPIC program ensures that the IRB follows established, repeatable processes for selection of major (defined as costing more than $5 million per year or is otherwise significant) IT investments, control, and evaluation, which includes a regular cost, schedule and performance review of all major information technology projects and annual reviews of all non-major projects. Approved major and non-major IT investment business cases are critical documents for preparing the OMB Exhibit 53.

FY 2007 Program Performance Estimates

Information Integration and Delivery

Natural Science Network — In FY 2007, the Natural Science Network will continue to operate through three major functions: the Science Information and Library Service Center (SILSC), Knowledge Management, and Information Delivery. In the SILSC, funds will be used to further develop electronic library capabilities to include increased electronic journals and related archive material as well as access to the digital data supporting ongoing and completed research. These journals provide the latest findings in their respective fields and are therefore critical to ongoing scientific research. There is a continuing concern about the rapidly increasing cost of access to electronic scientific journals because of licensing. In Knowledge Management, electronic tools development and implementation will ensure easy access to USGS data and information by anyone. For Information Delivery, the USGS will continue the transition to an on-demand printing and delivery capability through digital product generation as well as scanning existing hardcopy products. Partnerships with interpretive association to handle over-the-counter retails sales will be completed in four major offices.

Enterprise Publishing Network — In FY 2007, EPN will reduce the number of operating locations by more than half, towards a goal of 20. This will be accomplished while maintaining the high quality of the scientific publications of the USGS.

FY 2006 Planned Program Performance

Enterprise Publishing Network — The USGS implemented EPN on October 1, 2005. The EPN is the result of a significant restructure of the USGS workforce and business processes, using the High Performing Organization (HPO) model as the mechanism to accomplish this restructure. The goals of this restructuring achieve a unified bureau publishing policy and a streamlining and improvement of technical and business publishing processes to assure efficiency. The HPO model implementation will continue through 2006. The USGS fundamental science practices policy and guidance will be approved and implemented, creating a consistent approach to peer review and approval of USGS scientific publications.

Enterprise Web — The EWeb goals are organized around two fundamental principles: (1) providing governance and processes to achieve a well-managed USGS Web presence and (2) empowering USGS Web customers to easily obtain science information by place, science topics, and time. In order to achieve these goals, the 2006 EWeb activities have been mapped to the following three strategic outcomes identified by the USGS executive leadership, in conjunction with stakeholder and customer interviews and feedback.

Secure, Consolidated Web Infrastructure and Operations — Maintain, manage, and consolidate the USGS Web infrastructure to enable secure, efficient and effective enterprise solutions that are consistent with Federal and Departmental guidance and requirements. This will be accomplished by (1) continuing security planning, management, and C&A activities for the EWeb Enclave and its assets to ensure compliance with FISMA requirements and remediation of security-related Plans of Action and Milestones (POA&Ms), (2) continuing operation of the National Web Server System and other EWeb servers to improve security, to provide needed Web services (including ensuring public access during disasters), and to support server consolidation, (3) monitoring USGS Web infrastructure, approve new domains, and complete plan for consolidation of USGS Web-related servers to enhance security, to provide cost effective EWeb hosting services, and to enable content management, (4) establishing the enterprise services for Web-related enterprise architecture, including the Technical Reference Model development and the approval of Web hardware and software waivers, and (5) optimizing current search tools and incorporate others as possible to improve user ability to search and find USGS science information by place and topic.

Governance and Oversight — Establish and implement Web policy, processes and practices to enable the USGS Web presence to be well-managed and compliant with Federal requirements. Provide mechanisms to enable cross-USGS Web governance, communication, and learning. This will be accomplished by (1) managing the USGS homepages to improve user experience, to advance USGS science, and to integrate with information and services provided by other partners, especially other bureaus in Interior, (2) beginning to review existing and new USGS web sites according to a methodology and ranking approved by the USGS Web Advisory Group. Each Web site will be reviewed to ensure consistency with Federal requirements; to remove old information; to catalog current information; and to implement a corporate look and feel across the USGS Web presence, (3) providing a State of the Web report for USGS managers and others that characterizes the USGS web presence, current usage and customer satisfaction and tracks progress and identifies challenges, and (4) institutionalizing the processes and provide tools, training, and services that enable programs to manage their USGS Web presence and webmasters to collaborate and to manage web sites efficiently and effectively.

Science Information Integration and Delivery — Develop and implement Web-based solutions and best practices to support USGS programs in managing, integrating, and delivering science products and information. The USGS EWeb and NSN will partner with Interior, USGS science programs, the National Geospatial Program Office, the Office of Communication, the Web Advisory Group, and others to pilot *myUSGS*, a science portal that will enable information sharing, collaboration, and integration. Based on the results, a phased implementation plan will be developed that will include (1) Web content management, (2) a digital asset management system, (3) records management; (4) publication work flow and peer review processes, (5) a unified geospatial Web presence for the GOS portal, and (6) improved Web access to integrated science via the "Science Topics" (the USGS thesaurus), the FAQ database, and the Publication Warehouse.

Capital Asset Planning and Investment Control — In 2006, existing capability will be maintained and increased to include non-major IT investments. A plan to achieve ITIM Stage 3 will be developed, with a target of 50 percent compliance by September 30, 2006.

FY 2005 Program Performance Accomplishments

Enterprise Publishing — In 2005, publishing functions were restructured through implementation of a USGS directed business process reengineering supporting the science mission to achieve HPO. In addition, USGS started realigning existing science discipline publication resources to enable common publishing business practices and technical procedures. The USGS expanded the role of the Enterprise Publishing Office that will direct development and coordination of bureau publishing policies and procedures. This realignment maintains the link between science authors and publishing staffs. A 2-year phased transition is planned to minimize disruptions to science information delivery. Changes in publishing will link to other USGS strategic changes, promoting smoother integration of science and publishing, expanded enterprise approaches, common business practices, process re-engineering, and workforce planning. Progress on the Publications Warehouse continued, with the number of publications catalogued exceeding goals (see sidebar).

The USGS Publications Warehouse
The Publications Warehouse (PW) is the official USGS database and catalog of information products published by the USGS (*http://pubs.usgs.gov*), and as of September 30, 2005, contains more than 68,900 records. Individual programs and offices will be able to serve their publications lists utilizing data from PW, thus eliminating both costs and redundant datasets. In the future, PW will contain information about publications published outside USGS as well, such as journal articles, abstracts, proceedings, meetings, and other Government publications.

Enterprise Web — In 2005, USGS EWeb made significant progress in improving management controls and increasing focus on USGS customers.

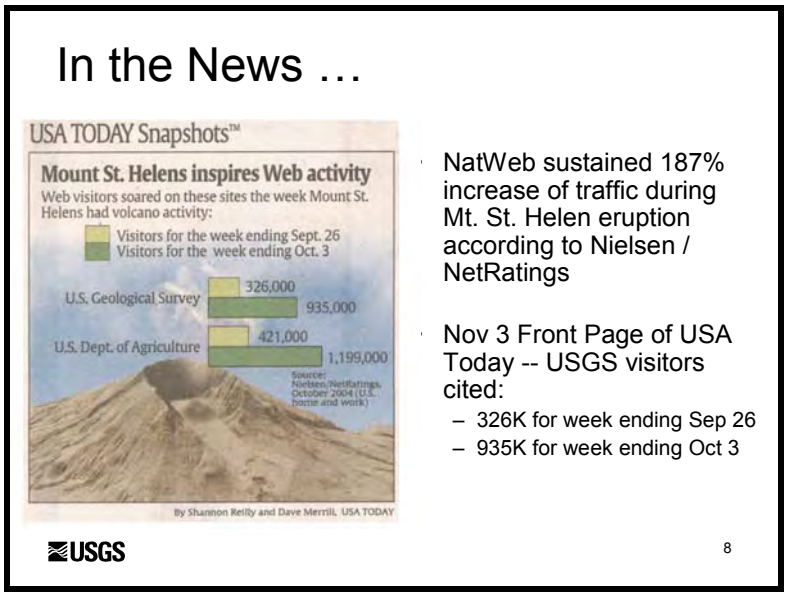
The USGS baseline Web infrastructure inventory was established and began quarterly reporting in compliance with the Department's Web Directive 2004–023. Currently, more than 450 Internet Web sites, 200 Intranet Web sites, 375 Web servers, and 500 Web application and database servers comprise the USGS Web presence. The USGS Web Advisory Group was established to guide development of policy and procedures needed to govern the USGS Web presence and ensure its compliance with Federal requirements. In addition, USGS worked closely with the Department Web Council to update Web policies and best practices to reflect new guidance and requirements from OMB, NARA, and other Federal content initiatives.

Improvements to the USGS homepages sharpened customer focus and provided more robust access to the breadth and diversity of USGS science, geospatial, and educational resources organized by place and by science topic. Included were an updated USGS homepage (*www.usgs.gov*), a new Science Topics Website (*http://www.usgs.gov/science/*), State pages (*http://www.usgs.gov/state/default.asp*), and a consolidated search page (*http://www.usgs.gov/search/*).

The USGS continued to develop and improve tools to better understand its Web customers and their requirements for searching and finding USGS Web-based information. The Thesaurus and Frequently Asked Questions databases were expanded, and the USGS search engine was optimized. A Web site template was developed that is consistent with USGS visual identity standards and Federal requirements.

The USGS continued to inventory, secure, and manage future development of the USGS Web infrastructure. The EWeb system of computer servers (enclave) maintained its C&A and implemented security recommendations. Security and reliability were strengthened by the

expansion of the National Web Server System, the consolidated and failure-resistant Web server infrastructure that ensures that critical USGS public Web sites will remain available and able to handle huge spikes of customer demand during emergency situations. These improvements to infrastructure allowed the USGS web to better serve the public during natural hazard events such as volcanic eruptions (see sidebar).



Complying with Statutory Mandates

Records Management Training — In 2005 USGS released a computer-based training course titled "An Introduction to Information Resources Management" that provided all employees with information on complying with Federal mandates, such as records management, privacy, FOIA, Section 508, etc.

Compliance with Records Management Statutes — The bureau continued to manage its permanent USGS Federal records by initiating actions to collect them for permanent transfer to the NARA. The USGS provided responses to court-mandated requests and other investigative data calls and initiated the process to establish the EROS facility as a "NARA Affiliated Archive" for aerial photographs. Under the proposal, the USGS retains physical custody of aerial photographs beyond their schedule disposition date, with the legal ownership transferring to NARA after 40 years.

Compliance with Privacy and Information Statutes — The USGS Privacy program was fully integrated into the IT Capital Asset Planning process by compiling Privacy Impact Assessments for all USGS 2007 Capital Asset Plans (Exhibit 300's). The Privacy program also responded to new FISMA privacy questions in the 2005 FISMA report. The USGS responded to approximately 85 Freedom of Information Act (FOIA) requests for information during 2005. The Section 508 program continued to implement the HiSoftware tool for Section 508 Web site repair, verification, and certification. USGS telecommunications and contracting offices worked to ensure that Section 508 requirements were built into all new telephone systems acquired by USGS. The USGS requested OMB approval of 10 new or existing information collection activities, as required by the Paperwork Reduction Act, and established an Information Policy Team to inventory and review future USGS information policies and procedures.

Capital Asset Planning and Investment Control — During 2005, the CPIC process achieved the following Interior Strategic Plan and GPRA goals, on target and on schedule:

- IT Management*:* Improve the bureau IT Management Process to reach Level 2 along GAO's ITIM framework by 2005.
- IT Investment Management: Percent of IT investment expenditures for which actual costs are within 90 percent of cost estimates established in the project or program baseline.
- IT Investment Management: 100 percent of IT investments expenditures reviewed/approved through the CPIC process.

The USGS Capital Planning and Investment Control process was further developed by partnering with USGS Science disciplines to advance the understanding and benefits of the Capital Planning and Investment Control process. A draft USGS Manual Chapter for IT Investment Management was prepared, as were standard, repeatable procedures to manage USGS IT investments through the CPIC process. Business cases for Major and Non-Major IT Investments and IT Infrastructure were maintained in eCPIC — the Department's Capital Planning repository, IT Investments were mapped to IT Security Enclaves and IT Architecture systems, and procedures were developed for Subject Matter Experts to review and score IT Capital Plans. The USGS developed the OMB Exhibit 53 through the electronic eCPIC tool, captured IT hardware and software costs in the bureau's project management system, and contributed to the development of departmentwide CPIC strategies, procedures, and training materials.

Performance Overview

Measures	FY 2005 Plan	FY 2005 Actual	Change from 2005 Plan	FY 2006 Enacted	2006 Change from 2005	FY 2007 Request	2007 Change from 2006
IT Investment: X% of major IT investment projects for which cost estimates, established in project or contract agreement, meet actual costs with a variance of X% (established in Exhibit 300 business case meet actual costs within a variance of 5%) **(BUR EI)**	100%	100%	0	100%	0	100%	0
# of bureauwide data integration practices and/or policies adopted **(EI)**	3	4	+1	3	-1	4	+1
IT Investment Management: X% of IT investments reviewed/approved through the CPIC process	100%	100%	0	100%	0	100%	0
IT Investments meet business/program needs: Business cases established for X% of USGS IT investments	100%	100%	0	100%	0	100%	0

Activity: Enterprise Information

Subactivity: National Geospatial Program

Subactivity	2005 Actual	2006 Enacted	2007 Fixed Costs & Related Changes[a/]	2007 Program Changes	2007 Budget Request	Change from 2006
National Geospatial Program	4,670	4,628	+65,164	-1,170	68,622	+63,994
Total Requirements	**4,670**	**4,628**	**+65,164**	**-1,170**	**68,622**	**+63,994**
FTE	***12***	***12***	***+303***	***-20***	***295***	***+283***

a/ Fixed cost increases for this subactivity total $1,235, of which $863 will be budgeted and $372 will be absorbed. Also includes a technical adjustment of +$64,301 for the budget restructure which moves CTM to the National Geospatial Program.

Summary of FY 2007 Program Changes for National Geospatial Program

Request Component	Amount	FTE
Program Changes		
• Departmental Working Capital Fund	+150	0
• Integrated Multi-Hazards Demonstration Project	+680	0
• Geospatial Data Integration	-2,000	-20
TOTAL	**-1,170**	**-20**

Justification of 2007 Program Changes

The 2007 budget request for the National Geospatial Program Subactivity is $68,622,000 and 295 FTE, which is a net program change of -$1,170,000 and -20 FTE.

This reflects a budget restructure that moves $64,301,000 of appropriated funds and 335 FTE from the Cooperative Topographic Mapping Subactivity in the Geography Research, Investigations, and Remote Sensing Activity to the National Geospatial Program Subactivity in the Enterprise Information Activity.

With the establishment of the Enterprise Information Activity in FY 2005, the USGS instituted a new management model for geographic research and geospatial information programs to consolidate funding for bureau information infrastructure and to enhance the integration, synthesis, and delivery of USGS geospatial data. The FY 2006 Budget Justification introduced the need to unify management and control of geospatial programs. A budget restructure proposal is included in the 2007 budget request to make these adjustments permanent.

This transfer is beneficial because it:

- Aligns management and performance responsibility for geospatial activities with program responsibility,
- Brings together the essential geospatial components of the USGS, and enables them to be managed as a unified portfolio that benefits the entire geospatial community,
- Enables adoption of a common architecture and so leverages the resources of a distributed network of geospatial data partners to strengthen the National Spatial Data Infrastructure,
- Shifts emphasis from producing maps to providing access to the creation of map products and geographic knowledge, and
- Coalesces and improves the geospatial data coordination, standards, partnership and policies of *The National Map*, Geospatial One Stop, and the Federal Geographic Data Committee.

Departmental Working Capital Fund (+$150,000 and 0 FTE) — Additional increases are requested for the centrally billed portion of the WCF related to Department Geographic Information Management.

Integrated Multi-Hazards Demonstration Project (+$680,000 and 0 FTE) — The budget includes an increase of $680,000 to continue development and implementation of the EI activities related to the Integrated Multi-Hazards Demonstration Project. The USGS will redirect $1,000,000 from lower priority activities to make enhancements to key IT infrastructure components to support the Integrated Multi-Hazards Demonstration Project. Enhancements will include providing more intensive network monitoring and technical support service for selected critical network components to detect and restore outages as quickly as possible, as well as acquisition of network hardware and software (switches, routers, etc.) and additional leased circuits to strengthen network redundancy and failover.

National Geospatial Program / Geospatial Data Integration (-$2,000,000 and -20 FTE) — The proposed reduction would result in a slowing of the development of hydrography, elevation, and imagery data. For hydrography, development of the National Hydrography Dataset would be delayed for remaining areas of interest to Interior bureaus in Montana, Washington, Oregon, Nevada, Arizona, and the Dakotas. For orthoimagery, the ability to maintain the currentness of high-resolution imagery over urban and natural hazard areas would be diminished.

Program Performance Change Table

Total Performance Change		**+4% Nation's surface data available +4% total cost saved for high resolution imagery -4% total cost FSA and USGS saved for 1-meter NAIP No change for number of workshops**			
	A	***B***	***C***	***D= B+C***	***E***
	Overall Performance Changes from 2006 to 2007				
Measure	**2006 Enacted Performance**	**2007 Base Performance Level**	**2007 Impact of Program Change on Performance**	**2007 Budget Request Performance**	**Out-year Impact of 2007 Program Change on Performance**
X% of the nation's surface for which hydrography, elevation, and orthoimagery data are available through the National Spatial Data Infrastructure Clearinghouse and supported through partnerships **(PART EI)**	**86%**	**86%**	**+3%**	**89%**	**+1%**
X% of total cost saved through partnering for data collection of high resolution imagery **(PART Eff. measure**	**44%**	**44%**	**+2%**	**46%**	**+2%**
X% of total cost FSA and USGS saved through partnering with other entities for imagery acquisition of 1-meter NAIP orthoimagery **(EI)**	**40%**	**40%**	**-4%**	**36%**	**0**
# of formal workshops or training provided to customers (instances/issues/events) **(EI)**	**23**	**23**	**-6**	**17**	**+6**

Column B: The performance level you expect to achieve absent the program change (i.e., at the 2006 enacted level plus/minus funded fixed cost/related changes); this would reflect, for example, the impact of prior year funding changes, management efficiencies, absorption of fixed costs, and trend impacts.

Column E: The out-year impact is the change in performance level expected in 2008 and Beyond of ONLY the requested program budget change; it does <u>not</u> include the impact of receiving these funds again in a subsequent outyear.

Program Overview

The National Geospatial Program (NGP) Subactivity addresses the Department's Serving Communities strategic goal of advancing knowledge through scientific leadership and informing decisions through the application of science.

The NGP coordinates and provides leadership in geospatial activities that ensure the development, maintenance, and availability of geographic data and related geographic knowledge in support of the NSDI. The major goals of the program are:

- Improve the value of the geospatial data available to government decisionmakers and the public by providing national leadership for GOS, *The National Map*, and FGDC,

- Implement *The National Map* to ensure the availability, currentness, and archive of nationally consistent and integrated base geospatial data across the country through partnerships with Federal, State, and local governments,
- Host, lead, and manage the GOS portal to ensure discovery of, and access to, geospatial data resources to enhance sharing and reduce duplication,
- Provide national leadership in the establishment and maintenance of organizational coordination mechanisms and policy development in support of the NSDI,
- Assure a unified and integrated presence with partners and customers in the geospatial data and technology arena to advance the development of the NSDI, and
- Lead the development and promote the use of international, national, and Federal geospatial standards to support the NSDI.

The National Map

The USGS is implementing *The National Map* by developing a network of up-to-date distributed digital databases, combining Federal, State, and local information, to provide a single consistent mapping framework for the country. *The National Map* provides a seamless base of digital geographic data that will serve multiple government agencies base mapping needs; and will provide the source data needed for updating and maintaining the Nation's topographic maps.

Geospatial One-Stop

The GOS portal, located at *http://www.geodata.gov*, serves as the government's gateway for the discovery and access to the Nation's distributed geospatial resources. Thousands of GIS organizations are developing digital geographic databases across the country. These data sets developed by Federal, State, tribal and local government organizations, as well as data from academia and the private sector are published to the GOS portal via metadata descriptions. The data, as well as Internet mapping services, models, applications, and place based publications can all be organized, discovered and accessed through the GOS portal. There are currently approximately 100,000 data sets published at *geodata.gov.*

Leveraging the Power of Geospatial One-Stop and *The National Map*

The USGS is committed to making geographic knowledge easily accessible to customers and partners through increased use of advanced computing, adoption of interoperable standards, archiving, and communication tools and through innovative collaboration with public and private organizations. FGDC provides coordination mechanisms and a governance structure to bring together partners, pursue creative investment strategies, and promote sound policy guidance for the entire geospatial community. GOS provides the primary Internet portal linking *The National Map* and the USGS scientific databases to other organizations' geospatial, natural science, and socio-economic databases. This capability will unify USGS geospatial programs and greatly improve communication tools for responding to public inquiries and expanding cooperation with private industry in product development and dissemination.

Implementation of the National Geospatial Program

The NGP consists of three components,

Geospatial Integration includes:

- Implementing the GOS portal to provide tools for the discovery, access and sharing of geospatial resources, and
- Implementing *The National Map*. *The National Map* contains applications that encompass converting, integrating, providing for quality control and assurance, managing, providing access to, archiving, applying, and acquiring geospatial data.

Geospatial Coordination includes:

- Developing standards, data models, enterprise architectures, information policies, promoting best practices and coordinating the geospatial activities of Federal agencies,
- Providing support for emergency operations, and
- Leading the effort in the development and implementation of NSDI.

Partnership Implementation includes:

- Providing for USGS geospatial liaison staff to develop partnerships and data-sharing consortia directly with State, local, and tribal government agencies, field offices of Federal agencies, and others; and projects that result from these partnerships.

Geospatial Integration

(Estimates for FY 2005, $0.0 million; FY 2006, $0.0 million; FY 2007, $46.0 million)

The USGS facilitates the development of and maintains critical, comprehensive databases to ensure the integration, availability, preservation, and dissemination of geospatial data to serve the natural sciences' needs for systematic analyses and investigations. These databases also support the national infrastructure for managing and sharing geographic knowledge across all levels of government, and with citizens. In unifying the USGS geospatial programs, the NGP has positioned itself to serve as the geospatial knowledge broker for the Nation.

Private sector firms provide a number of essential products and skills, including production of base geospatial products, such as orthoimagery, elevation and vector feature data, revised maps, and the development of a wide range of value-added products. The USGS uses these services for data acquisition when necessary and to offer a contract vehicle for State and local governments to use to achieve economies of scale on projects. The USGS is committed to contracting its map production activities and related services, thereby meeting expectations of both the Congress and OMB for Federal use of private sector services.

Geospatial Coordination

(Estimates for FY 2005, $4.7 million; FY 2006, $4.6 million; FY 2007, $9.2 million)

The USGS staffs and leads the FGDC Secretariat. The Secretariat provides leadership and administrative support to the FGDC Steering Committee, the policy-level group; and the working level groups: the thematic subcommittees and cross-cutting working groups. The FGDC Secretariat staff initiates and leads the activities essential to reaching broad agreement within the national and international geospatial community on key technical and policy issues.

The NGP will lead the effort to unify disparate geospatial enterprise architectures, aligning them with the Federal Enterprise Architecture (FEA), and ensuring that the needs of the non-Federal

community are accommodated. A national geospatial enterprise architecture will be a common point of reference for the development of physical architectures that will ensure geospatial interoperability at all levels of government. A geospatial enterprise architecture will demonstrate management excellence by identifying common lines of business and be the model for further transformations necessary to implement the key components of the NSDI.
GIS and management excellence will both be enhanced by effectively managing national geospatial investments. An enterprise system requires knowledge of the investments necessary to develop and operate that system. One of the key areas if this vision is to be achieved is to develop a strategic plan for geospatial investments. An enterprise system of geospatial data and applications will require not only an organized method for understanding national investments but also a commitment to ensure that those investments meet business needs and are sustainable.

The Office of Emergency Operations promotes the adoption of USGS programs as the underpinning for Federal mapping activities and those of other public and private sector organizations with homeland security, homeland defense, law enforcement and incident command mission responsibilities.

Partnership Implementation
(Estimates for FY 2005, $0.0 million; FY 2006, $0.0 million; FY 2007, $13.4 million)

USGS partnerships activities ensure the development and maintenance of base geographic data consistent with national content specifications by seeking new partnership opportunities, building relationships with geospatial organizations, and working collaboratively to prepare the base geospatial data.

USGS Partners with Kentucky
On November 16, 2005 Suzette Kimball, USGS Eastern Regional Director, presented a commemorative graphic to Kentucky Governor Ernie Fletcher in recognition of the partnership between USGS and the Commonwealth that has contributed to Kentucky's participation in, and contributions to *The National Map*. Kentucky's high-end web mapping capability, the KYGeonet (*http://kygeonet.ky.gov/)* is the backbone for Kentucky's The Commonwealth Map (*http://kygeonet.ky.gov/tcm/viewer.htm*) and other Web-based applications.

FY 2007 Program Performance Estimates

National Geospatial Program Subactivity — The proposed reduction will result in a slowdown in the development of hydrography, elevation, and imagery data. For hydrography, development of the National Hydrography Dataset would be delayed for remaining areas of interest to Interior bureaus in Montana, Washington, Oregon, Nevada, Arizona, and the Dakotas. For orthoimagery, the ability to maintain the currentness of high-resolution imagery over urban and natural hazard areas would be diminished.

Geospatial Integration

Geospatial One-Stop — In 2007, USGS will provide organizational leadership, management, and funding support for the GOS portal through the NGP.

Transportation Feature Data — The transportation data theme consists of roads, railroads, airports, and miscellaneous transportation features. In FY 2007 the USGS will continue to make available for seamless viewing and downloading data being developed by the Census Bureau. It

also will work with Federal, State, and local governments to develop strategies to maintain these data.

Structures Feature Data — The structures data theme is comprised of manmade features important to planners, land managers, utility companies, and the general public for a broad range of analyses and applications. This theme is key for the locations of critical structures, which are of vital interest to emergency responders. The data include those from Federal partners including agencies of the Departments of Homeland Security and Defense, and State and local government agencies. In FY 2007 the USGS will continue to integrate data from these sources and make them available for seamless viewing and downloading.

Boundary Feature Data — In FY 2007, for boundaries of jurisdiction, the USGS will continue to make available for seamless viewing and downloading data being developed by the Census Bureau. It also will work with Federal, State, and local governments to develop strategies to maintain these data. For boundaries of Federal and other publicly-owned land, USGS will work with agencies responsible for these lands on data maintenance strategies. USGS will integrate these data, and make them available for seamless viewing and downloading.

Data Access and Discovery — In FY 2007, USGS will support and upgrade (as needed) continued access to the seamless national databases it hosts and Web mapping services made available by partners. Major effort will be made to make these data sets accessible through the Geospatial One Stop.

Standards — The USGS coordinated the development of standards for digital orthoimagery, hydrography and elevation as part of its participation in the GOS initiative and the FGDC. In FY 2007, USGS will support the American National Standards Institute's (ANSI) process for adopting these and other standards developed through GOS and the FGDC as national standards.

Geospatial Coordination

Enterprise Architecture — In FY 2007, USGS participation will emphasize the incorporation of digital rights management for geographic data, which will allow greatly improved ways of integrating and accessing data sets with differing levels of security and licensing requirements. In FY 2007, the USGS will also lead the development of a Federal Enterprise Architecture geospatial profile. Advances in this area will allow USGS more flexibility in integrating data from Federal, State, and local government agencies as well as private industry that must adhere to certain access and integrity restrictions.

Geospatial Investments — The transformations toward a national GIS and toward management excellence will both be enhanced by effectively managing national geospatial investments. One of the key areas of the Federal Government that must be transformed if this vision is to be achieved is to develop a strategic plan for geospatial investments. An enterprise system of geospatial data and applications will require not only an organized method for understanding national investments but also a commitment to ensure that those investments meet business needs and are sustainable. In 2007, USGS will implement key recommendations of the Interior Geospatial Blueprint Modernization project.

Emergency Operations — In 2007, USGS will continue to coordinate with U.S. Northern Command (USNORTHCOM) to provide expertise in support of preparations for natural disasters, coordinate with the DHS to align the NGP strategic actions with the strategic priorities of DHS; provide direct support to the U.S. Marshals Service, and continue engagement with the Intelligence community to ensure continued coordination with National domestic geospatial activities. The USGS mission and role is being recognized in the Homeland Defense/Homeland Security community in support of natural hazard events.

Partnership Implementation

Federal Partnerships — USGS seeks to leverage its resources with other Federal agencies both for cooperation with other agencies and to improve the interactions of the Federal Government with other sectors of partners, especially State and local governments. In 2007, USGS will accomplish these partnerships through formal mechanisms such as the interagency coordinating committee the FGDC, the GOS initiative, the National Digital Orthophoto Program, the National Digital Elevation Program, and the Board on Geographic Names; as well as through bilateral interactions with partner agencies.

Public Interest Organizations — Public interest organizations such as NSGIC and the National Association of Counties (NACo) offer an opportunity to reach out to many potential partners. These organizations represent State and local government agencies and help coordinate a variety of issues with national program stewards for geospatial products. In FY 2007, the USGS will build on experience gained in working with NSGIC and NACo to work more closely with other public interest organizations such as the Urban and Regional Information Systems Association, the National Governors Association, the Western Governors Association, and the National League of Cities.

USGS is committed to establishing NSDI Partnership Offices in every State to enable the Geospatial Liaisons to most effectively interact with partners. In FY 2007 the USGS will continue to establish new NSDI Partnership Offices in remaining Sates that lack a resident Geospatial Liaison.

In FY 2007, efforts will continue to support the USGS-NSGIC "Fifty States Initiative" by providing assistance to partners to develop State-based strategic and business plans for geospatial activities. This initiative began in 2005 and was supported in 2006 under the FGDC Cooperative Agreements Program.

FY 2006 Planned Program Performance

Geospatial Integration

Data Integration and Coverage Continue to Expand for National Data Sets by:

- Pursuing completion of urban imagery coverage, and replace data that are more than 2 years old, through partner arrangements,
- Continuing coordination and National Elevation Data (NED) integration of high resolution elevation data acquired through the FEMA Flood Map Modernization Program,
- Continuing coordination and integration of bathymetry elevation data acquired through NOAA into a seamless topographic/bathymetric elevation model,

- Implementing databases that provide seamless access for viewing and downloading data from *The National Map* for transportation, structures, and boundaries,
- Developing a business model for the new web-based topographic mapping program in which the public can make their own topographic map,
- Providing and develop seamless online data viewing and downloading for data themes,
- Converging similar functions of *The National Map* and the GOS portal; participate in the planning, testing, and implementation of "phase 2" of that portal, and
- Continuing to work with the Open Geospatial Consortium to develop specifications for open web services and a common architecture for open services that reduce technical barriers to data sharing.

Geospatial One-Stop — GOS portal capabilities will grow and improve. Plans have been developed to increase the number of participating partners and published metadata records. Assistance will also be provided to develop additional GOS Communities. The GOS is expected to surpass 200,000 geospatial data resources in its catalog, and usage will grow to 500,000. Work will continue in the development of a partnership with the National Geographic Society. Integration of the GOS and *The National Map* for data and Web service registration and access will be completed.

IT Security of *The National Map* — There will continue to be extensive work on improving and maintaining the C&A of *The National Map* Reengineering Project. Continued emphasis will be placed on system level contingency testing for all system components, full independent security test and evaluation, completion of Plans of Action & Milestones (POA&Ms), E-Authentication documentation, self-assessment updates, and update of security documents.

2006 Management Actions and OMB Circular A–76 — Based on authority granted by the Office of Personnel Management to the Department of the Interior, USGS will continue to restructure its map production workforce through separation incentives. The USGS received buyout authority in December 2005 that will expire in September 2006.

Continuing with management decisions made in 2005 (a scoping strategy for the NGTOC that was developed and approved by the Director with the decision to pursue OMB Circular A–76 competitive sourcing activity and an executive decision to centralize the NGTOC), in 2006 a team was assembled and tasked to develop a Performance Work Statement and conduct a sourcing competition using A–76. A Most Efficient Organization team was tasked to develop a government-based proposal. In October 2005, Interior asked USGS to put on hold its A–76 study of NGTOC functions pending review of the consolidation of the NGTOC at the Denver Federal Center. An internal review of the decision process was undertaken and in December 2005. The review team found the "the process leading to the site selection for NGTOC was open, fair, and adequate to support the decision." In January 2006, Interior's Assistant Secretary for Water and Science concurred with this finding and the A–76 study was resumed.

Geospatial Coordination

NSDI Clearinghouse Actions — The NSDI Clearinghouse will continue to coordinate the publication of metadata describing geographic data and services at over 250 distributed

Clearinghouse nodes. All domestic NSDI Clearinghouse metadata collections will be made accessible through the GOS portal as the primary governmentwide search interface.

Development of the Global Spatial Data Infrastructure — The FGDC will participate with other countries in developing the Global Spatial Data Infrastructure (GSDI), as a key way to foster use of common and consistent policies, protocols, and standards for more effective use and exchange of geospatial data both within nations and across political boundaries. FGDC will also support the Group on Earth Observation comprised of U.N. and European Commission members, and Global Earth Observation System of Systems, a ten year implementation plan to build the infrastructure for global sustainable development. The FGDC is providing leadership and support for the ninth GSDI international conference in Chile and the groundwork will be laid for a eleventh GSDI meeting.

National Security Requirements — USGS will work with the National Geospatial Intelligence Agency and DHS to leverage FGDC activities and products for national security requirements which include development of data standards, data models, and data sharing partnerships with State and local governments, Canada and Mexico.

Homeland Security and Critical infrastructure Data Needs — Work will continue on developing standard geospatial data sharing agreements and guidelines for developing agreements for homeland security purposes, providing a consistent national set of symbols for use in maps that support emergency response activities, developing linear and polygonal symbology to support emergency response, providing principles and guidance on geospatial information content useful for homeland security applications, facilitating implementation of geoaddressing techniques based on the U.S. National Grid, and identification of geospatial data that would be useful for homeland security applications.

Partnership Implementation

Key NGP partnership goals include pursuing Memorandums of Understanding for building the NSDI in every State; supporting the FGDC Fifty States Initiative by assisting State partners in developing strategic business plans for geospatial activities; and working with State authorities to integrate geospatial requirements into their State Homeland Security Plans. USGS will refine the recommendations of the Future Directions governance report and work with partner organizations to develop effective, participatory governance processes for the NSDI.

Expansion of NSDI Liaison Office Network — The USGS will continue to maintain NSDI liaisons in Alaska, Arkansas, California, Colorado, Delaware, Florida, Hawaii, Idaho, Kansas, Kentucky, Louisiana, Minnesota, Missouri, Montana, Massachusetts, New York, North Carolina, Ohio, Oregon, Pennsylvania, South Carolina, Texas, Utah, Virginia, Washington, and Wisconsin. The plan for 2006 is to establish liaison offices in several new States: Michigan, Alabama, and either Maine or Connecticut.

Working with Tribal Governments — USGS will continue an ongoing interagency agreement with DHS/FEMA. The Emergency Management Framework for Tribal Governments course was developed and is being delivered to those in the tribal communities who have responsibility for emergency operations planning and can facilitate the use of metadata and GIS as a critical support system to effective emergency response and recovery efforts.

Tribal Partnership to promote the NSDI with FWS and the FGDC — USGS has an ongoing interagency agreement with FWS for 2006. In support of this effort, the GIS Introduction for

Conservation Professionals, and GPS/GIS Introduction for Natural Resource Field Personnel was developed and is being delivered to tribal communities who have responsibility for mapping and tracking flora and fauna and can facilitate the use of metadata and GIS as a critical support for tracking threatened and endangered species.

Private Sector Partners — The USGS has established a number of research partnerships with private businesses and universities, to the mutual benefit of the USGS and its partners. An example of an ongoing partnership is with the National Geographic Society to evaluate map kiosk technology. The kiosk incorporates scanned USGS topographic maps to allow customers to create custom topographic maps and print their selections on a self-service basis through a simple touch-screen interface.

Academic Partners — Through a research partnership with Florida International University's High Performance Database Research Center, the USGS is cooperating to develop techniques for archiving, dispensing, and displaying geospatial data produced by the USGS. The university's TerraFly Web site demonstrates seamless data presentation, automatic e-commerce delivery of data, and applications combining USGS data with data available from other sources.

TerraServer Project with Microsoft, Inc. — The partnership with Microsoft Research resulted in the creation of the TerraServer which provides more than eight terabytes of image data to all Internet users. The research conducted by Microsoft resulted in proven techniques that apply database methods and the latest computer hardware to serve digital orthoimagery and other geospatial data in a seamless manner.

FY 2005 Program Performance Accomplishments

Geospatial Integration

Integrate Role of GOS in Hurricane Support — The "GIS for the Gulf" implemented a GIS database for areas that were affected by Hurricanes Katrina and Rita. GOS completed areas of functional integration with *The National Map* to include partner registration, initial viewer integration, and coordinated outreach and partnering.

National Data Sets on Call to Support Responders to U.S. Natural Disasters — Within hours of Katrina's disastrous landfall, critical pre-hurricane imagery provided views of the pre-existing landscape which helped in search and rescue operations, and prioritize cleanup and recovery efforts. In cooperation with FEMA, a clearinghouse was established for all information and data on areas struck by Katrina and Rita. Pre- and post-hurricane imagery from numerous data sources were immediately loaded to an ftp data server for rapid release to relief organizations and agencies, as well as government disaster management teams.

Current and Temporal Orthoimagery Archive, Research and Implementation — During the recent Hurricane Katrina disaster, responders were readily able to access imagery in a familiar format and gain knowledge instantly on the availability of new and existing data. Imagery spanning 60 years was available to address long term environmental issues such as natural hazards, invasive species, urban growth, oil, and gas development and off road vehicle use.

Data Integration and Coverage Continue to Expand for National Data Sets — The USGS worked to integrate data for America's urban areas into *The National Map*. High resolution

imagery data are used not only to plan public security measures for activities such as large sporting events, rallies, and demonstrations in major cities, but also provide current pre-hurricane imagery that was critical for search and rescue operations.

Graphic Map Production and Map on Demand — USGS implemented a prototype service to generate maps from data in *The National Map.* The service provides the user the ability to generate maps in a variety of electronic formats for easy download and use within GIS systems. Following Hurricanes Katrina and Rita, map data and information was needed by first responders to locate and rescue persons trapped in their residences. Using *The National Map* map-on-demand capability, maps were produced in the Louisiana area that was impacted by Hurricane Katrina. Maps were also used to show levee breaches and the lowest documented elevation to determine flood depth.

Cost Benefit Study — *The National Map* could provide a net $2.05 billion in present-day value of benefits, above and beyond the cost to develop and maintain the database. In 2005 USGS published a cost benefit study to evaluate the net benefits of *The National Map* that was published in USGS Circular 1271, "*A Cost-Benefit Analysis of The National Map*" and describes methods used to determine the value of this type of unique product.

Research and Development — USGS conducted research and development that investigated new technologies, techniques, tools, and processes to advance the *The National Map*. These included: investigations in the restoration of data from lossy compression algorithms; tools and techniques for fast re-projections of geospatial data; techniques for directed edge detection for change identification in urban areas; and National database models for the transportation, boundaries, and structures data themes.

Geospatial Coordination

Geospatial Enterprise Architecture Profile — A Geospatial Community of Practice team was convened to develop a Geospatial Profile for the Federal Enterprise Architecture (FEA). The profile documents cross-cutting capabilities that pervade many FEA Lines of Business. The profile provides guidance to chief architects to systematically consider geospatial capabilities of each of the FEA Reference Models in their agency architecture designs. These reference models address business processes, performance, technology, services, and data capabilities in the fulfillment of agency missions. A draft profile document was prepared and is being revised for promulgation via the FGDC and the Federal Chief Information Officer Council.

Geospatial Modernization Blueprint — The USGS led the development of a Geospatial Blueprint for Interior. The NGP provide the coordination for this activity. The Geospatial Modernization Blueprint is intended to address the geospatial target architecture and requirements the Department's mission and programs areas.

Hazard Support from USGS — USGS supported USNORTHCOM concerning the hurricanes along the Gulf Coast and other events on 2005. USGS created custom geospatial products to meet the needs of the NORTHCOM. USGS performed reach-back to USGS scientists across the country in support of daily emergency operations and all hazard events. USGS also provided scientific input to the NORTHCOM Joint Operations Center during increased seismic activity periods in California.

Geospatial Data Content Guidelines for Homeland Security — As co-chair of the FGDC Homeland Security Working Group, USGS developed a guidance document for the collection

and attribution of national infrastructure information. *The National Map* and the geospatial data program of the DHS both depend heavily upon data procured through partnership agreements with State and local agencies. This data content guidance document is critical to ensuring the compatibility of geospatial data originating from State and local sources with that of national data sets used in homeland security applications. The first version of the Geospatial Data Content Guidelines for Homeland Security is complete and currently in review by DHS.

Partnership Implementation

State and Local Governments — *The National Map* is useful to State and local government in supporting Homeland Security Initiatives. The successes of the cross-sector partnership in Indiana demonstrate the power and potential of the NSDI Partnership Offices to seize and build upon opportunities with State and local partners. The USGS is working with the Indiana Geographic Information Council, the State government, and local partners to implement IndianaMap, a statewide geospatial data infrastructure that has been developed partially to help satisfy the geospatial data needs of the Indiana Department of Homeland Security.

Enhancing Tribal Participation in NSDI — The FGDC Tribal Liaison has an agreement with DHS/FEMA. The Emergency Management Framework for Tribal Governments course is being delivered to those in the tribal communities who have responsibility for emergency operations planning and can facilitate the use of metadata and GIS as a critical support system to effective emergency response and recovery efforts. The Liaison also has an interagency agreement with FWS. The GIS Introduction for Conservation Professionals, and GPS/GIS Introduction for Natural Resource Field Personnel are being delivered to tribal communities who have responsibility for mapping and tracking flora and fauna and can facilitate the use of metadata and GIS as a critical support for tracking threatened and endangered species. USGS signed a Memorandum of Understanding with the Coeur d'Alene Tribe that will allow the Tribe's GIS department to link a dedicated data server to *The National* Map for display of selected tribal boundary, structure, transportation, imagery, and elevation data that will be used in a USGS-supported effort by the Tribe to develop wildfire fuels maps over their lands.

NSDI Governance — USGS completed a report with recommendations for the future governance of the NSDI. The team included representatives from Federal, State, and local governments; from the private and non-profit sectors; and from academia. Recommendations included: enhance the role and functions of the FGDC, establish a National Geospatial Coordination Council, and improve management of Federal Geospatial Programs.

FY 2006 Planned Program Evaluations/Reviews

- GIO Managers Quarterly Review Meetings
- Coordination of NSDI Cooperative Agreements Program (CAP) grant applications and proposal evaluation process
- NGP 2006 Plan of Work
- GIO Portfolio Review Board Analysis of Portfolio
- Bureau Investment Review Board – review of investment management maturity of *National Map* Reengineering Project
- Review of NGTOC decision (Eastern Region director team)
- OMB Circular A-76 Study for Geospatial Operations

- National Research Council study, "Beyond Mapping: The challenges of New Technology in the Geographic Information Sciences" – external review
- American Society of Photogrammetry and Remote Sensing study, "Panel Report to USGS on Digital Orthoimagery" – external technical review of strategic issues facing USGS orthoimagery activities

Performance Overview

Measures	FY 2005 Plan	FY 2005 Actual	Change from 2005 Plan	FY 2006 Enacted	2006 Change from 2005 Plan	FY 2007 Request	2007 Change from 2006
Content and expanse of knowledge base: average % of coverage for 6 data themes in *The National Map* at medium resolution; does not measure currentness **(SP EI) (PART)**	70%	69%	-1%	78%	+9%	90%	+12%
Content and expanse of knowledge base: average % of coverage for 7 data themes in *The National Map* at high resolution; does not measure currentness **(SP EI) (PART)**	54%	46%	-8%	61%	+15%	72%	+11%
# of annual gigabytes collected **(EI)**	62,622	6,023	56,599	26,728	20,705	25,428	-1,300
# of cumulative gigabytes managed **(EI)**	148,479	108,035	40,444	175,207	67,172	200,635	+25,428
# of formal workshops or training provided to customers (instances/issues/events) **(EI)**	21	29	+8	23	-6	17	-6
# of mapping nodes (publicly available Web mapping services available through *The National Map*) **(EI)**	140	152	+12	155	+3	200	+45
# of partnerships for *The National Map* built with State and local governments that collect and maintain higher resolution, more current data **(PART EI)**	28	35	+7	20	-15	20	0
# of data standards used in implementing *The National Map* partners **(PART EI)**	22	22	0	22	0	22	0
X% of total cost saved through partnering for data collection of high resolution imagery **(PART Eff. measure)**	42%	72%	+30%	44%	-28%	46%	+2%
X% of the nation's surface for which hydrography, elevation, and orthoimagery data are available through the National Spatial Data Infrastructure Clearinghouse and supported through partnerships **(PART EI)**	83%	71%	-12%	86%	+15%	89%	+3%

Measures	FY 2005 Plan	FY 2005 Actual	Change from 2005 Plan	FY 2006 Enacted	2006 Change from 2005 Plan	FY 2007 Request	2007 Change from 2006
X% of the area of 11 Western States for which orthoimagery have been acquired through a FSA/USGS partnership with other entities to achieve a 5-year cycle for 1-meter NAIP imagery **(EI)**	Baseline	Baseline	0	36%	+36%	62%	+26%
X% of total cost FSA and USGS saved through partnering with other entities for imagery acquisition of 1-meter NAIP orthoimagery **(EI)**	Baseline	Baseline	0	40%	+40%	36%	-4%
# of new NSDI Clearinghouse nodes established for serving data **(EI)**	50	43	-7	50	+7	50	0
# of informal NSDI conference outreach exhibits **(EI)**	50	56	+6	50	-6	50	0
# of new NSDI standards developed **(EI)**	25	22	-3	30	+8	32	+2
# of new NSDI partnership agreements **(EI)**	60	36	-24	60	+24	60	0

This page intentionally left blank.

Science Support

Activity	2005 Actual	2006 Enacted	2007 Fixed Cost & Related Changes [a/]	2007 Program Changes	2007 Budget Request	Change from 2006
Science Support	65,584	69,302	2,090	-4,010	67,382	-1,920
Total Requirements $000	**65,584**	**69,302**	**2,090**	**-4,010**	**67,382**	**-1,920**
FTE	***462***	***459***	***0***	***0***	***459***	***0***

[a/] Fixed cost increases for this activity total $2,453, of which $2,090 will be budgeted and $363 will be absorbed.

Summary of FY 2007 Program Change for Science Support

Request Component	Amount	FTE
Program Changes		
• Remove one-time funding for Landsat 7 Pay-back	-3,941	0
• Director and bureau support reduction	-69	0
TOTAL	**-4,010**	**0**

Justification of FY 2007 Program Changes

The 2007 budget request for Science Support is $67,382,000 and 459 FTE, which is a net change of -$1,920,000 and 0 FTE from the 2006 enacted level.

The FY 2007 budget reduces the following:

Landsat 7 Pay-back Funding (-$3,941,000 and 0 FTE) — Reduces Science Support for the one-time appropriation of $3,941,000 received in FY 2006. The funding had been provided in 2006 to cover information technology and critical infrastructure investments that were deferred from 2005 to provide resources to cover the funding shortfall in the Landsat program.

Director's Office, Administrative Policy and Services, Human Capital and Regional Offices (-$69,000 and 0 FTE) — Reduction will be absorbed equally by the Director's Office, Administrative Policy and Services, Human Capital and Regional Offices through operating expenses and attrition.

Program Performance Change — No performance table is shown because there is no performance measure associated with this FY 2007 reduction.

Program Overview

Science Support funds the executive and managerial direction of the bureau, as well as bureau sustaining support services. Science Support has four components: leadership activities, the Office of Administrative Policy and Services, the Office of Human Capital and bureauwide costs.

Leadership — The Director serves as Chief Executive of the USGS with ultimate authority for all strategy, policy, and program decisions. This includes direct involvement in program, budget, finance, and communications development. The Deputy Director serves as Chief Operating Officer supporting the Director in implementing policy decisions, with a focus on operational issues.

Use of Cost and Performance Information

In accordance with departmental guidelines, USGS implemented Activity Based Costing/Management in FY 2005. Cost and performance data were presented in the FY 2005 Performance and Accountability report where the Statement of Net Cost was presented aligned to the Department's revised Strategic Goals.

The Executive Leadership Team is composed of 15 senior policy-level leaders of the bureau including the Director and Deputy Director. It identifies issues of interest and concern to the USGS enterprise and functions as a senior advisory body to the Director and as the principal mechanism for building a bureau-centered culture.

Associate Directors have oversight of national programs, establish program direction and goals, and serve as science advisors to the Director for their respective program areas. Regional Directors are responsible for meeting regional science and operational needs through integrated science centers and other means. The bureau uses regional science programs and integrated science centers as tools to effectively coordinate program activities in addressing regional issues.

The Office of Budget and Performance and the Office of Communications report to the Director and provide bureau-level advice and staff assistance to the Director and executive leadership. This advice includes bureauwide policy, guidance, and direction for:

- Budget formulation, execution, presentation, and advocacy with the Department, Office of Management and Budget, and Congressional Appropriations Committees,
- Strategic planning and performance management, and
- Communicating information about USGS research, programs, activities and products, and liaison and close coordination between USGS and the Congress, the Department, and other bureaus for congressional and public affairs matters.

The **Office of Administrative Policy and Services** provides bureau-level policy, program direction, and leadership for science support. These support services include accounting and fiscal management; general services and office support; security; safety, environmental protection, and occupational health; contract negotiation and administration; grant administration; technology transfer, facilities and property management; and business information systems management. The Associate Director for Administrative Policy and Services, also serves as the USGS Chief Financial Officer (CFO).

The **Office of Human Capital** provides bureau-level leadership, program direction, and staff support for human capital programs, including equal employment opportunity, diversity,

affirmative employment, employee development, personnel management, and supervisory, managerial and leadership training development.

Bureauwide Costs — Bureau sustaining costs are budgeted centrally. The budget for these costs is formulated annually based on past actual expenses and an estimate of future need. Certain essential program support costs are relatively uncontrollable by the USGS and, because of the nature of organization and billing arrangements, are more effectively and efficiently managed centrally (e.g., payments to the Department of the Interior for services provided through the Departmental Working Capital Fund for departmentwide centralized services, payments to the Department's National Business Center (NBC) for administrative systems and automated data processing services provided through the NBC Working Capital Fund, and other costs, such as the Federal Lab Consortium, Flexibility Spending Account, and Seismic Safety System). Other bureau-level costs include payments to the Department of Labor for unemployment compensation and on-going injury compensation and human resources initiatives. The Science Support Activity also partners with other Interior bureaus and offices to provide shuttle service to and from the Main Interior Building to the Reston area.

Science Support Restructure — The 2007 budget request proposes a budget restructure to eliminate the subactivity entitled "Payments to the NBC," which was originally intended to reflect payments to the Department for common services provided by the National Business Center and billed through the Department's Working Capital Fund. However, the subactivity has not kept pace with the increasing number and cost of services provided by the NBC and other Departmental offices. Additional funding has had to be provided from the Bureau Operations subactivity in particular, and from other components of the budget as well, to cover the full scope of Departmental services. Since the subactivity no longer reflects the purpose for which it was created, USGS proposes to consolidate the Payments to the NBC subactivity with the Bureau Operations subactivity and manage the Science Support activity at the activity level. This approach also mirrors the level at which this activity is overseen in the appropriation.

FY 2007 Program Performance Estimates

The President's Management Agenda — Offices within the Science Support Activity manage and oversee bureauwide implementation of the President's Management Agenda initiatives that are part of ongoing departmentwide and governmentwide efforts to implement innovative Federal programs that promote improved financial management, competitive sourcing, strategic management of human capital, expanded electronic Government, and budget and performance integration. Highlights of USGS efforts in FY 2007 on specific initiatives follow:

- **Financial Management Improvements —** The USGS continues to enhance performance against measures identified under the President's Management Agenda. The bureau's most recent assessment was "yellow." The bureau is working with the Department and OMB to meet the "getting to green" requirements by demonstrating successful usage of management reports for decision making purposes in a given program. The USGS will demonstrate this with the many management reports available to manage the bureau's reimbursable program, which accounts for approximately 25 percent of the bureau's funds. During FY 2007, the bureau will refine our implementation of OMB Circular A–123 by standardizing the reviews and documentation of management control reviews conducted by regional centers. The USGS will also continue participation and implementation plans for transition to the Department's Financial and Business Management System (FBMS).

- **Budget and Performance Integration —** A comprehensive system of program evaluations executed through a 5-year program review schedule, National Research Council reviews, OMB Program Assessment Rating Tool (PART) evaluations, and Organizational Assessments are all fundamental to an integrated program- and budget-planning process that ensures that the management of programs and funding is handled appropriately and uniformly at local, regional, and national levels. The USGS Director's Assurance Statement, Internal (Management) Control Reviews and Audit Follow-Up, continue to lead the Department in scope, thoroughness, and documentation. The USGS continues to implement the Department's Strategic Plan as an integrating framework for budget and performance. Specific measures tied to departmental priorities are used in SES performance plans and are cascaded to all employees. USGS implements Activity Based Costing/Management (ABC/M) objectives, through a distributed planning and budgeting system that uses ABC/M data and interfaces with the financial system to provide budget and program managers financial information to support the development of annual budgets. Capturing cost of work will help USGS better document the basis for cost-share projects, assessment, and cost recovery.

- **Competitive Sourcing —** USGS continues to complete business strategy review (BSR) efforts on business areas as defined in the Competitive Sourcing Green Plan FY 2005 – FY 2008 that has been coordinated and approved by the Department. In FY 2007, USGS will conduct BSRs on Information Technology and Science, accounting for approximately 50 percent of total full time equivalents (FTE) on the USGS FAIR Act Inventory. Studies of both science technician and science support functions performing Hydrologic Data Collection, and geospatial data production functions in the National Geospatial Technical Operations Center (NGTOC) will be completed in FY 2007. Additional studies may be launched based on the results of completed BSRs. Funds will be required for external expertise for these reviews and studies. FTE resources are required to implement and manage the USGS Competitive Sourcing Initiative, including the oversight of contractor support, development of Competitive Sourcing Plans and management of the FAIR Act inventory collection process. Under the Competitive Sourcing mandate, implemented through the OMB Circular A–76, Federal agencies are required to review commercial functions performed by Federal employees.

- **Asset Management —** USGS continues its efforts to implement Executive Order 13327, Real Property Asset Management. USGS has participated in the development of the Department of the Interior Asset Management Plan and has provided inventory information to the Federal Real Property Profile. In FY 2007, USGS will complete Asset Business Plans for key science centers and office complexes. These plans will enable USGS to continue efforts to provide space and facilities that are appropriate for world-class science while controlling costs.

- **Strategic Management of Human Capital —** In FY 2007, the Office of Human Capital will focus on Organizational Performance and Organizational Change. The USGS Organizational Excellence Model will serve as the systemic framework for measuring organizational performance and for aligning all the aspects of organization change to achieve science excellence. The featured applications of the Organizational Excellence model in FY 2007 will include implementation of management strategies to help employees and managers deal with the impact of organizational change brought about by competitive sourcing, workforce adjustments, and restructuring that might occur in the headquarters and regions. A second application will be the development of performance measures that will be used to mark progress toward the goals of science excellence.

Lastly, a Human Capital focus in FY 2007 will be the development and implementation of strategies and tools for workforce and succession planning. Among these tools will be manager and employee surveys, demographic and employment trends, automated workforce planning and development capabilities, use of the new Learning Management system, and enhancing Mentoring Program flexibilities for transfer of skills and knowledge.

Workforce Diversity — Improving workforce diversity is a priority for the USGS and a significant workforce planning issue. During FY 2007 the USGS will continue implementation strategies to comply with the requirements of the Equal Employment Opportunity Commission's (EEOC) Management Directive (MD)–715, particularly with regard to the identification of barriers that prevent the accomplishment of diversity and affirmative employment goals. The USGS will use new, real-time reporting tools that will assist Human Resource (HR) and line managers with identifying demographic trends and recruitment opportunities. The USGS will use the USGS Diversity Council to help identify barriers to diversity and recommend solutions to management. The USGS will direct its recruitment efforts to provide our regions with additional fiscal resources to establish relationships with local colleges and universities with majors in the USGS programs and with high enrollments of minority students. The USGS will continue implementing the Department's Workforce Diversity Plan and focus on goals measured by outcomes in recruitment, retention, zero tolerance and accountability.

Leadership Development — The USGS will continue to develop leadership skills and behaviors at all levels of the organization in FY 2007, through its internal leadership training program, championed and participated in by USGS senior executives and augmented by online performance support tools and external leadership development resources.

FY 2006 Planned Program Performance

Unless otherwise noted, the planned program activities listed below demonstrate the utility of USGS products that are counted under the mission goal Management Excellence. The outcomes that contribute fall under the strategies "Human Capital Management," "Improved Financial Management," "Performance-Budget Integration," and "Competitive Reviews and Contract Management."

Financial Management — The USGS received an unqualified financial audit opinion on the FY 2005 annual Performance and Accountability Report, annual financial statements and successfully cleared the two reportable conditions and one non-compliance with laws and regulations received in FY 2004. During FY 2006, the USGS will effectively implement OMB's revised Circular A–123, "Management's Responsibility for Internal Control." During FY 2006, the USGS provided well attended and well received training on various financial topics to administrative staff and Cost Center Managers by conducting bureauwide workshops for cost center managers in November 2005. The same will be done for administrative staffs in March 2006.

Budget and Performance Integration — During FY 2006, USGS Earth Surface Dynamics and Coastal and Marine Geology programs will be evaluated using the PART process. All PARTed programs have developed new milestones for OMB recommendations in pursuit of continuous improvement. The cyclic 3-year revision of the Strategic Plan begun in FY 2005 will

conclude in FY 2006 in time for FY 2008 implementation. Specific measures tied to departmental priorities have been used in SES performance plans and cascaded to all employee plans. USGS implemented ABC/M coding at the task level rather than project level for FY 2006 to increase the granularity of the data to begin to make appropriate use of these data for cost analysis. USGS also refined the way we capture Information Technology costs in FY 2006, creating a process that's useful for extracting Exhibit 53 IT information for the Department at a detail level that has not been possible to retrieve until now. Continued effort is needed to standardize processes and ensure consistency of interpretation before ABC data can be routinely used to manage.

Competitive Sourcing — USGS continues its Competitive Sourcing planning effort based on the strategy and timetable for conducting business strategy reviews (BSRs) on all commercial full time equivalents (FTE) by the end of FY 2008 as outlined in the Competitive Sourcing Green Plan for FY 2005 – FY 2008. The BSRs link bureau mission, strategic change initiatives, current and future science directions, and workforce planning activities into a comprehensive coordinated vision. In FY 2006, USGS will complete BSRs on the Library and Information Services and Administrative Management business areas, totaling more than 1,700 FTE. FY 2006 will be the first year of performance by the Visual Information High Performing Organization (HPO).

Asset Management — In FY 2006, USGS completed an updated inventory of all USGS assets to meet the requirements of the governmentwide Federal Real Property Profile. USGS will also complete its first Asset Management Plan. The plan will follow the example and guidance established in the Department of the Interior Asset Management Plan. The focus of the plan will be on ensuring that USGS space and facilities meet the needs of USGS science programs, are well-maintained within the budget allowed, and used effectively.

Strategic Management of Human Capital — Organizational Performance. In FY 2006, the USGS will continue to implement applications of the USGS Organizational Excellence model; a systemic framework for measuring organizational performance and aligning all the aspects of the organization needed to achieve science excellence. The USGS will use the model as a planning tool for implementing any restructuring of headquarters and regions.

Workforce Adjustments — In FY 2006, the USGS will expand its workforce planning efforts to address the impacts of restructuring of the USGS organizations, competitive sourcing initiatives and other workforce strategies that will shift the numbers and balance of USGS employees and skills. These efforts will include the pursuit of additional authorities for Voluntary Separation Incentive Payments and Voluntary Early Retirement from OPM and OMB.

The USGS will also implement the Department Supervisory Development Policy requirements and begin the implementation of the Department Succession Planning policies related to supervisor, managerial, and executive level positions. The Mentoring Program will be enhanced to provide additional performance support for supervisory development.

Tools for Managers — The USGS will continue to extend the capabilities of the automated desktop workforce planning tools for managers and the integration of workforce data into the Department Learning Management System. In FY 2006, the USGS will complete coverage of critical and emerging skills included in the skills assessment, refining the information reports capabilities, and developing tools to link identified skill needs to course listings and (or) other developmental opportunities.

Improving workforce diversity is a priority for the USGS and a significant workforce planning issue. A major initiative in FY 2006 is to continue complying with the requirements of the EEOC MD–715, particularly with regard to the identification of barriers that prevent the accomplishment of equal opportunity and affirmative employment goals. The USGS will implement new, real-time reporting tools that will assist HR and line managers to identify demographic trends and recruitment opportunities. The USGS will implement the Department's Strategic Plan for Achieving and Maintaining a Highly Skilled and Diverse Workforce FY 2005 – FY 2009.

Core Competencies Initiative in Support of Strategic Management of Human Capital Goal — The USGS has developed safety and health core competencies required by full time professionals and collateral-duty personnel at all grade levels. This initiative included identification of the basic tasks of the positions, development of reference manuals that provided guidance on safety and health roles and responsibilities, template position documents, and individual development plan guidance. USGS efforts have resulted in the departmentwide adoption of a core competencies guidebook. USGS safety training and policy documents will be updated in FY 2006 to reflect these guidelines and subsequently posted for employee access on the internal safety Web site.

The USGS will implement the Core Competencies for Managers Model to enhance managerial performance at all levels.

USGS Fleet Management Efficiencies — In FY 2006, USGS will implement a set of strategies designed to reduce fleet costs, reduce the age of the fleet, and reduce fossil fuel consumption. USGS will implement a vehicle replacement plan and optimize the use of Working Capital Funds. The Fleet Management Plan will require cost center managers to justify retention of vehicles. Fleet fuel efficiency goals and other performance indicators will be utilized.

Electronic Government

HSPD-12 Implementation — In FY 2006, USGS will continue implementation of the processes required by Homeland Security Presidential Directive (HSPD)-12 that all employees, contractors, volunteers, and other affiliates are subjected to an identity-proofing and background investigation process. As part of this process, USGS will begin issuing Smart Card identification badges to all new employees as well as contractors, volunteers, and other affiliates. In FY 2006, USGS will also begin the process of issuing new identification badges to existing employees at the National Center, Reston, Virginia; National Wildlife Health Center, Madison, Wisconsin; EROS Data Center, Sioux Falls, SD; and certain facilities of the Florida Integrated Science Center.

Environmental Management System Deployment — USGS has completed initial implementation of environmental management systems at appropriate facilities in accordance with Executive Order (E.O.) 13148, "Greening the Government through Leadership in Environmental Management." In FY 2006, USGS will provide USGS facilities with access to a Web-based system, referred to as the EMS Facilitation System to provide field staff with step-by-step tools necessary for developing and implementing EMS at field locations, while ensuring consistent implementation across the bureau. EMS implementation involved identifying facility activities that impact the environment, prioritizing these environmental impacts in terms of significance, choosing one or more significant aspects upon which to focus your improvement efforts, and developing an environmental response plan outlining steps to achieve improvement.

Technology Transfer — The following table projects the FY 2006 Technology Transfer Activity:

(Dollars in thousands)

Technology Transfer FY 2005	Total Number	Private/Small Businesses	Non-Profits / Academic Institutions	Government/ International Entities	Partner Contributions	USGS In-Kind Contribution
CRADAS	13	7 / 2	4 / 0	0 / 0	$4,800	$2,400
Other Agreements	37	6 / 8	10 / 4	4 / 5	$1.200	$510
Patent Licenses	16	2 / 12	0 / 2	0 / 0	$40	$1

FY 2005 Program Performance Accomplishments

Unless otherwise noted, the FY 2005 Program Performance Accomplishments listed below demonstrate the utility of USGS products that are counted under the mission goal Management Excellence. The outcomes that contribute fall under the strategies "Human Capital Management," "Improved Financial Management," "Performance-Budget Integration," and "Competitive Reviews and Contract Management."

Financial Management — The USGS achieved an unqualified financial audit opinion on the FY 2005 annual Performance and Accountability Report, annual financial statements and also successfully cleared the two reportable conditions and one non-compliance with laws and regulations from FY 2004, resulting in no material or reportable findings for FY 2005. This success is due to improved policies and procedures, enhanced staff capability, and continued focus on training for administrative staffs. The bureau implemented two "hard close" of accounts in FY 2005: after the ends of the 2nd and 3rd quarters; these activities allowed the bureau to closely examine the results and served to highlight problems that needed to be addressed.

Budget and Performance Integration — USGS conducts both peer and management reviews as well as PART evaluations to improve the accountability and quality of programs. By the end of FY 2005, USGS PART evaluations stand at eight programs "moderately effective," one program "effective," and none rating "adequate," "ineffective" or "results not demonstrated." All OMB recommendations have been addressed with action plans. The USGS continues to implement the Department's strategic plan that has enabled integration of budget and performance since FY 2004, and provided a meaningful measure of departmental accountability. Specific measures tied to departmental priorities have been used in SES performance plans. The cyclic 3-year revision of the Strategic Plan began in FY 2005 and will conclude in FY 2006 in time for FY 2008 implementation. USGS began implementing ABC/M in concert with the Department in FY 2004. USGS coded ABC activities at the project level to capture the full cost of doing work, for example, all effort related to research. ABC reports and data can be extracted by all managers at all levels on a daily basis for verifying, validating, and for performing analyses for decisionmaking. Continued effort is needed to standardize processes and ensure consistency of interpretation before ABC data can be routinely used to manage.

Organizational Excellence Model — The USGS developed a USGS Organizational Excellence model that identifies the critical leadership and management, people, process, and structure components that support USGS science outcomes at the program, bureau, and societal level. The model provides a systemic framework for planning and decision making, communicating the components that underpin organizational success, and measuring

organizational performance. The first significant application of the model was the completion of a manager's survey to address and report issues surrounding restructuring initiatives. The results of this survey led to the Director's decision to include the Organizational Excellence model as a tool in future USGS change initiatives.

Workforce Planning — In FY 2005, the USGS focused workforce planning efforts to address the bureau's strategic goal of integrated science. In addition, workforce plans were developed and implemented for the balance and number of skills and occupations needed to achieve the bureau's strategic program goals. Workforce plans served as the basis for the development of six separate requests for authority to offer Voluntary Separation Incentive Payments and Voluntary Early Retirement to approximately 1200 employees. These authorities will be effective in FY 2006 to help achieve desired workforce balance and gain the flexibilities needed to acquire emerging skill needs.

Leadership and Management Development — During FY 2006, the USGS continued to provide leadership training for the purpose of developing a critical mass of leaders at all levels of the organization. The Management/Supervisory Program implemented a 360 evaluation process for supervisors based on the Human Resources competencies identified in the Core Competency Model for Manager. The USGS also implemented the full suite of Core Competencies for Managers with the goal of improving managerial performance at all levels of the USGS. This effort has been linked with the USGS workforce planning effort and with the long-term leadership development goals of the USGS.

Competitive Sourcing — USGS completed reviews of the Visual Information, Mapping and Charting and Science Technician and Science Technical Support business areas pursuant to the Competitive Sourcing Green Plan for FY 2005 – FY 2008. An HPO was formed for the Visual Information business area and formally established on October 2, 2005. Competitive Sourcing study announcements were made for both remaining business areas on September 30, 2005. USGS initiated the BSR on the Library and Information Services business area, totaling approximately 104 FTE, in July 2005 in accordance with the Green Plan.

Fleet Management — The USGS reduced FY 2005 vehicle fleet costs by more than the targeted $975,000. We continued efforts to right-size and efficiently and effectively manage the fleet in support of the USGS Mission by working with cost center managers to ensure that mission requirements were met with the smallest possible number of vehicles, and with the most fuel-efficient vehicles available to perform the necessary and critical functions. The USGS Vehicle Fleet Management Strategic Plan was finalized and approved, and implementation of the policies and guidance in that document will ensure effective management of the fleet. New reports were made available through the bureau's utilization data collection system; these reports have given local managers and the bureau fleet manager the information needed to identify under-utilized vehicles and opportunities to share vehicles and (or) dispose of vehicles no longer fully utilized. Procedures for implementing GSA AutoChoice were developed, and GSA AutoChoice was fully implemented so that all vehicle orders are being processed electronically.

Energy Management — The USGS National Center is a General Services Administration (GSA) delegated facility, consisting of three buildings and a central power plant totaling 1.1 million square feet on 105 acres in Reston, VA. In FY 2005, USGS was designated to received the Department of Energy Annual Award for Energy Management/Energy Efficiency. This award was due to the energy management program USGS implemented at the National Center that resulted in an annual energy reduction of 76.6 million British thermal units

(MBtu) per thousand square feet (ksf), or 31 percent as compared to the FY 1985 baseline. These energy reductions equate to seven million dollars in savings to taxpayers.

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 USGS this function is housed in the Office of Policy and Analysis where two FTE's service USGS Science Centers and offices throughout the country.

As part of their duties the team negotiates and drafts Cooperative Research and Development Agreements (CRADAs); Technical Assistance Agreements, Facility Use Agreements, and Patent Licenses. It 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. USGS has a total of 60 current patents. During FY 2005, the U.S. Patent and Trademark Office accepted filings for 5 new USGS patents and issued 9 patents to USGS. The table below summarizes the number of completed projects in FY 2005. The 41 agreements and three licenses completed in FY 2005 represent a 25 percent increase over the number of agreements concluded in FY 2004.

FY 2005 Technology Transfer Activity

(Dollars in thousands)

Technology Transfer FY 2005	Total Number	Private/Small Businesses	Non-Profits / Academic Institutions	Government/ International Entities	Partner Contributions	USGS In-Kind Contribution
CRADAS	10	6 / 1	3 / 0	0 / 0	$4,000	$2,000
Other Agreements	31	5 / 7	9 / 3	3 / 4	$1,000	$425
Patent Licenses	15	1 / 12	0 / 2	0 / 0	$36	$6

USGS science and research contributes to a broad range of collaborative projects in the private sector. Highlights in FY 2005 included support to a Native American Corporation seeking to understand the mineral diversity in its territory; partnering with a pharmaceutical company interested in qualifying its drugs for inoculation of additional fish species; and licensing three small US businesses for various underwater equipment—a sea-bed microscope; and a new self contained battery operated current meter for measuring water flow velocity in a stream or river.

Performance Overview

The Science Support Activity promotes the orderly and efficient conduct of USGS programs through organizational leadership, shared administrative support services, and promotion of common business practices. This activity oversees all the Department's goals that USGS supports—both mission and management excellence. Key indications of USGS performance are reflected in the end outcome goals for informing decisions through the application of science; workforce knowledge and skills; accountability; and modernization. To measure progress in achieving the intermediate outcome measure of obtaining an unqualified opinion, USGS tracks the percent of corrective actions completed from the OIG/GAO annual accountability report and audited financial statement for weaknesses identified in the Federal Manager's Financial Integrity Act (FMFIA) corrective action plan.

Measure	2005 Plan	2005 Actual	Change from 2005 Plan	2006 Enacted	2006 Change from 2005 Actual	2007 Request	2007 Change from 2006
X% of managers who indicate that their workforce has the job-relevant knowledge and skills necessary to accomplish organizational goals (SP)	70%	65%	-5%	65%	0	65%	0
Human Capital Plan Implementation: Performance-based management – X% of SES executives and direct reports that have performance agreements containing GPRA performance-based elements (SP)	100%	100%	0	100%	0	100%	0
Core Competencies Training for Fiscal Community: X% of fiscal community personnel trained in core competencies (BUR)	25%	50%	+25%	75%	+25%	100%	+25%
Competition: # of FTE in competitive sourcing studies completed during the fiscal year (SP)	0 FTE	0 FTE	0 FTE	119 FTE	119 FTE	524 FTE	+405 FTE

This page intentionally left blank.

Facilities Activity

Subactivity	2005 Actual	2006 Enacted	2007 Fixed Cost & Related Changes [a/]	2007 Program Changes	2007 Budget Request	Change from 2006
Rental Payments	71,367	71,805	+1,123	-540	72,388	+583
FTE	*0*	*0*	*0*	*0*	*0*	*0*
Operations and Maintenance	19,820	19,604	+107	0	19,711	+107
FTE	*58*	*58*	*0*	*0*	*58*	*0*
Deferred Maintenance & Capital Improvement	3,424	3,373	0	0	3,373	0
FTE	*0*	*0*	*0*	*0*	*0*	*0*
Total Requirements $000	**94,611**	**94,782**	**+1,230**	**-540**	**95,472**	**+690**
FTE	***58***	***58***	***0***	***0***	***58***	***0***

[a/] Fixed cost increases for this activity total $1,275 of which $1,230 will be budgeted and $45 will be absorbed.

Activity Summary

The 2007 budget request for the Facilities Activity is $95,471,000, which is a net change of +$690,000 and 0 FTE from the 2006 enacted level.

Funds for this activity provide safe and functional workspace and facilities for accomplishing the bureau's scientific mission. The appropriated funds included in this activity cover approximately 80 percent of recurring USGS facilities costs. Customers, through reimbursable funding provide approximately 14 percent, and USGS science programs provide the remaining funds.

Use of Cost and Performance Information

Development of the Strategic Facilities Management Plan has helped achieve the facilities program goal to provide quality space to further science programs while optimizing facilities location, distribution, and use. The final Strategic Facilities Master Plan (SFMP) was received in October 2005. The SFMP outlined a strategy to reduce the current funding shortfall, provided a thorough analysis of the facilities program, identifies opportunities to reduce cost through improved utilization, and further provides a strategy to properly fund operations and maintenance at USGS owned sites.

The development of the SFMP accomplished the following tasks:

- Performed a comprehensive analysis of USGS facilities,
- Determined adequacy of USGS facilities in meeting USGS current and planned mission needs,
- Examined the performance of USGS facilities and compared against external benchmarks,
- Recommended performance metrics,
- Developed a business case process and tool to evaluate facilities investments,
- Identified opportunities for reducing costs, operating within available funds and reducing the deferred maintenance (DM) backlog, and
- Discussed budgetary strategies to fully fund facilities and eliminate the DM backlog.

This activity supports the Department of Interior's Serving Communities goals, "protect lives, resources and property and advance knowledge through scientific leadership and Inform decisions through the application of science." This activity also

tracks outputs including "number of bureau condition assessments completed" (within a 5-year cycle) and "number of deferred maintenance and capital improvements."

The USGS defines facilities as separate and individual buildings, structures, or other constructed real property improvements. The USGS further defines facilities to include all locations where USGS activities are conducted including office space, laboratory space, warehouse space, and related parking and common space. The USGS has classified large (greater than 45 feet in length) research vessels as facilities.

The goal for the facilities program is to meet bureau science needs while optimizing facilities location, distribution, and use to control or reduce costs. Objectives for meeting this goal include:

- Coordinate facility planning with science planning to provide safe, high-quality workspace aligned with science needs,
- Meet performance targets by improving space utilization, controlling rent and operating costs, and releasing unneeded space,
- Eliminate the deferred maintenance backlog,
- Establish an effective maintenance program at each owned facility to meet industry best practices, and
- Increase co-location consistent with science program objectives.

Use of Cost and Performance

The Asset Priority Index (API) was developed for each owned building through the Strategic Facilities Master Plan contract. API is a metric that helps asset managers assess the priority, or level of importance, of facilities relative to one another in regards to the USGS mission. API is a tool that managers can employ in conjunction with other key metrics such as utilization, condition, and operating cost to prioritize investment decisions, identify candidates for disposal and support portfolio-level decision making the Deferred Maintenance backlog. API is required by the Department for projects that are included in the bureau 5-year Deferred Maintenance and Capital Improvement Plan. It is also a new requirement of the Federal Real Property Council to be entered into the Federal Real Property Profile for all owned and leased assets. The USGS Investment Review Board will use the API as a part of their decisionmaking process when reviewing proposed facilities projects to align proposals with mission requirements.

Five-Year Facility Plan — The bureau initiated national and regional 5-year facility plans to ensure that facilities meet science mission requirements and that facilities costs are reasonable and adequately funded. These plans will be amended to include specific action plans that target facility cost reductions.

Bureau Systems — This activity utilizes a Web-based facilities information system which continues to streamline the budget data collection process for facilities and increases the availability of much-needed management information on bureau real property holdings. Comprehensive facility condition assessments continue to identify deficiencies that need priority attention, creating an information base that promotes effective stewardship and a more informed asset investment process. The implementation of Interior's standard facilities maintenance management system provides the capability for the USGS to report our operations and maintenance consistently across the bureau.

Maintaining America's Heritage — The Department of Interior is committed to preserving and maintaining operational facilities and major equipment investments as well as to responsible stewardship of Interior's managed natural and cultural treasures. The FY 2007 USGS budget request includes $33 million for facilities and equipment maintenance and deferred maintenance under the Maintaining America's Heritage initiative. The Operations and Maintenance and the

Deferred Maintenance and Capital Improvements subactivity descriptions provide details on the immediate and long-term maintenance projects underway and planned for the next 5 years to ensure that facilities and equipment are functional, safe, and useful to the fullest extent of their lifecycle.

Congressional Directives

The FY 2006 Appropriations Act for the Department of the Interior and Related Agencies included the following directive for the USGS Facilities program:

> "The Senate Appropriations Committee remains concerned about reported poor and und unsafe conditions in the research facilities and office buildings at the Patuxent Wildlife Research Center and Patuxent Research Refuge. The Committee expects the Secretary of the Interior to complete a facilities and budget plan by not later than March1, 2006, which identifies the priorities, schedule, funding requirements, phasing options and agencies responsible for the repair, rehabilitation or replacement of facilities, buildings and associated infrastructure at the Center and Refuge."

Talks with FWS and USGS are in process. A joint plan is expected to be delivered on time.

Subactivity Overview

The Facilities Activity comprises three subactivities:

The **Rental Payments** subactivity provides for rental payments to the General Services Administration (GSA), to other Federal agencies, to private lessors, and to cooperators for space holdings nationwide. The USGS occupies a total of 4.4 million square feet of rentable space in about 220 GSA buildings nationwide, making USGS one of the largest users of GSA space within the Department. The USGS acquires space directly at over 100 other sites.

The **Operations and Maintenance** subactivity includes the recurring costs of providing for the basic operations and upkeep of facilities and ensuring that they are maintained in compliance with applicable safety and other standards. The USGS has 34 owned installations (283 buildings) on approximately 2,100 acres. This includes 9 biological science centers, 8 biological field and research stations, the National Center for EROS; 10 geomagnetic, seismic, and volcano observatories, a Water Resources district office, and 7 other miscellaneous owned properties, such as gauging stations, storage annex, and warehouses. The USGS also owns 8 large research vessels.

The **Deferred Maintenance and Capital Improvement** subactivity funds are used to address the highest priority USGS facility and equipment needs to conform to safety and environmental standards. The current funding level provides for approximately 3.9 percent of the facilities Deferred Maintenance and Capital Improvement backlog. The condition assessment program includes annual surveys and a cyclic process for comprehensive onsite inspections to document deferred maintenance.

This page intentionally left blank.

Activity: Facilities

Subactivity: Rental Payments

Subactivity	2005 Actual	2006 Enacted	2007 Fixed Cost & Related Changes [a/]	2007 Program Changes	2007 Budget Request	Change from 2006
Rental Payments	71,367	71,805	+1,123	-540	72,388	+583
Total Requirements	**71,367**	**71,805**	**+1,123**	**-540**	**72,388**	**+583**
FTE	***0***	***0***	***0***	***0***	***0***	***0***

[a/] Fixed cost increases for this program total $1,123, of which $1,123 will be budgeted and 0 will be absorbed.

Summary of FY 2007 Program Changes for Rental Payments

Request Component	Amount	FTE
Program Change		
• Space Savings	-540	-0
TOTAL	**-540**	**-0**

Justification of FY 2007 Program Changes

The 2007 budget request for the Rental Payments is $72,388,000 and 0 FTE, which is a program change of -$540,000 and 0 FTE.

The 2007 budget request for the USGS includes a reduction of $540,000 in the Facilities Activity, Rental Payments Subactivity. The proposed decrease supports the bureau's efforts to reduce space costs through consolidations and co-locations.

In addition to the reduction in rental payments described above, the USGS is also undertaking facilities management actions intended to result in space cost savings over the long term. The USGS is reducing space utilization in several locations through consolidations of existing facilities and closure of unneeded space. The USGS Strategic Facilities Master Plan and the assignment to the Investment Review Board will generate additional opportunities for reducing USGS space requirements over time.

Program Performance Change — Though the program contributes to the strategic goals of advancing knowledge through scientific leadership and informing decisions through the application of science, there are no performance measures specifically linked to this program change.

Program Overview

The Rental Payments component of the Facilities Activity funds payments to General Services Administration (GSA), other Federal sources, private lessors, and cooperators for space occupied by the USGS nationwide. The USGS occupies a total of 4.3 million square feet of rentable space in about 190 GSA buildings nationwide, making USGS one of the largest users of GSA space within the Department. The USGS acquires space directly at over 100 other sites. This component funds 80 percent of the appropriated portion of the rental payments. Remaining costs are funded from reimbursables and USGS programs. The USGS has unique facility requirements necessary to support science functions and relies heavily on GSA to meet needs such as providing modern laboratory and other support space. Approximately 90 percent of USGS rental costs for space holdings provided through GSA, 7 percent for cooperative space arrangements, and the remaining rental costs are for other Federal agencies and private lessors.

Use of the USGS Investment Review Board (IRB) — The USGS Investment Review Board reviews major information technology investments. The IRB is chaired by the Deputy Director and is composed of senior managers, including a science discipline Associate Director, a Regional Director, the Geographic Information Officer, Budget Officer, and Chief Financial Officer. USGS has expanded the role of the IRB to include facility investments to insure that costs are contained and long-term space commitments are justified. In addition to proposed construction investments with a life cycle cost of $2 million or more, the IRB will review all space transactions (occupancy agreements, leases, etc.) with a life cycle cost of $1 million or more. Regional boards will review transactions below this threshold.

Business case analysis (BCA) will be the bureau's primary review mechanism. With the completion of the draft Strategic Facilities Master Plan, the USGS has established a standard BCA template for bureauwide use. This template will allow all projects presented to the IRB to be reviewed in a consistent manner.

FY 2007 Program Performance Estimates

The 2007 budget request for the Rental Payments is $72,388,000 and 0 FTE, which is a program change of -$540,000 and 0 FTE.

This program addresses the Department's Serving Communities strategic goal of advancing knowledge through scientific leadership and informing decisions through the application of science.

The activities described below are counted under the mission goal "Serving Communities."

Lafayette Expansion — Construction on this project is expected to be funded through grants or direct appropriation and is anticipated to begin in 2007. In September 2003, USGS completed the Louisiana Science and Facility Expansion Study identifying current and future science growth areas in the Lower Mississippi Valley (LMV)-Gulf Coast focus area. The expansion study recommends that an integrated science facility be constructed adjacent to the existing National Wetlands Research Center (NWRC). The target square footage for the new facility is 75,000 to 80,000 square feet in office space and laboratories with an estimated construction cost of $22 million. With the impacts of Hurricane Katrina and Rita, construction costs are now

estimated at $29.2 million. Through the cooperation with the University of Louisiana at Lafayette, USGS is currently conducting a $1.4 million programming and design project for the new facility funded with grants received from the Department of Energy and the U.S. Department of Housing and Urban Development. The design project began in June 2004 and was completed in November 2005.

FY 2006 Planned Program Performance

The activities described below are counted under the mission goal "Serving Communities."

Facility Planning and Management

Strategic Facilities Master Plan — The final Strategic Facilities Master Plan (SFMP) was received in October 2005. The SFMP process accomplished the following tasks:

- Performed a comprehensive analysis of USGS facilities,
- Determined adequacy of USGS facilities in meeting USGS current and planned mission needs,
- Examined the performance of USGS facilities and compared against external benchmarks,
- Recommended performance metrics,
- Developed a business case process and tool to evaluate facilities investments,
- Identified opportunities for reducing costs and reducing the current deferred maintenance backlog, and
- Analyzed budgetary strategies to fully fund facilities and eliminate the deferred maintenance backlog.

The SFMP outlines a strategy to reduce the current funding shortfall. It provides a thorough analysis of the facilities program and identifies opportunities to reduce cost through improved utilization. It further provides a strategy to properly fund operations and maintenance and deferred maintenance at USGS owned sites. Efforts are underway to use the SFMP to achieve these goals in FY 2006–07.

Participation with GSA on the Denver Federal Center Master Site Plan and Environmental Impact Statement — GSA is developing a new Master Site Plan and Environmental Impact Statement for the Denver Federal Center (DFC). The primary goal of the site plan is to transform the DFC into a dynamic, mixed-use urban center. Plans call for a new hospital and major transit and light rail center. USGS is the largest Federal tenant on the DFC campus and will be working closely with GSA as an agency representative for the planning process. Additionally, in January 2006 USGS provided formal review and written comments to the Environmental Impact Statement under the requirements of the National Environmental Policy Act (NEPA). NEPA requires the Federal Government to analyze project impacts to human health and the environment prior to project implementation.

Denver Federal Center Renovations and Relocations — GSA is developing a feasibility study for renovation of Building 20 and the possible demolition of Building 53 on the DFC. The completed studies will contain project scopes, design budgets, and construction budgets and are scheduled to be submitted to GSA Headquarters in March 2006. USGS has coordinated meetings for GSA, the architectural team, and USGS Building 20 occupants to determine space requirements that will support a robust science program.

The USGS Research Drilling Program has been located in Buildings 111G and 111J of the DFC for the past 10 years. This required environmental clean up of the northwest corner of the DFC and proposed future development for an expanding metro area transit system. After a long search for suitable properties, the Central Region Facilities Staff was able to negotiate a lease effective October 1, 2005, to relocate the Research Drilling Program.

John W. Powell Federal Building Renovations — The GSA is in the design phase of renovating the John W. Powell Federal Building Cafeteria Serving Area. This $1.5 million project will address accessibility, environmental compliance, and efficiency upgrades.

The Washington Gas Company is under contract to design and construct $1.3 million in facility improvements to the solid-state physics building and the power plant located on the Reston campus. The scope of work includes installing one 300-HP power-plant steam producing boiler, removing existing diesel-driven emergency generator and installing a natural gas driven generator, reconfiguring connected electric loads to support boiler operation during the loss of normal electric power, and replacing existing heating equipment. Impletion is scheduled by September 30, 2006.

Florida Integrated Science Center at St Petersburg/Tampa — Construction on the new 11,000 square foot building in St. Petersburg started in May 2005. Completion is expected in December 2006.

Space Management — The USGS has completed implementation of the Aperture Software Program at the John W. Powell Federal Building, Denver Center, and Menlo Park Center to aid in the management of space allocation, design, and facilities planning. The system will provide space reports by cost center and allow science programs to track actual space utilization and costs associated with their space holdings by building and type of space. Once drawings of the Regional Centers are completed, USGS will explore opportunities to include drawings of all USGS occupied facilities into the Aperture software system. The Web-based system is housed on the USGS headquarters servers accessible to all regions.

Signed February 4, 2004, Executive Order (EO) 13327 promotes efficient and economical use of the Federal Government's real property assets. In compliance with the EO, the Federal Real Property Profile (FRPP) reporting requirements were updated to include 23 data elements for owned, leased, and State or foreign government-owned assets. The FY 2005 FRPP report was due in December 2005. Simultaneously, the USGS collected, validated and loaded the data necessary for the new critical data elements and tested and validated a new version of its Federal Real Property Management (FRPM) system to handle the storage and reporting of the new critical data elements. For its 692 real property assets, USGS reported 22 of the 23 data elements required by the Federal Real Property Council, the Office of Management Budget, and the Department. These included 55 land assets, 363 buildings, and 274 structures. The remaining data element requires reporting FY 2005 operations and maintenance actual costs and is due during the 2nd Quarter of FY 2006.

In addition to its real property database, FRPM is the USGS system for processing and storing monthly General Services Administration (GSA) and Department of Homeland Security (DHS) billing and inventory data. FRPM enhancements included programs to permit cost allocation per Occupancy Agreement (GSA's assignment mechanism) to be consistent with internal space allocations. This capability will improve the efficiency and accuracy of distributing financial charges for GSA and DHS costs within USGS. The enhanced system is scheduled for final acceptance in 2nd Quarter FY 2006.

A Web-based locator system has been launched, allowing all USGS employees access to a Web link where they can enter an employee name or room number and see a graphic showing the room's location in the building. A kiosk with the same access has been purchased to be installed in the John W. Powell Building's visitor's entrance for visitors to locate rooms and employees.

Space Savings — In early FY 2006, USGS Northern Prairie Wildlife Research Center (NPWRC) transferred the Woodworth Field Station site to the Fish and Wildlife Service (FWS), the primary user of the location. The site is currently underutilized by the NPWRC and is no longer cost effective to maintain. The buildings include dormitory/dry lab, shop/garage, and a gas house. The cost savings will be realized in FY 2006 and beyond. The projected savings are not readily available, although any savings in operations and maintenance cost will be used to further reduce the funding shortfall in the operations and maintenance subactivity.

The Western Region is negotiating a new Occupancy Agreement (OA) with GSA for the Menlo Park campus. The new OA retains USGS presence on the entire campus at a lower rate for a 5-year period. Cost savings will also begin in fiscal year 2008 instead of fiscal year 2009. Retention of the entire campus saves consolidation cost in fiscal year 2007, and brings science partners into a highly desirable geographic area at a low rate, strengthening collaboration and enhancing the Menlo Park's utilization rate. This partnership growth is already underway with the relocation of the California State Geological Survey onto the Menlo Park campus. The new OA also allows the natural attrition of the campus population to occur over time, and will make future release of space less costly.

The USGS has established a plan to utilize any realized savings from the new Menlo Park OA and use those savings to fund future downsizing at the Menlo campus. Savings will be used to fund the eventual consolidation and release of the excess space on the campus as natural attrition of the population occurs. Consolidation changes to the campus are expected to begin in fiscal year 2010. In that year, GSA will amend the OA to add the tenant improvements to the rent bill.

The Jacksonville, FL, field office was closed in August 2005 and staff was consolidated at the Altamonte Springs, FL, office. The New Ellenton, SC, field office is being closed, and staff will be consolidated at Columbia, SC, office. The Knoxville and Nashville, TN, offices are reducing space; the Memphis, TN, field office has relocated to cooperative space with a university partner, all leading to cost reductions. The cooperative agreement for the space currently occupied by the Florida Integrated Science Center (FISC), in Tampa will expire in August 2006. After exploring several alternatives, FISC has decided to remain in their existing space in the USF University Business Center for an additional five years. The cost for the space will be reduced by one dollar per square foot and the cooperator has agreed to provide additional tenant improvements at no cost to the government. The FISC Miami Water Science Center relocated to temporary space on the Nova Southeastern University East Campus in Fort Lauderdale, FL, in July 2005.

FY 2005 Program Performance Accomplishments

The activities described below are counted under the mission goal "Serving Communities."

Facility Planning and Management

John W. Powell Federal Building Laboratory Renovation Project — The final phase of the laboratory renovation project was completed in August 2005. The new laboratories were reconfigured using a modular concept to standardize the layouts, incorporate adequate fume removal, create hazardous material storage, design proper exiting from high hazardous materials, and create hazard zones and secondary exits within the laboratories. The total dollar amount of the project was $35 million. A joint GSA and USGS dedication ceremony was held in December 2005.

USGS Drive Asphalt Repairs and Safety Improvements at John W. Powell Federal Building — Road repairs were accomplished along U.S. Geological Survey Drive. This $140,000 road repair provided for additional improvements at the bus stop turn-around. Several sidewalks were patched near the visitor's entrance and along the parking lot sediment basin. The service road to the solid-state physics building was widened to accommodate truck traffic when necessary.

Lafayette Expansion — In September 2003, USGS completed the Louisiana Science and Facility Expansion Study identifying current and future science growth areas in the Lower Mississippi Valley (LMV)-Gulf Coast focus area. The expansion study recommends that an integrated science facility be constructed adjacent to the existing National Wetlands Research Center (NWRC). The target square footage for the new facility is 75,000 to 80,000 square feet in office space and laboratories with an estimated construction cost of $22 million. With the impacts of Hurricane Katrina and Rita, construction costs are now estimated at $29.2 million. Through the cooperation with the University of Louisiana at Lafayette, USGS is currently conducting a $1.4-million program and design project for the new facility funded with grants received from the Department of Energy and the U.S. Department of Housing and Urban Development. The design project began in June 2004 and was completed in November 2005.

Activity: Facilities

Subactivity: Operations and Maintenance

Subactivity	2005 Actual	2006 Enacted	2007 Fixed Cost & Related Changes [a/]	2007 Program Changes	2007 Budget Request	Change from 2006
Operations and Maintenance	19,820	19,604	+107	0	19,711	+107
Total Requirements	**19,820**	**19,604**	**+107**	**0**	**19,711**	**+107**
FTE	***58***	***58***	***0***	***0***	***58***	***0***

[a/] Fixed cost increases for this activity total $152, of which $107 will be budgeted and $45 will be absorbed .

Program Overview

The FY 2007 budget request for the Operations and Maintenance Program is $19,711,000 and 58 FTE.

The **Operations and Maintenance** subactivity includes the recurring costs of providing for the basic operations and upkeep of facilities and ensuring that they are maintained in compliance with applicable safety and other standards. The USGS has 34 owned installations (283 buildings) on approximately 2,100 acres. This includes biological science centers (9), biological field and research stations (8), the National Center for EROS; geomagnetic, seismic, and volcano observatories (10), a Water Resources district office, and other miscellaneous owned property such as gauging stations, storage annex, and warehouses (7). The USGS also owns eight large research vessels.

Use of Cost and Performance Information

The Research Vessel *Siscowet* Condition Assessment performed in FY 2004 documented the maintenance backlog and most critical deficiencies on the vessel. The Siscowet was decommissioned in FY 2005 due to the poor condition and large deferred maintenance backlog on the vessel.

The Facilities Operations and Maintenance subactivity, funds the routine, daily work necessary for the basic operation and upkeep of USGS-owned facilities to ensure that facilities are in compliance with Federal, State, and local standards and to ensure that facilities remain safe for USGS employees working at the facilities, as well as partners and customers visiting the facilities. This subactivity funds the operations and maintenance costs associated with appropriated work. The cost related to reimbursable activities is recovered from reimbursable customers and a small portion is paid by USGS programs. Operations and maintenance functions include ongoing facility support that sustains day-to-day USGS scientific activities at 34 owned installations ranging from major science centers with complex facilities such as laboratories and chemical storage buildings to smaller facilities such as research stations, research vessels, geomagnetic and seismological observatories, and warehouses.

This subactivity provides routine operation and maintenance of large vessels. Large research vessels have characteristics, costs, and operations and maintenance features that coincide with those of USGS facilities. These vessels are mobile installations, meeting the criteria for the Comprehensive Condition Assessment. Vessels must exceed 45 feet in length and perform overnight field research to be classified as facilities. There are currently eight large vessels that support biology research, water resources investigations, and marine geology research; five on the Great Lakes, two in California, and one in Alaska.

Operations of facilities include activities related to costs such as utilities for owned facilities, as well as all utility costs not included in rent:

- Electricity, water, and sewage,
- Fuel: gasoline, propane (vehicles, vessels, and heating), natural gas, diesel, and oil (heating),
- Janitorial services: window cleaning and carpet cleaning,
- Upkeep of grounds: grass mowing, snowplowing, and grounds irrigation,
- Waste management/disposal: refuse collection and sewage effluent pumping,
- Vehicles: tractors and trucks solely operated in direct support of operating the facility (includes rented vehicles, vehicles and owned and leased from GSA),
- Vessels: safe and effective operations and maintenance, apply upkeep standards necessary to realize the anticipated useful life of the fixed asset, provide for salaries and benefits of marine professionals operating the vessel, fuel, docking fees, inspections, minor repairs, cyclic maintenance, and at least one vessel haulout a year, and
- Annual certification for facility systems, such as fire systems, fire extinguishers, back flow preventers, and fume hoods.

Maintenance of facilities involves the upkeep of constructed USGS-owned facilities and structures and capitalized equipment necessary to maintain the useful life of the asset, including 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; re-roofing; resurfacing; special safety inspections and other actions to assure continuing service and to prevent breakdown; scheduled servicing (such as heating, ventilation, and air conditioning equipment); and maintenance for owned facility-related vehicles.

Salary costs associated with staff that performs operations and maintenance activities are included. USGS staff that perform operations and maintenance are located at the facility they are operating and maintaining. These are primarily USGS-owned facilities, but also include GSA-owned facilities for which GSA has delegated operations and maintenance authority to the USGS (e.g., the National Center) and facilities owned by other agencies or organizations for which the USGS has agreed to cover operations and maintenance expenses in exchange for use of the space (e.g., Patuxent). Staff at these facilities are responsible for the day-to-day operations of the facility and for maintaining it in operating order. This includes such operations as janitorial services, landscaping, snow removal, operation of the heating and air conditioning

system, plumbing, electrical, elevator operations, fire alarm systems, fume hood operations, storage, and removal of hazardous materials, etc. Depending upon the location, some of these functions are carried out by government employees and some via contract.

Staff associated with operations and maintenance program management at the regions and headquarters are funded by the Science Support Activity. Bureau policy for facilities operation and maintenance is established at headquarters. Staff at the regional and headquarters level who perform operations and maintenance program management establish standards for operations and maintenance, develop and implement plans for bureauwide systems (e.g., MAXIMO), develop deferred maintenance plans, develop contracts for Operation and Maintenance services, formulate regional and bureauwide operation and maintenance budgets, respond to departmental and OMB reporting requirements, etc.

2007 Program Performance Estimates

Asset Business Plan — Following the development of the USGS Asset Management Plan (AMP) in FY 2006, the bureau will be asked to prepare Site-Specific Asset Business Plans (ABP) that will support the bureau AMP. The ABP will be a 5 to 10 year plan that addressing the specific needs of a field unit, campus, or region covering all assets reported in the Federal Real Property Profile. ABP's will provide a comprehensive review of the life-cycle costs, use and needs of the assets under the plan.

Maintenance Management System — The USGS Facilities Maintenance Management System (FMMS) implementation will allow the USGS to define requirements for the Spare Parts Inventory module and roll-out, define requirements for 23 additional sites and roll-out at 12 of those sites, and define requirements for DMCI module.

2006 Program Performance Accomplishments

Unless otherwise noted, the planned program performance for FY 2006 listed below demonstrates the utility of facilities condition, facilities management, and deferred maintenance and capital improvements counted under the output measures for "buildings (administrative, employee housing) are in fair to good condition as measured by the Facilities Condition Index," "number of bureau condition assessments in progress or completed (within a 5-year cycle)," "number of deferred maintenance and capital improvements (cumulative)," and "percentage of facilities that have a calculated Facilities Condition."

Facilities Maintenance Management System — The USGS Facilities Maintenance Management System (FMMS) implementation included completing site assessments, training and system roll-out at 13 USGS owned installations and the headquarters facility in Reston, VA. Modules include equipment, locations, work order tracking, failure codes, job plan and preventive maintenance, and handheld technology.

USGS upgraded FMMS to MAXIMO v5.2. Additional servers were purchased and installed to improve the performance of the system. Handhelds were purchased and distributed to maintenance staff at 14 locations to simplify their interface with the system. The USGS participates in the Department Asset Management Team to help integrate the Department Asset Management Plan into the USGS FMMS.

Asset and Portfolio Management — With the issuance of Executive Order 13327, Federal Real Property Asset Management, on February 4, 2004, the OMB directed all major agencies to:

- Establish the position of a Senior Real Property Officer, who is accountable for the effective management of agency real properties,
- Determine inventory needs, and management costs for real properties,
- Develop and implement asset management plans,
- Develop and monitor real property performance measures, and
- Dispose of properties that are not needed.

The executive order created an interagency Federal Real Property Council (FRPC) to develop guidance, serve as a clearing house for best practices, and facilitate the efforts of the Senior Real Property Officers. The FRPC established four committees: Asset Management Planning, Performance Measures, Property Inventory; and Systems.

In June 2005, the Department issued an Asset Management Plan (AMP), which "establishes a strategic direction for the management of assets within the Interior portfolio." The AMP supports a portfolio-centered approach that will strengthen the management of Interior's vast and varied real property inventory. USGS is committed to meeting the asset management requirements set forth in the Department's AMP.

The FRPC outlined 23 inventory and performance measure data elements that must be reported to GSA as part of the annual real property inventory. To meet the new reporting requirements, USGS purchased an upgrade to its existing Federal Real Property Management inventory system. The new application became operational in December 2005 and successfully produced the USGS FY 2005 Federal Real Property Profile Report to GSA by the requested deadline. In addition to tracking the 23 data elements for each USGS real property asset, the system will be used to process the monthly bills for General Services Administration Rent and Department of Homeland Security.

Patuxent Wildlife Research Center Facilities Modernization Project — Planning and concept development have continued to address the facilities issues at the Patuxent Wildlife Research Center. Given the FY 2006 Congressional language to report jointly NLT March 2006 as to the USGS/FWS plan to address the facility issues at Patuxent, a joint group has been working on the response. Options being developed are (1) minimal new construction/rehabilitation, (2) address essential requirements, (3) address all pressing FWS/USGS needs. Briefings have been provided to the USGS and FWS Directors. Briefings at the Department level are being scheduled. Final submittal to congress is planned for March 1, 2006.

Facility Energy and Water Management Program — The bureau's Facility Energy Program supports the USGS mission by providing leadership, information, support, data analysis, and access to resources to assist in the economical and environmentally sound purchase, use, storage, and control of the energy and water resources at all USGS installations. This program emphasizes the Department's Strategic Plan mission areas, Resource Protection and Resource Use. Through the efficient management of energy and water resources, the USGS reduces the impact facilities have on the environment. These practices promote responsible use, ensure optimal value, improve operational efficiencies, set a good example for the public, and insure energy expenditures are optimized.

FY 2005 Program Performance Accomplishments

Unless otherwise noted, the FY 2005 program performance accomplishments listed below demonstrate the utility of facilities condition, facilities management, and deferred maintenance and capital improvements counted under the output measures for "buildings (administrative, employee housing) are in fair to good condition as measured by the Facilities Condition Index," "number of bureau condition assessments in progress or completed (within a 5-year cycle)," "number of deferred maintenance and capital improvements (cumulative)," and "percentage of facilities that have a calculated Facilities Condition."

Facilities Maintenance Management System — The USGS continued the implementation of the Facilities Maintenance Management System (FMMS). In preparation for full implementation of FMMS, a review of building equipment inventories for accuracy and completeness was begun by 14 field installations. Each facility began creating maintenance schedules for all building equipment.

The FMMS supports the key business principles guiding Interior's operations: customer value, accountability; modernization; and integration. Through the use of standard business practices, standard nomenclature, specification templates, and building system definitions, USGS will be able to report operations and maintenance consistently across the bureau. FMMS will be expanded to include the remainder of the USGS-owned installations, including vessels. Functionality will be added as funding permits.

This page intentionally left blank.

Activity: Facilities

Subactivity: Deferred Maintenance and Capital Improvement

Subactivity	2005 Actual	2006 Enacted	2007 Fixed Cost & Related Changes [a/]	P2007 Program Changes	2007 Budget Request	Change from 2006
Deferred Maintenance & Capital Improvement	3,424	3,373	0	0	3,373	0
Total Requirements	**3,424**	**3,373**	**0**	**0**	**3,373**	**0**
FTE	***0***	***0***	***0***	***0***	***0***	***0***

[a/] Fixed cost are not a component of this subactivity.

Program Overview

The FY 2007 budget request for the Deferred Maintenance and Capital Improvement Subactivity is $3,373,000.

The Deferred Maintenance and Capital Improvement subactivity funds are used to address the highest priority USGS facility and equipment needs to conform to safety and environmental standards. The current funding level provides for approximately 3.9 percent of the facilities Deferred Maintenance and Capital Improvement backlog. The condition assessment program includes annual surveys and a cyclic process for comprehensive onsite inspections to document deferred maintenance.

The USGS is committed to the continual improvement of the stewardship of our assets. The primary goal of our program is to support the agency mission by providing a safe, comfortable, environment for the employee, visitors and contractors at USGS facilities. Improving the maintenance of existing facilities and equipment ensures the health and safety of the public and employees, protects cultural and natural resources, and insures compliance with building codes and standards. This program addresses the Department's Strategic Plan mission area serving communities by focusing on the strategic goal of "protect lives, resources and property." To clearly measure progress in achieving the intermediate outcomes of improving information base, information management, and technical assistance, the USGS tracks the intermediate outcomes for Facilities Condition, as measured by the Facilities Condition Index (FCI), number of bureau condition assessments in progress or completed, and number of deferred maintenance and capital improvement projects completed.

Facilities projects reflect the results of comprehensive evaluations conducted by independent architect/engineer firms. These installationwide, building-specific assessments are the linchpin of a program to establish core data on the condition of the Department's constructed assets.

The USGS has stewardship responsibility for unique mission equipment assets such as hazard-warning networks, river cableways, and gauging stations. These require effective maintenance and capital investments to preserve functionality. Projects addressing these assets are included

under the Equipment Section of the 5-year Maintenance and Capital Improvement Plans and Health. These assets are evaluated using the same safety criteria as our constructed real property assets.

For FY 2007, remediation of the most critical health, safety, and resource-protection deficiencies is again the focus of the priority facility projects. Of the $3.4 million budget request for FY 2007, $2.07 million is for facility projects, $0.44 million is for equipment projects, and the remaining $0.89 million is for condition assessments and implementation of the Department's standard facilities maintenance management system.

FY 2007 Program Performance Estimates

The USGS backlog of deferred maintenance is approximately $38 million. The USGS addresses the most critical maintenance and capital improvement needs prioritized according to Department's guidelines. The FY 2007 budget request includes a Maintenance and Construction Plan for FY 2007– 2011 that list the USGS deferred maintenance and capital improvement projects. This plan is subject to adjustments in outyears due to funding changes and revised priorities based on comprehensive facility condition assessments, annual condition surveys, and emergency needs.

Facility and Equipment Projects for FY 2007

FY 2007 Deferred Maintenance and Construction Plan

The following table lists, in priority order, the proposed projects to be addressed with FY 2007 Deferred Maintenance funding in USGS:

FY 2007 Facility Projects

Great Lakes Science Center **$50,000**	**Replace Steam Boilers —** The existing steam boilers have far exceeded their life expectancy. Excessive rust, deteriorating piping and faulty controls indicates that a failure may be imminent in the near term. The boilers support science processes and provide environmental heating for occupant comfort.
Northern Prairie Wildlife Research Center **$662,000**	**Replace Auto Bridge —** A new bridge is needed for access to Riverside buildings. The bridge is essential to get employees, fire equipment, heating fuel deliveries and construction equipment to the Riverside site safely.
National Wildlife Health Center **$746,000**	**Replace TIB Roof, Fascia Panels & Repair Water Damage —** The TIB Rubber Membrane Roofing System and metal fascia and chase panels have exceeded their life expectancy, are deteriorating, and must be replaced. Roof leakage has become common, resulting in water leaking into biological containment laboratories, animal rooms, light fixtures and conduits, as well as through ceilings and interior walls. Emergency patches are becoming less and less effective. Current conditions create an unhealthy and potentially unsafe work environment (mold/electrical/slipping hazards), compromise containment in biological safety level III area as required by the Centers for Disease Control for working on diseases that are known human/wildlife pathogens (threatening mission, public safety and natural resources). The rusted fascia and chase panels also can create entry points for birds, rodents, and insects. The project description and categorization have been modified to reflect the increasing deterioration of the roof and panels.

S. O. Conte Anadromous Research Center **$43,000**	**Correct Fire Deficiencies, Exit Signage and Other Electrical Deficiencies —** Many of the existing components of the fire alarm for the main building are 18 years old and the smoke and duct detectors are failing, resulting in a large number of "false" alarms and subsequent unnecessary evacuations of the building. Replacement of existing 60 smoke detectors, pull stations, wiring, and possibly the control panel is necessary to correct this problem. Also, all points of egress require updating of signaling and lighting devices to meet life safety codes. In addition, install firewalls as identified in the condition assessment to meet fire codes and provide safety to persons in building. The transom glass will be replaced with code-compliant firewall materials.
Great Lakes Science Center R/V Grayling **$150,000**	**Install surveillance system, correct ballast, install grid coolers, and install insulation and framing on the Research Vessel Grayling —** The Research Vessel Grayling is used for science related cruise missions on the Great Lakes. The cruises can last from a few days to several weeks. Crew and passengers live and work on the vessel while operating/maintaining the vessel and conducting their science. The safe and proper operation of the vessel is required for these cruises. Replace/install equipment to remediate possible hazards, Install video surveillance system to improve observation of the back deck for safety of crew performing O&M responsibilities, or passengers conducting science; add 10-tons of ballasts; install bow thruster for safe steering of the vessel; add grid coolers to generators to diffuse heat and prevent burns, and replace increasingly undependable pilot electronics; install and add sound-absorbing materials to reduce extreme engine noise exceeding OSHA standards (insulate interior, crew quarters, insulate stern and engine areas), and install non-flammable framing in the crew quarters; and install tuflex tiles on the surface over the metal deck plates.
Great Lakes Science Center **RV Musky II** **$100,000**	**Upgrade or repair** hatches and internal bulkheads, propulsion components, fuel gauges, shutoffs, alarms, heating ventilation and air conditioning and electrical systems.
Upper Mid-west Environmental Sciences Center **$124,000**	**Rehabilitate North Chemical Bunkers —** Condition Assessment revealed unsafe ventilation, misplaced emergency showers, and noncompliant spill containment at the two north chemical bunkers. Replace inadequate heating and ventilation system with code-compliant system; relocate two emergency showers and install eye wash stations and integrated alarm if shower or station used. Excavate and remove underground containment tank; install grated spill containment trench and chemical-resistant floor and wall coatings in each bunker; install proper shelving for chemical storage; install bonding cable to prevent static discharge; and install panic button or communication device to use in an emergency situation.
EROS Data Center **$147,000**	**Replace Electrical Switchgear —** The electrical switchgear is 33 years old. The disconnect switches are the main disconnects for the electrical distribution bus-duct. The switches have failed to operate properly on more than one occasion and represent a critical safety deficiency. Deteriorated switches with inadequate insulation appear to be open but are actually inoperable, creating an unacceptable risk of explosion, fire, and switch-operator injury as full electrical load would be dangerously diverted into a single switch. Switchgear failure also creates an unacceptable risk to historical data in the event of critical building emergencies and would severely impede critical missions such as satellite telemetry backup. This project is estimated at $267,000. This initial funding will allow us to begin the design process.

FY 2007 Equipment Projects

600 sites nationwide **$240,000**	**Repair or Replace Cablecars —** Revised load tests reveal that the 600 cablecars in active use nationwide could fail under adverse field conditions such as snagged cables during flood conditions. Depending on their design and condition, remediation will require partial or total replacement of the cablecars. Interim actions have begun where risk is the highest, but all 600 cars will require either retrofit or replacement.
Northern California Seismic Network **$200,000**	**Replace Network Analog and Microwave Stations —** Replace earthquake network stations that provide seismic monitoring and (or) warning for large metropolitan areas. The requested funds would be used to replace existing equipment that has exceeded its expected life and that cannot be expected to operate continuously without increased failure rates. The current equipment, which supports the network, may fail during an emergency, which would limit or possibly prevent adequate response to other Federal agencies, local governments, the private sector, and public needs.

Condition Assessments **$210,000**	**Condition Assessments/Engineering Support —** Funding is proposed to complete condition assessments for the identification of maintenance and capital improvement needs and to provide engineering services support for funded facility projects.
Maintenance Management System **$500,000**	**Maintenance Management System —** Funding is proposed to implement and maintain a maintenance management system that meets bureau reporting and oversight requirements.
Project Planning **$200,000**	Funding will be applied toward contract architectural, engineering and design services for complex projects particularly for developing project requirements and budget estimates.

FY 2006 Planned Program Performance

Unless otherwise noted, the planned program performance for FY 2006 listed below demonstrate the utility of facilities condition, facilities management, and deferred maintenance and capital improvements counted under the output measures for "buildings (administrative, employee housing) are in fair to good condition as measured by the Facilities Condition Index," "number of bureau condition assessments in progress or completed (within a 5-year cycle)," "number of deferred maintenance and capital improvements (cumulative)," and "percentage of facilities that have a calculated Facilities Condition."

In FY 2006 the USGS continued to address critical life safety issues through the Deferred Maintenance Capital Improvements program through seven fire and fire suppression projects and construction projects, such as upgrading a deficient fume hood system at USGS Western Fisheries Research laboratory in Washington.

Replacement or renovation of cableways at many of the 113 sites nationwide continues. Many cableways at these sites do not meet modern design and load-testing criteria to ensure the safe collection of essential scientific data. All 113 sites are scheduled for replacement or renovation.

The following centers are scheduled to have condition assessments performed in FY 2006: Florida Caribbean Science Center, EROS Data Center, National Wetlands Research Center, Leetown Science Center, and Hammond Bay Fish Research Station.

Northern California earthquake network analog and microwave stations that have exceeded their expected life and cannot be expected to operate continuously will be replaced to avoid failure during an emergency. These stations provide monitoring and (or) warnings for large metropolitan areas.

Asset Priority Index (API) scores for all of the USGS owned assets will be established in the first quarter of FY 2006. The bureau guidance and procedures for integrating API into the Deferred Maintenance and Capital Improvement process will be established by the end of the FY 2006.

FY 2005 Program Performance Accomplishments

Unless otherwise noted, the FY 2005 program performance accomplishments listed below demonstrate the utility of facilities condition, facilities management, and deferred maintenance and capital improvements counted under the output measures for "buildings (administrative, employee housing) are in fair to good condition as measured by the Facilities Condition Index," "number of bureau condition assessments in progress or completed (within a 5-year cycle),"

"number of deferred maintenance and capital improvements (cumulative)," and "percentage of facilities that have a calculated Facilities Condition."

In FY 2005 USGS continued to address critical life safety and code deficiency issues at our installations. The DMCI program funded six projects that addressed fire alarm, fire suppression and life safety code deficiencies. These projects help to create a safe working environment for USGS employees and contractors.

An upgrade to the critical power system at the EROS Data Center was completed. This project provides improvements to the reliability of the power protecting critical satellite data and significantly reduces the impact of power interruptions at the facility. During FY 2005 the USGS also began the design for a state-of-the-art Biological Safety Level III (BSL III) laboratory at the Leetown Science Center.

Additionally, the USGS continued efforts to remove from service old stream cableway systems. Many of these systems are no longer safe and have become a hazard while others have been replaced with modern technology that does not require cableways. The safety of the remaining cableways is being evaluated. Those that are no longer in use or present a danger are being removed from service.

Condition Assessments — The condition assessment for the research vessel Sturgeon was completed in FY 2005 after commissioning in the 4th quarter of FY 2004. The second 5-year cycle of condition assessments completed in FY 2005 were the solid-state physics lab, Reston, VA; the Columbia Environmental Research Center, Columbia, MO; the Northern Prairie Wildlife Research Center, Jamestown, ND; the Woodworth Field Station, Woodworth, ND; the Northern Appalachian Research Lab, Wellsboro, PA; the Upper Midwest Environmental Research Center, La Crosse, WI; and the Boise District Office, Boise, ID. The second round of condition assessment reports identify the most critical maintenance deficiencies, update the deferred maintenance backlog and help determine future priorities.

Performance Overview

Measure	2005 Plan	2005 Actual	Change from 2005 Plan	2006 Enacted	2006 Change from 2005 Actual	2007 Request	2007 Change from 2006
End Outcome Goal 1.1: Resource Protection. Improve Health of Watersheds, Landscapes, and Marine Resources							
Facilities Condition: Conservation and biological research facilities are in fair to good condition as measured by the Facilities Condition Index. (lower FCI is good) **(NK)**	0.24	0.24	0	0.24	0	0.24	0
End Outcome Goal 1.2: Resource Protection: Sustain Biological Communities							
Facilities Condition: Conservation and biological research facilities are in fair to good condition as measured by the Facilities Condition Index (lower FCI is good) **(SP)**	0.19	0.19	0	0.19	0	0.19	0
End Outcome Goal 4.1: Serving Communities: Protect Lives, Resources and Property							
Facilities Condition: Hazard Buildings (administrative, employee housing) are in fair to good condition as measured by the Facilities Condition Index (FCI) **(SP)**	0.20	0.20	0	0.20	0	0.20	0
End Outcome Goal 4.2: Serving Communities: Advance Knowledge through Scientific Leadership							
Facilities Condition: Facilities are in fair to good condition as measured by the Facilities Condition Index (FCI) **(SP)**	0.17	0.17	0	0.17	0	0.17	0
# of bureau conditional assessments in progress or completed (within a 5-year cycle) **(Facilities)**	9	9	0	15	+6	24	+9
# of deferred maintenance and capital improvements (cumulative) **(Facilities)**	54	53	-1	67	+14	74	+7
End Outcome Goal 5.3: Management Excellence: Modernization							
Facilities Management: X% of facilities that have a calculated Facilities Condition **(SP)**	95%	100%	+5%	100%	0	100%	0

Working Capital Fund Overview

The 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, to agencies of the Federal Government and others. The WCF consists of both investment components and fee-for-service components, as follows:

Investment Components

- **Telecommunications Investment —** This component is 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 Investment —** This component is 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 Investment —** This component supports 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 Investment —** This component is used for the preparation and production of technical publications reporting on the results of scientific data and research. Research projects typically are 3 to 5 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.

Fee-for-Service Components

- **National Water Quality Laboratory (NWQL) —** The NWQL is a Fee-for-Service component, conducting chemical analysis of water, sediments, and aquatic tissue for all USGS water district offices and other customers, including other USGS disciplines, other Interior bureaus, and government agencies. The NWQL also does biological classification for these customers. NWQL analyses services are provided on a reimbursable basis, with the price of services calculated to cover direct and indirect costs.

- **USGS Hydrologic Instrumentation Facility (HIF) —** The 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, and tests and evaluates instruments as they become available in the marketplace.

- **Bureau Laboratories —** This component currently includes three laboratories. There are two Eastern Region Water Research Laboratories that perform gaseous dissolved chlorofluorocarbon measurements and isotope-ratio measurements of water, sediments, rocks, and gases for all WRD district offices, other USGS disciplines, and other Federal agencies. The Vancouver Project Office/Cascades Volcano Observatory Sediment Laboratory analyzes suspended sediment, bedload, and bed material collected as part of routine surveillance and special project sampling in the Cascades, routinely processes sediment samples for several WRD offices, and provides analyses for other volcano observatories in Alaska and Hawaii, as well as international projects.

- **National Training Center —** This component conducts fee-for-service USGS training programs. These programs include, but are not limited to, 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 —** This component provides 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.

- **GSA Delegated Buildings —** This 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 section 205(d) of the Federal Property and Administrative Services Act of 1949, as amended. Delegated functions include building operations, maintenance, 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 to provide us with this no-year flexibility.

The WCF Investment Components provide 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. WCF Fee-for-Service Components provide 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.

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** This authority established the Telecommunications Amortization Fund, which was displayed as part of the Surveys, Investigations and Research appropriation from FY 1986 through FY 1990. Beginning in FY 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 FY 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 FY 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

(dollars in millions)

Identification Code **14-4556-0-4-306**		**2005 Actual**	**2006 Estimate**	**2007 Estimate**
	Obligations by program activity:			
09.01	Working Capital Fund	65	62	59
10.00	Total new obligations	65	62	59
	Budgetary resources available for obligation:			
21.40	Unobligated balance carried forward, start of year	73	62	51
22.00	New budget authority (gross)	54	51	49
23.90	Total budgetary resources available for obligation	127	113	100
23.95	Total new obligations	-65	-62	-59
24.40	Unobligated balance carried forward, end of year	62	51	41
	New budget authority (gross), detail			
	Mandatory:			
69.00	Offsetting collections (cash)	54	51	49
	Change in obligated balances:			
72.40	Obligated balance, start of year	12	18	20
73.10	Total new obligations	65	62	59
73.20	Total outlays (gross)	-59	-60	-57
74.40	Obligated balance, end of year	18	20	22

United States Geological Survey

Federal Funds

General and special funds:

WORKING CAPITAL FUND

Program and Financing

(dollars in millions)

Identification Code **14-4556-0-4-306**		**2005 Actual**	**2006 Estimate**	**2007 Estimate**
	Outlays (gross), detail:			
86.97	Outlays from new mandatory authority	28	23	22
86.98	Outlays from mandatory balances	31	37	35
87.00	Total outlays (gross)	59	60	57
	Offsets:			
	Against gross budget authority and outlays:			
88.00	Offsetting collections (cash) from:			
	Federal sources	54	51	49
	Net budget authority and outlays:			
89.00	Budget authority	0	0	0
90.00	Outlays	5	9	8

United States Geological Survey

Federal Funds

General and special funds:

WORKING CAPITAL FUND

Balance Sheet

(dollars in millions)

Identification Code **14-4556-0-4-306**		**2004 Actual**	**2005 Actual**
	ASSETS:		
	Federal assets:		
1101	Fund balances with Treasury	85	80
	Investments in U.S. securities:		
1106	Receivables, net		
1803	Other Federal assets: Property, plant and equipment, net	8	10
1999	Total assets	93	90
	LIABILITIES:		
2101	Federal liabilities: Accounts payable		
2201	Non-Federal liabilities: Accounts payable	5	5
2999	Total liabilities	5	5
	NET POSITION:		
3300	Cumulative results of operations	88	85
3999	Total net position	88	85
4999	Total liabilities and net position	93	90

Object Classification

(dollars in millions)

Identification Code 14-4556-0-4-306		2005 Actual	2006 Estimate	2007 Estimate
	Reimbursable obligations:			
	Personnel compensation:			
11.1	Full-time permanent	12	10	10
11.3	Other than full-time permanent	1	1	1
11.5	Other personnel compensation	1	0	0
11.9	Total personnel compensation	14	11	11
12.1	Civilian personnel benefits	4	3	3
21.0	Travel and transportation of persons	1	1	1
22.0	Transportation of Things	1	0	0
23.1	Rental payments to GSA	0	0	2
23.2	Rental payments to others	0	0	1
23.3	Communications, utilities, and miscellaneous charges	2	1	2
24.0	Printing and reproduction	0	1	1
25.2	Other services	10	13	9
25.3	Other purchases of goods and services from Government Accounts	3	2	1
25.4	Operation and maintenance of facilities	5	6	6
25.7	Operation and maintenance of equipment	2	1	1
26.0	Supplies and materials	4	4	4
31.0	Equipment	16	18	17
33.0	Investments and loans	1	1	0
41.0	Grants, subsidies, and contributions	2	0	0
99.0	Reimbursable obligations	65	62	59
99.9	Total new obligations	65	62	59

Personnel Summary

Identification Code 14-4556-0-4-306		2005 Actual	2006 Estimate	2007 Estimate
	Reimbursable:			
2001	Civilian full-time equivalent employment	206	179	179

Summary of Requirements by Object Class

(dollars in millions)

Appropriation: Surveys, Investigations, and Research		2006 Estimate		Fixed Costs & Related Changes		Program Changes		2007 Request	
Object Class		FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount
	Personnel compensation								
11.1	Full-time permanent		420		7		-20		407
11.3	Other than full-time permanent		31		1		-2		30
11.5	Other personnel compensation		10		0		0		10
	Total personnel compensation	5,908	461	-72	8	-271	-22	5,565	447
12.1	Civilian personnel benefits		120		5		-9		116
13.0	Benefits for former personnel		5		0		1		6
21.0	Travel and transportation of persons		23		0		0		23
22.0	Transportation of things		4		0		0		4
23.1	Rental payment to GSA		60		1		0		61
23.2	Rental payments to others		5		0		0		5
23.3	Comm., utilities and misc. charges		17		0		0		17
24.0	Printing and reproduction		2		0		0		2
25.1	Advisory and assistance services		10		0		-1		9
25.2	Other services		102		-4		4		102
25.3	Other purchases of goods and services from Government accounts		16		0		-3		13
25.4	Operation and maintenance of facilities		4		0		0		4
25.7	Operation and maintenance of equipment		13		0		-3		10
26.0	Supplies and materials		24		0		-1		23
31.0	Equipment		33		0		-2		31
32.0	Land and structures		1		0		0		1
41.0	Grants, subsidies, and contributions		71		0		0		71
	Total requirements		**971**		**10***		**-36**		**945**

Notes: - This information is displayed in budget authority (not obligations) by object class.
- Change from MAX information: 65 FTE were moved from direct to reimbursable, and the object class detail was adjusted accordingly.
- * The Hurricane Katrina supplemental of $5.3M was reduced from the Fixed Costs and Related Changes column.

Summary of Requirements by Object Class

(dollars in millions)

Appropriation: Surveys, Investigations, and Research Reimbursable Obligations		2006 Estimate FTE	2006 Estimate Amount	2007 Request FTE	2007 Request Amount	Increase or Decrease FTE	Increase or Decrease Amount
	Personnel compensation						
11.1	Full-time permanent		140		142		2
11.3	Other than full-time permanent		19		19		0
11.5	Other personnel compensation		4		4		0
	Total personnel compensation	2,670	163	2,652	165	-18	2
12.1	Civilian personnel benefits		40		41		1
13.0	Benefits for former personnel		2		2		0
21.0	Travel and transportation of persons		8		7		-1
22.0	Transportation of things		4		4		0
23.1	Rental payments to GSA		15		15		0
23.2	Rental payments to others		1		1		0
23.3	Communications, utilities and miscellaneous charges		5		5		0
24.0	Printing and reproduction		1		1		0
25.1	Advisory and assistance services		3		3		0
25.2	Other services		46		41		-5
25.3	Other purchases of goods and services from Government accounts		49		45		-4
25.4	Operation and maintenance of facilities		1		1		0
25.7	Operation and maintenance of equipment		3		3		0
26.0	Supplies and materials		11		10		-1
31.0	Equipment		11		10		-1
41.0	Grants, subsidies, and contributions		33		30		-3
	Total requirements		**396**		**384**		**-12**

United States Geological Survey

Federal Funds

General and special funds:

SURVEYS, INVESTIGATIONS, AND RESEARCH

Program and Financing

(dollars in millions)

Identification Code 14-0804-0-1-306		2005 Actual	2006 Estimate	2007 Estimate
	Obligations by program activity:			
	Direct program:			
00.01	Geographic Research, Investigations, and Remote Sensing	119	129	77
00.02	Geologic Hazards, Resources, and Processes	236	242	224
00.03	Water Resources Investigations	214	217	204
00.04	Biological Research	174	179	173
00.05	Enterprise Information	45	46	111
00.06	Science Support	65	69	67
00.07	Facilities	96	95	95
09.01	Reimbursable program	411	396	384
10.00	Total new obligations	1,360	1,373	1,335
	Budgetary resources available for obligation:			
21.40	Unobligated balance carried forward, start of year	21	22	16
22.00	New budget authority (gross)	1,361	1,367	1,335
22.10	Resources available from recoveries of prior year obligations	2	0	0
22.22	Unobligated balance transferred from other accounts	1	0	0
23.90	Total budgetary resources available for obligation	1,385	1,389	1,351
23.95	Total new obligations	-1,360	-1,373	-1,335
23.98	Unobligated balance expiring or withdrawn	-3	0	0
24.40	Unobligated balance carried forward, end of year	22	16	16
	New budget authority (gross), detail:			
	Discretionary:			
40.00	Appropriation	958	976	945
40.00	Appropriation – Avian Influenza supplemental	0	4	0
40.00	Appropriation – Hurricane Katrina supplemental	0	5	0
40.33	Appropriation permanently reduced (HR 2863)	0	-10	0
40.35	Appropriation permanently reduced	-13	-4	0
42.00	Transferred from other accounts	4	0	0
43.00	Appropriation (total discretionary)	949	971	945
	Mandatory:			
62.00	Transferred from other accounts	0	0	6
	Spending authority from offsetting collections:			
	Discretionary:			
68.00	Offsetting collections (cash)	280	396	384
68.10	Change in uncollected customer payments from Federal sources (unexpired)	132	0	0
68.90	Spending authority from offsetting collections (total discretionary)	412	396	384
70.00	Total new budget authority (gross)	1,361	1,367	1,335

United States Geological Survey

Federal Funds

General and special funds:

SURVEYS, INVESTIGATIONS, AND RESEARCH

Program and Financing

(Dollars in millions)

Identification Code 14-0804-0-1-306		2005 Actual	2006 Estimate	2007 Estimate
	Change in obligated balances:			
72.40	Obligated balance, start of year	91	96	177
73.10	Total new obligations	1,360	1,373	1,335
73.20	Total outlays (gross)	-1,345	-1,292	-1,334
73.40	Adjustments in expired accounts (net)	-12	0	0
73.45	Recoveries of prior year obligations	-2	0	0
74.00	Change in uncollected customer payments from Federal sources (unexpired)	-132	0	0
74.10	Change in uncollected customer payments from Federal Sources (expired)	136	0	0
74.40	Obligated balance, end of year	96	177	178
	Outlays (gross), detail:			
86.90	Outlays from new discretionary authority	1,116	1,203	1,170
86.93	Outlays from discretionary balances	229	89	158
86.97	Outlays from new mandatory authority	0	0	6
87.00	Total outlays (gross)	1,345	1,292	1,334
	Offsets:			
	Against gross budget authority and outlays:			
	Offsetting collections (cash) from:			
88.00	Federal sources	-227	-218	-211
88.40	Non-Federal sources	-188	-178	-173
88.90	Total, offsetting collections (cash)	-415	-396	-384
	Against gross budget authority only:			
88.95	Change in uncollected customer payments from Federal sources (unexpired)	-132	0	0
88.96	Portion of offsetting collections (cash) credited to expired account	135	0	0
	Net budget authority and outlays:			
89.00	Budget authority	949	971	951
90.00	Outlays	930	896	950

Object Classification

(dollars in millions)

Identification Code 14-0804-0-1-306		2005 Actual	2006 Estimate	2007 Estimate
	Direct obligations:			
	Personnel compensation:			
11.1	Full-time permanent	421	420	413
11.3	Other than full-time permanent	31	31	30
11.5	Other personnel compensation	9	10	10
11.9	Total personnel compensation	461	461	453
12.1	Civilian personnel benefits	114	120	117
13.0	Benefits for former personnel	4	5	7
21.0	Travel and transportation of persons	23	23	23
22.0	Transportation of things	4	4	4
23.1	Rental payments to GSA	58	60	61
23.2	Rental payment to others	5	5	5
23.3	Comm., utilities, and miscellaneous charges	17	17	17
24.0	Printing and reproduction	2	2	2
25.1	Advisory and assistance services	10	10	9
25.2	Other services	99	108	100
25.3	Other purchases of goods and services from Government accounts	13	16	13
25.4	Operation and maintenance of facilities	4	4	4
25.7	Operation and maintenance of equipment	10	13	10
26.0	Supplies and materials	23	24	23
31.0	Equipment	31	33	31
32.0	Land and structures	1	1	1
41.0	Grants, subsidies, and contributions	70	71	71
99.0	Direct obligations	949	977	951

Object Classification

(dollars in millions)

Identification Code 14-0804-0-1-306		2005 Actual	2006 Estimate	2007 Estimate
	Reimbursable obligations:			
	Personnel compensation:			
11.1	Full-time permanent	135	140	138
11.3	Other than full-time permanent	18	19	19
11.5	Other personnel compensation	4	4	4
11.9	Total personnel compensation	157	163	161
12.1	Civilian personnel benefits	39	40	40
13.0	Benefits for former personnel	2	2	2
21.0	Travel and transportation of persons	9	8	7
22.0	Transportation of things	4	4	4
23.1	Rental payments to GSA	15	15	15
23.2	Rental payments to others	1	1	1
23.3	Comm., utilities, and miscellaneous charges	5	5	5
24.0	Printing and reproduction	1	1	1
25.1	Advisory and assistance services	4	3	3
25.2	Other services	55	46	46
25.3	Other purchases of goods and services from Government accounts	58	49	45
25.4	Operation and maintenance of facilities	1	1	1
25.7	Operation and maintenance of equipment	3	3	3
26.0	Supplies and materials	12	11	10
31.0	Equipment	12	11	10
41.0	Grants, subsidies, and contributions	33	33	30
99.0	Reimbursable obligations	411	396	384
99.9	Total new obligations	1,360	1,373	1,335

Personnel Summary

Identification Code 14-0804-0-1-306		2005 Actual	2006 Estimate	2007 Estimate
	Direct:			
1001	Total compensable work years: Full-time equivalent employment	6,041	5,905	5,627
	Reimbursable:			
2001	Total compensable work years: Full-time equivalent employment	2,673	2,673	2,590

This page intentionally left blank.

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

(dollars in thousands)

	2005 Actual	2006 Estimate	2007 Estimate
Surveys, Investigations, and Research (SIR)			
Geographic Research, Investigations, and Remote Sensing			
Annual appropriation	111,305	121,391	68,732
No-Year appropriation	7,506	8,044	7,882
Subtotal (appropriation)	118,811	129,435	76,614
Non-Federal (Domestic) sources			
Sale of photos, reproductions, and digital products	6,116	4,752	4,752
Sale of personal property	4	0	0
Optical calibration	465	593	625
Miscellaneous	203	200	200
Subtotal (non-Federal domestic sources)	6,788	5,545	5,577
Non-Federal (Foreign) sources			
Landsat International Ground Station Fees	2,087	1,679	1,679
Miscellaneous	61	40	40
Subtotal (non-Federal foreign sources)	2,148	1,719	1,719
State and local sources			
Matched	1,247	1,041	0
Unmatched	1,675	1,597	140
Subtotal (State and local sources)	2,922	2,638	140
Federal sources			
Agency for International Development	2,899	3,723	3,800
Department of Agriculture	1,157	2,528	442
Department of Commerce			
National Oceanic and Atmospheric Administration	50	30	30
Department of Defense			
Corps of Engineers	566	215	209
National Geospatial-Intelligence Agency	1,860	475	475
Other	1,648	531	428
Department of Homeland Security			
Federal Emergency Management Agency	693	325	425
Department of the Interior			
Bureau of Land Management	905	757	238
Bureau of Reclamation	225	10	15
Fish and Wildlife Service	1,193	64	64
National Park Service	2,337	2,242	614
Office of Secretary	5,668	3,032	2,932
Department of Justice	3	3	0
Department of State	113	0	0
Environmental Protection Agency	1,029	713	460

	2005 Actual	2006 Estimate	2007 Estimate
General Services Administration	15	5	5
Health and Human Services	307	161	161
Housing and Urban Development	75	70	75
National Aeronautics and Space Administration	10,899	9,369	9,500
Sale of maps, photos, reproductions, and digital products	951	772	772
Optical calibration	10	10	10
Remote sensing data purchases	403	300	300
Miscellaneous agencies	96	30	30
Subtotal (Federal sources)	33,102	25,365	20,985
Total: Geographic Research, Investigations, and Remote Sensing	**163,771**	**164,702**	**105,035**

	2005 Actual	2006 Estimate	2007 Estimate
Surveys, Investigations, and Research (SIR)			
Geologic Hazards, Resources, and Processes:			
Annual appropriation	230,742	235,286	217,419
Multi-Year appropriation	3,230	4,870	0
No-Year appropriation	2,060	1,435	700
Subtotal (appropriation)	236,032	241,591	218,119
Non-Federal (Domestic) sources			
Miscellaneous	2,391	2,392	2,392
Subtotal (non-Federal domestic sources)	2,391	2,392	2,392
Non-Federal (Foreign) sources			
Saudi Arabia	213	150	150
Miscellaneous	6,030	5,060	10,140
Subtotal (non-Federal foreign sources*)*	6,243	5,210	10,290
State and local sources			
Unmatched	4,434	4,316	4,316
Subtotal *(*State and local sources*)*	4,434	4,316	4,316
Federal sources			
Agency for International Development	1,094	920	920
Central Intelligence Agency	50	50	50
Department of Agriculture	113	114	114
Department of Commerce			
National Oceanic and Atmospheric Administration	5,988	5,657	5,662
Department of Defense			
Corps of Engineers	460	484	509
Other	2,891	3,753	3,773
Department of Energy	2,492	2,260	2,208
Department of Homeland Security			
Federal Emergency Management Agency	33	33	33
Department of the Interior			
Bureau of Indian Affairs	246	245	245
Bureau of Land Management	1,336	1,331	1,336
Bureau of Reclamation	385	386	391
Fish and Wildlife Service	32	33	33
Minerals Management Service	15	20	25
National Park Service	548	555	560
Office of Secretary	12	0	0
Department of Justice	17	0	0
Department of State	3,808	3,900	3,904
Department of Veterans Affairs	83	100	105
Environmental Protection Agency	893	893	898
General Services Administration	23	25	28
National Aeronautics and Space Administration	4,048	4,040	4,190
National Science Foundation	1,095	800	880

	2005 Actual	2006 Estimate	2007 Estimate
Nuclear Regulatory Commission	576	568	568
Miscellaneous agencies	61	61	61
Subtotal (Federal sources)	26,299	26,228	26,493
Total: Geologic Hazards, Resources, and Processes	**275,399**	**279,737**	**261,610**

	2005 Actual	2006 Estimate	2007 Estimate
Surveys, Investigations, and Research (SIR)			
Water Resources Investigations:			
Annual appropriation	213,178	211,764	204,047
No-Year appropriation	622	5,251	0
Subtotal (appropriation)	213,800	217,015	204,047
Non-Federal (Domestic) sources			
Permittees & licensees of the Federal Energy Regulatory Commission	3,638	3,641	3,651
Miscellaneous	306	367	141
Subtotal (non-Federal domestic sources)	3,944	4,008	3,792
Non-Federal (Foreign) sources			
Saudi Arabia	50	50	50
Miscellaneous	812	914	800
Subtotal (non-Federal foreign sources)	862	964	850
State and local sources			
Matched	62,337	63,467	64,000
Matched (In-Kind Services – NON ADD)	666	666	666
Unmatched	83,937	83,116	81,797
Subtotal (State and local sources)	146,274	146,583	145,797
Federal sources			
Agency for International Development	602	302	265
Central Intelligence Agency	325	435	297
Department of Agriculture	1,826	1,531	1,593
Department of Commerce			
National Oceanic and Atmospheric Administration	1,260	1,396	1,180
Department of Defense			
Corps of Engineers	27,107	27,427	27,197
Other	12,100	12,042	11,820
Department of Energy			
Bonneville Power Administration	55	55	55
Other	12,564	11,482	9,288
Department of Homeland Security			
Federal Emergency Management Agency	1,072	1,080	1,080
Other	682	690	690
Department of the Interior			
Bureau of Indian Affairs	721	720	700
Bureau of Land Management	4,838	3,380	3,430
Bureau of Reclamation	11,699	12,219	11,458
Fish and Wildlife Service	975	987	1,002
National Park Service	4,049	3,940	3,923
Office of Secretary			
National Business Center	21	21	21
Other	102	39	9
Department of Justice	6	0	0
Department of State	2,057	1,396	1,378

	2005 Actual	2006 Estimate	2007 Estimate
Department of Transportation	67	67	67
Environmental Protection Agency	9,185	8,952	8,670
Health and Human Services	226	216	216
National Aeronautics and Space Administration	224	482	102
Nuclear Regulatory Commission	262	75	0
Tennessee Valley Authority	210	210	210
Miscellaneous agencies	450	308	318
Subtotal (Federal sources)	92,685	89,452	84,969
Total: Water Resources Investigations	**457,565**	**458,022**	**439,455**

	2005 Actual	2006 Estimate	2007 Estimate
Surveys, Investigations, and Research (SIR)			
Biological Research:			
Annual appropriation	453	0	0
Multi-Year appropriation	173,234	178,568	172,596
No-Year appropriation	282	111	0
Subtotal (appropriation)	173,969	178,679	172,596
Non-Federal (Domestic) sources			
Technology Transfer	1	1	1
Miscellaneous	360	284	284
Subtotal (non-Federal domestic sources)	361	285	285
Non-Federal (Foreign) sources			
Miscellaneous	85	85	85
Subtotal (non-Federal foreign sources)	85	85	85
State and local sources			
Matched	158	158	158
Unmatched	7,071	7,126	7,226
Subtotal (State and local sources)	7,229	7,284	7,384
Federal sources			
Department of Agriculture	1,439	1,271	1,270
Department of Commerce			
National Oceanic and Atmospheric Administration	1,140	1,002	1,002
Department of Defense			
Corps of Engineers	21,362	18,420	18,920
Other	5,645	5,543	5,643
Department of Energy			
Bonneville Power Administration	776	750	750
Other	75	80	90
Department of Homeland Security			
Federal Emergency Management Agency	49	49	49
Department of the Interior			
Bureau of Land Management	3,864	3,003	3,003
Bureau of Reclamation	12,121	11,275	11,075
Fish & Wildlife Service	8,594	8,423	8,423
National Park Service	3,130	2,975	3,075
Office of the Secretary	1,238	1,210	1,210
Department of State	50	50	50
Department of Transportation	456	452	472
Environmental Protection Agency	1,988	1,950	1,955
Health and Human Services	224	224	224
National Aeronautics and Space Administration	63	63	63
National Science Foundation	42	42	42
Miscellaneous agencies	68	0	0
Subtotal *(*Federal sources*)*	62,324	56,782	57,316
Total: Biological Research	**243,968**	**243,115**	**237,666**

Surveys, Investigations, and Research (SIR)

	2005 Actual	2006 Estimate	2007 Estimate
Enterprise Information:			
Annual appropriation	44,810	46,394	111,231
Subtotal (appropriation)	44,810	46,394	111,231
Non-Federal (Domestic) sources			
Map receipts	4,114	3,944	3,941
Sale of photos, reproductions, and digital products	74	74	74
Miscellaneous	2	2	2
Subtotal (non-Federal domestic sources)	4,190	4,020	4,017
Non-Federal (Foreign) sources			
Miscellaneous	44	75	31
Subtotal (non-Federal foreign sources)	44	75	31
Federal sources			
Department of Agriculture	128	303	3
Department of Commerce			
National Oceanic and Atmospheric Administration	0	60	0
Other	0	450	0
Department of Defense			
National Geospatial-Intelligence Agency	230	0	0
Other	443	653	53
Department of Energy	0	100	0
Department of Homeland Security	447	1,000	0
Department of the Interior			
Bureau of Indian Affairs	327	357	357
Bureau of Land Management	1,893	2,040	2,040
Bureau of Reclamation	151	166	166
Fish and Wildlife Service	517	561	561
Minerals Management Service	75	80	80
National Park Service	547	572	572
Office of Secretary			
National Business Center	42	0	0
Other	29	36	36
Office of Surface Mining	75	80	80
Department of Justice	0	100	0
Department of Labor	0	100	0
Department of the Transportation	210	150	0
Department of Treasury	0	100	0
Environmental Protection Agency	178	203	53
General Services Administration	0	100	0
Health and Human Services	0	100	0
Housing and Urban Development	0	100	0
National Aeronautics and Space Administration	661	815	515
National Science Foundation	0	100	0
Nuclear Regulatory Commission	0	100	0

	2005 Actual	2006 Estimate	2007 Estimate
Sale of maps, photos, reproductions, and digital products	3	1	0
Miscellaneous agencies	13	13	13
Subtotal (Federal sources)	5,969	8,440	4,529
Total: Enterprise Information	**55,013**	**58,929**	**119,808**

	2005 Actual	2006 Estimate	2007 Estimate
Surveys, Investigations, and Research (SIR)			
Science Support:			
Annual appropriation	65,472	69,302	67,382
No-Year appropriation	81	0	0
Subtotal (appropriation)	65,553	69,302	67,382
Non-Federal (Domestic) sources			
Technology Transfer	43	51	53
Subtotal (non-Federal domestic sources)	43	51	53
Federal sources			
Department of Agriculture	2	0	0
Department of Commerce			
National Oceanic and Atmospheric Administration	20	15	15
Department of Defense			
Corps of Engineers	1	1	1
Department of Interior			
Bureau of Indian Affairs	177	132	134
Bureau of Land Management	43	33	33
Bureau of Reclamation	1,156	2,734	1,400
Minerals Management Service	79	69	71
Office of Secretary			
National Business Center	93	76	71
Other	849	781	872
General Services Administration	50	0	0
Miscellaneous agencies	99	80	80
Subtotal (Federal sources)	2,569	3,921	2,677
Total: Science Support	**68,165**	**73,274**	**70,112**

	2005 Actual	2006 Estimate	2007 Estimate
Surveys, Investigations, and Research (SIR)			
Facilities:			
Annual appropriation	71,271	71,805	72,388
Multi-Year appropriation	24,388	21,084	21,083
No-Year appropriation	342	1,812	2,000
Subtotal (appropriation)	96,001	94,701	95,471
Federal sources			
Central Intelligence Agency	265	335	345
Department of Interior			
Office of Secretary	0	126	130
General Services Administration	40	40	40
Subtotal (Federal sources)	305	501	515
Total: Facilities	**96,306**	**95,202**	**95,986**
SIR Summary:			
Annual appropriation	737,231	755,942	741,199
Multi-Year appropriation	200,852	204,521	193,679
No-Year appropriation	10,893	16,654	10,582
Non-Federal sources			
Map receipts	4,114	3,944	3,941
Domestic	13,603	12,357	12,175
Foreign	9,382	8,053	12,975
State and local sources	160,859	160,821	157,637
Federal sources	223,253	210,689	197,484
Total: SIR	**1,360,187**	**1,372,981**	**1,329,672**

	2005 Actual	2006 Estimate	2007 Estimate
Surveys, Investigations, and Research (SIR)			
Contributed Funds:			
Permanent, indefinite appropriation:			
Geographic Research, Investigations, and Remote Sensing	39	14	8
Geologic Hazards, Resources, and Processes	399	851	1,023
Water Resources Investigations	355	359	148
Biological Research	522	531	337
Enterprise Information	117	0	0
Science Support	890	22	0
Total: Contributed Funds	**2,322**	**1,777**	**1,516**
Operation and Maintenance of Quarters:			
Permanent, indefinite appropriation:			
Geologic Hazards, Resources, and Processes	36	58	17
Biological Research	45	50	65
Total: Operation & Maintenance of Quarters	**81**	**108**	**82**
Working Capital Fund:			
National Water Quality Lab	16,575	15,006	15,449
Hydrologic Instrumentation Facility	11,051	12,668	13,000
Other	36,905	34,007	30,601
Total: Working Capital Fund	**64,531**	**61,681**	**59,050**
Allocations from other Federal Agencies: *			
Department of the Interior: Departmental Offices			
Natural Resource Damage Assessment	1,738	1,200	1,200
Total: Allocations	**1,738**	**1,200**	**1,200**

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

Trust Funds

DONATIONS AND CONTRIBUTED FUNDS

Program and Financing

(dollars in millions)

Identification Code 14-8562-0-7-306		2005 Actual	2006 Estimate	2007 Estimate
	Obligations by program activity:			
09.01	Donations and Contributed Funds	2	2	1
10.00	Total new obligations	2	2	1
	Budgetary resources available for obligation:			
21.40	Unobligated balance carried forward, start of year	1	1	0
22.00	New budget authority (gross)	2	1	1
23.90	Total budgetary resources available for obligation	3	2	1
23.95	Total new obligations	-2	-2	-1
24.40	Unobligated balance carried forward, end of year	1	0	0
	New budget authority (gross), detail:			
	Mandatory:			
60.26	Appropriation (trust fund)	2	1	1
	Change in obligated balances:			
72.40	Obligated balance, start of year	0	1	2
73.10	Total new obligations	2	2	1
73.20	Total outlays (gross)	-2	-1	-1
74.40	Obligated balance, end of year	1	2	2
	Outlays (gross), detail:			
86.97	Outlays from new mandatory authority	0	1	1
86.98	Outlays from mandatory balances	2	0	0
87.00	Total outlays (gross)	2	1	1
	Net budget authority and outlays:			
89.00	Budget authority	2	1	1
90.00	Outlays	2	1	1

Object Classification

(dollars in millions)

Identification Code 14-8562-0-7-306		2005 Actual	2006 Estimate	2007 Estimate
	Direct obligations:			
12.52	Other services	2	2	1

Employee Count by Grade
(Total Employment)

	2005 Actual	2006 Estimate	2007 Estimate
Executive Level V	1	1	1
SES	29	30	30
Subtotal	30	31	31
SL - 00	12	12	12
ST - 00	36	40	40
Subtotal	48	52	52
GS/GM -15	596	583	575
GS/GM -14	797	780	769
GS/GM -13	1,382	1,353	1,334
GS -12	1,620	1,587	1,563
GS -11	1,454	1,424	1,403
GS -10	17	16	16
GS - 9	1,060	1,038	1,023
GS - 8	308	303	297
GS -7	696	681	672
GS - 6	242	236	233
GS - 5	294	287	283
GS - 4	199	195	192
GS - 3	107	105	103
GS - 2	39	38	38
GS -1	16	15	15
Subtotal	8,827	8,641	8,516
Other Pay Schedule Systems	276	268	268
Total employment (actual/estimate)	9,181	8,992	8,867

Program/Project Support of Bureau, Department, and Governmentwide Costs

External Administrative Costs

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

Centralized billing is used whenever the product or service being provided is not severable or it is inefficient to bill for the exact amount of product or service being procured. Customers are billed each year using a pre-established basis that is adjusted annually to reflect change over time. The following table provides the actual centralized billing to the USGS for FY 2005 and estimates for FY 2006 and 2007. The change between 2006 and 2007 is fully funded through a mixture of uncontrollable and program changes.

FY 2007 WORKING CAPITAL FUND
CENTRALIZED BILLING
U.S. GEOLOGICAL SURVEY

(dollars in thousands)

Activity/Office	FY 2005 Actual	FY 2006 Estimate	FY 2007 Estimate
Other OS Activities			
Invasive Species Program	183.4	196.0	195.9
Invasive Species DOI Coordinator	30.2	32.0	32.4
Secretary's Immediate Office	213.6	228.0	228.3
Alaska Field Office	10.3	10.9	11.1
Secretary's Immediate Office	10.3	10.9	11.1
Alaska Resources Library and Information Services	156.8	166.4	166.4
Secretary's Immediate Office	156.8	166.4	166.4
Lewis and Clark Bicentennial	29.1	0.0	0.0
Secretary's Immediate Office	29.1	0.0	0.0
Document Management Unit	5.6	5.7	20.7
Office of the Executive Secretariat	5.6	5.7	20.7
Departmental News and Information	20.5	21.8	29.7
Departmental Newsletter	71.4	68.6	41.0
Hispanic Media Outreach	20.3	22.9	24.3
Office of Communications	112.1	113.2	95.0
California Desert Managers Group Coordinator	37.1	41.2	43.2
Fish, Wildlife, and Parks	37.1	41.2	43.2
Financial Management Training	26.9	27.4	30.2
Travel Management Center	70.5	44.8	45.6
Office of Financial Management	97.4	72.2	75.8
Activity Based Costing/Management	141.1	141.6	141.6
Office of Financial Management	141.1	141.6	141.6
Quarters Program and Interior Collections Mgmt Sys	2.1	0.6	2.3
Interior Collections Management System (ICMS)	0.0	0.0	3.0
DOI Space Management Initiative	0.0	32.8	31.5
Property and Acquisition Management	2.1	33.3	36.8
Planning and Performance Management	168.5	171.2	177.9
Office of Planning and Performance Mgmt	168.5	171.2	177.9
Center for Competitive Sourcing Excellence	49.1	49.7	62.6
Office of Competitive Sourcing	49.1	49.7	62.6
DOI wide OWCP Coordination	0.0	0.0	9.1
Employee Counseling	19.0	19.2	19.2
CLC – Human Resources	3.5	5.0	5.0
OPM Federal Employment Services	20.3	20.3	20.3
Office of Human Resources	42.8	44.4	53.5
Special Emphasis Program	4.9	4.9	4.9
Recruitment/Outreach	3.3	0.0	0.0
Office of Civil Rights	8.2	4.9	4.9
Occupational Health and Safety	154.1	159.4	163.6
Health & Safety Training Initiative	41.8	41.8	41.8
Office of Occupational Health and Safety	195.9	201.3	205.4

FY 2007 WORKING CAPITAL FUND
CENTRALIZED BILLING
U.S. GEOLOGICAL SURVEY

(dollars in thousands)

Activity/Office	FY 2005 Actual	FY 2006 Estimate	FY 2007 Estimate
Classified Information Facility	44.0	44.6	66.3
Emergency Preparedness	92.2	120.8	126.1
Law Enforcement Coordination and Training	0.0	46.3	47.1
Watch Office	136.3	138.3	144.6
Office of Law Enforcement and Security	272.5	350.0	384.2
IT Security	466.7	467.7	262.9
IT Security Certification and Accreditation	0.0	430.6	430.6
Information Technology Architecture	507.9	508.9	477.2
Capital Planning	111.1	131.6	175.3
Enterprise Resource Management	0.0	0.0	33.8
Data Resource Management Program	39.2	39.3	22.1
Office of the Chief Information Officer	1,124.9	1,578.1	1,401.9
DOI-wide Telecommunications Initiatives			
Frequency Management Support	115.8	218.4	84.4
Messaging	0.0	0.0	2,299.8
OS-HSPD 12 (e-Authentication)	0.0	223.2	125.8
Enterprise Services Network (ESN)	1,227.9	1,333.0	5,255.2
ESN – Program Change	0.0	1,229.4	0.0
ARTNET	58.7	0.0	0.0
Active Directory	0.0	153.4	153.4
Office of the Chief Information Officer	1,402.4	3,157.4	7,918.6
Web & Internal/External Comm	79.1	79.5	74.1
DOI FOIA Tracking & Reporting System	14.2	49.2	8.5
GPEA	50.2	50.2	7.0
Office of the Chief Information Officer	143.5	178.9	89.6
Solicitor – Ethics Training/ALLEX Database/FOIA Appeals	6.6	6.6	6.6
ALLEX Database	3.0	3.0	3.0
FOIA Appeals	0.0	0.0	10.5
Solicitor	9.6	9.6	20.2
CFO Financial Statement Audit	565.8	565.9	597.9
Departmentwide Activities	565.8	565.9	597.9
E Government Initiatives	412.0	369.2	369.2
Volunteer.gov	13.1	13.1	13.1
Office of Planning and Performance Mgmt	425.1	382.3	382.3
WCF Management	18.7	0.00	0.0
Coop ECO Study Units (CESU)	73.4	73.4	73.4
Glen Canyon Adaptive Management Plan	0.0	94.9	99.7
DOI Geographic Info Mgmt EGIM	0.0	80.3	230.8
SBA Certifications	1.5	0.4	0.5
NTIA Spectrum Management	501.1	501.2	186.2
Contingency Reserve	9.5	9.4	9.4
Departmentwide Activities	604.2	759.6	600.0
Subtotal Other OS Activities	5,817.8	8,265.9	12,718.1

FY 2006 WORKING CAPITAL FUND
CENTRALIZED BILLING
U.S. GEOLOGICAL SURVEY

(dollars in thousands)

Activity/Office	FY 2005 Actual	FY 2006 Estimate	FY 2007 Estimate
National Business Center			
Cultural Resources & Events Management	38.3	50.9	58.9
Partnership Schools & Commemorative Programs	0.0	3.3	3.7
Departmental Museum	187.3	189.1	187.2
Departmental Library	300.4	329.2	329.5
Learning and Performance Center Management	51.1	48.5	45.8
SESCDP & Other Leadership Programs	108.5	72.6	70.8
Washington Learning & Performance Center	66.5	48.1	56.3
Albuquerque Learning & Performance Center	9.4	8.4	7.0
Anchorage Learning & Performance Center	14.7	9.4	8.9
Denver Learning & Performance Center	97.3	85.9	81.5
On-Line Learning	61.6	61.2	58.4
NBC - Human Capital/DOIU	935.1	906.6	907.9
Computer Applications and Network Services	20.0	21.1	21.3
Telecommunications Services	4.7	7.2	7.2
Voice/data switching	1.7	1.8	1.8
New PBX Telephone System	1.9	2.0	1.7
Records Management/FOIA	58.1	57.9	59.6
Aviation Management – Information Technology	15.9	0.0	0.0
NBC IT Security Improvement Plan	0.0	0.0	438.9
NBC - IT	102.2	89.9	530.5
FPPS-Application Management Office	96.1	140.8	143.2
FPPS – Payroll Operations	856.4	813.0	828.4
FPPS – Payroll Systems	1,091.5	941.1	952.2
NBC – E-payroll	2,044.0	1,894.9	1,923.8
Interior Complex Management and Services	2.1	3.1	3.1
Family Support Room	0.0	0.1	0.1
Moving Services	0.5	0.9	0.7
Shipping and Receiving	0.9	1.5	1.6
Space Management Services	0.5	0.6	0.7
Drug testing - intra department	32.7	2.8	3.4
Security	11.6	20.1	21.0
Accessible Technology Center	42.9	40.5	40.7
Federal Executive Board	33.6	32.3	32.8
Health Unit	0.7	0.8	1.0
OWCP Coordination	1.3	0.0	0.0
Blue Pages	79.5	83.1	87.3
Mail Policy	33.0	42.3	41.4
Mail and Messenger Services	69.5	73.6	78.2
Special Events Services	0.0	0.0	7.3
NBC – Administrative Operations	308.6	301.8	319.4
Financial Systems (inc Hyperion)	2,460.2	2,506.2	2,563.9
Departmental Offices Accounting	16.6	0.0	0.0
IDEAS	380.0	378.2	378.2
Quarters Program	0.7	0.7	0.8
NBC – CFO	2,857.5	2,885.1	2,942.9
Aviation Management Directorate	150.2	159.6	164.5
Aviation – Mandatory Services	150.2	159.6	164.5
Subtotal National Business Center	6,397.6	6,238.0	6,789.1
TOTAL	12,215.4	14,503.9	19,507.2

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 billing to the USGS for FY 2005 and estimates for FY 2006 and 2007.

FY 2007 WORKING CAPITAL FUND
DIRECT BILLING
U.S. GEOLOGICAL SURVEY

(dollars in thousands)

Activity/Office	FY 2005 Actual	FY 2006 Estimate	FY 2007 Estimate
Other OS Activities			
Office of Assistant Secretary – PMB			
Financial Management Activities	31.1	0.0	0.0
Finance Budget Conf OC MD	11.2	5.7	5.7
Linh Luu Award bureaus	0.3	0.0	0.0
Office of Financial Management	42.5	5.7	5.7
CTA A&E Contract	100.0	0.0	0.0
Facilities Management Conf 02	10.0	0.0	0.0
CTA A&E Contract	15.0	0.0	0.0
Office of Acquisition and Property Management	125.1	0.0	0.0
OSDBU SBA Certifications	0.3	0.0	0.0
Office of Small & Disadvantaged Business Utilization	0.3	0.0	0.0
Volunteer.gov	12.5	0.0	0.0
Planning and Performance Management	12.5	0.0	0.0
Departmental Medals	19.5	19.5	19.5
Human Resources Policy	19.5	19.5	19.5
EEO Training	1.1	1.4	1.1
Civil Rights	1.1	1.4	1.1
ESN	0.0	1,858.7	3,961.4
Office of Information Resources Management	0.0	1,858.7	3,961.4
Oracle License & Support Contract	914.0	0.0	00
Microsoft Enterprise Licenses	1,504.0	1,351.8	1,351.9
Anti-Virus Software Licenses	105.5	0.0	105.5
Popkin System Architect Licenses	2.4	1.3	1.3
Karta GoLearn Licenses	0.0	4.6	4.6
Office of the Chief Information Officer	2,525.9	1,357.7	1,463.3
OCIO IT Security	101.9	0.0	0.0
IT Security – Reimb	123.9	0.0	0.0
IT Security Certification & Accreditation	122.8	55.0	0.0
Internet Domain Reimb	3.1	0.0	0.0
Office of the Chief Information Officer	351.7	55.0	0.0
FY 2005 KPMG Audit	36.4	35.3	0.0
FY 2006 KPMG Audit	0.0	182.6	18.3
FY 2007 KPMG Audit	0.0	0.0	182.6
CFO Financial Statement Audit	36.4	217.9	200.9

FY 2007 WORKING CAPITAL FUND
DIRECT BILLING
U.S. GEOLOGICAL SURVEY

(dollars in thousands)

Activity/Office	FY 2005 Actual	FY 2006 Estimate	FY 2007 Estimate
Cooperative Conservation Conference	14.1	0.0	0.0
Glen Canyon	95.0	0.0	0.0
Great Lakes Interagency Task Force	29.3	0.0	0.0
Federal FSA Program	0	264.5	133.9
FBMS Change Order Funding	300.0	0.0	0.0
DOIwide Initiatives	438.3	264.5	133.9
Office of Program Analysis – International Affairs			
Solicitor's Conference	1.0	0.0	0.0
Office of Solicitor	1.0	0.0	0.0
Indirect costs – Admin Services	2.0	94.1	94.1
OS Budget Office	2.0	94.1	94.1
Subtotal Other OS Activities	3,556.4	3,874.4	5,879.9

FY 2007 WORKING CAPITAL FUND
DIRECT BILLING
U.S. GEOLOGICAL SURVEY
(dollars in thousands)

Activity/Office	FY 2005 Actual	FY 2006 Estimate	FY 2007 Estimate
National Business Center			
Strategic Management of Human Capital Directorate			
Aviation Management – Human Capital	5.2	0.0	0.0
Career, Balance, and Diversity Forums	3.7	2.3	0.0
Financial Management Intern Program 2	12.0	0	0.0
Online Learning	51.3	109.9	57.7
NBC – Human Capital/DOIU	72.2	112.2	57.7
Information Technology Directorate			
Enterprise Infrastructure	371.3	382.4	393.9
Technology Services	1.0	1.0	1.0
NBC – CIO	372.3	383.4	394.9
Federal Personnel Payroll Systems and Services Directorate			
FPPS – Application Management Office	6.8	5.4	5.6
FPPS – Payroll Systems	288.8	297.5	308.3
NBC - E-payroll	295.6	302.9	313.9
Administrative Operations Directorate			
Aviation Management – Acquisitions	22.7	0.0	0.0
Flags & Seals	1.4	1.4	1.1
Building Alteration Services	0.1	0.1	0.1
Creative Communications	69.8	72.0	62.4
Reimbursable ATC Services	0.4	0.4	0.4
Overseas Mail Services	7.5	8.4	9.2
NBC - Administrative Operations	101.8	82.3	73.2
Budget and Finance Directorate			
IDEAS	120.0	156.8	161.5
Aviation Management – Finance	24.1	0.0	0.0
NBC AMD	144.1	156.8	161.5
Aviation – Discretionary Activities	2,175.2	48.3	50.0
Aviation Management Directorate	2,175.2	48.3	50.0
Appraisal Services Directorate			
Appraisal Services Mineral Appraisals	0.0	525.0	0.0
NBC – Appraisal Services	0.0	525.0	0.0
Subtotal National Business Center	3,161.1	1,610.9	1,051.1
TOTAL	6,717.5	5,485.3	6,931.0

Payments to other Federal agencies include the following:

	2006 Budget	2006 Revised	2007 Change
Worker's Compensation Payments	$3,425	$3,375	-$381
Amount Absorbed		[$50]	

The adjustment is for actual charges through June 2005, in the costs of compensating injured employees and dependents of employees who suffered accidental deaths while on duty. Costs for 2006 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.

	2006 Budget	2006 Revised	2007 Change
Unemployment Compensation Payments	$592	$583	+$141
Amount Absorbed		[$9]	

The adjustment is for estimated 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

	2006 Budget	2006 Revised	2007 Change
Rental Payments to GSA and Others	65,004	64,048	+$1,123
Amount Absorbed		[$956]	

The adjustment is for changes in the costs payable to General Service 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. 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.

Internal Bureau Overhead/Cost Allocation Methodology

The USGS manages overhead/administrative costs at two levels—the bureau and science center. Bureau-level costs include headquarters and regional support for executive, managerial, supervisory, administrative, and financial functions and related bureauwide systems. At the bureau level, funding appropriated to the Science Support and Enterprise Information budget activities 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 the Science Support and Enterprise Information program areas, as well.

The USGS charges a bureau overhead rate (12 percent in FY 2006 and FY 2007) on reimbursable work from non-Interior customers to cover their share of bureau-level costs. In some cases, the USGS does apply reduced or special rates 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 Science Support and

Enterprise Information programs, including the anticipated overhead collections to pay for bureauwide costs.

Source of Funding (dollars in thousands)	FY 2007 Appropriation	FY 2007 Bureau Overhead Distribution	FY 2007 Total
Science Support Budget Activity	67,382	27,650	95,032
Enterprise Information Budget Activity	111,231	8,259	119,490
Total Funding	**178,613**	**35,909**	**214,522**

At the science center level, because there 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, etc. The cost during FY 2005, for the local overhead, totaled $134 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 Department 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 Department bureaus for common services and bureau costs combined remains 15 percent net. In FY 2007, of the 15 percent, 8 percent is applied to bureau costs, and the remaining 7 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 percent) from USGS appropriated funds. In FY 2005, the bureau began a glide path to share the combined 15 percent overhead more equitably. Under this distribution, the cost centers are required to fund a lesser amount from science program funds and the bureau is required to use a greater proportion of science support funding for the total bureau overhead costs. 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 FY 2006 is 3 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.
- A bureau special rate of 3 percent net is applied to cover reduced administrative costs when the USGS receives funds from a non-USGS organization and awards a grant to a third-party entity.
- A bureau special rate of 3 percent net is applied to cover reduced administrative costs when the USGS receives funds from one or more non-USGS organizations to support, under USGS leadership, a strategic science objective which includes the USGS passing through funds to one or more third party entities.

- A bureau special rate of 3 percent net is applied to cover reduced administrative costs 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.
- A bureau special rate of 3 percent net is applied to cover reduced administrative costs 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 collocated 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.

Authorizations

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 geological 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 by and with the advice and consent of the Senate. P.L. 102–285, Sec. 10(a) establishes the official name as United States Geological Survey.

Title 2 – The Congress

2 U.S.C. 681–688 Congressional Budget and Impoundment Control Act of 1974. Describes the general Federal budget process, including rescissions, reservations, and deferrals of budget authority.

Title 5 – Government Organization and Employees

5 U.S.C. Includes personnel matters (classification, pay rates, benefits, etc.), the Freedom of Information Act, the Privacy Act, the Computer Matching and Privacy Act, and other issues related to general Federal functions and employment. The Appendices to Title 5 include the Federal Advisory Committee Act (FACA) of 1972, Inspector General mandates, and other matters that include Federal entities such as the USGS.

Title 7 – Agriculture

7 U.S.C. 136 Federal Environmental Pesticide Control Act of 1972. Amends the program established by the Federal Insecticide, Fungicide and Rodenticide Control Act of 1947 for controlling the sale and distribution of "economic poisons." The law requires registration of pesticides to avoid unreasonable adverse effects to humans or the environment.

7 U.S.C. 2201 Department of Agriculture Organic Act of 1956. Requires the Secretary of Agriculture to obtain the advice of the Secretary of the Interior as to whether certain lands that are being patented, disposed of, or exchanged are mineral in character.

7 U.S.C. 2204(b) Rural Development and Policy Act of 1980. Authorizes the Secretary of Agriculture to enter cooperative agreements with other Federal agencies and other organizations concerning water management for rural areas.

Title 15 – Commerce and Trade

15 U.S.C. 631, 631(a) Small Business Act. Fosters the economic interests of small businesses and sets forth procedures. Encourages Federal agencies to use small businesses and women-owned businesses for services and other contracted activities.

15 U.S.C. 2901–2908 The National Climate Program Act of 1978. Establishes a national climate program to assist the Nation and the world in understanding and responding to natural

and human-induced climate processes and their known and potential effects. The Department of the Interior has a mandated role in this Program.

15 U.S.C. 2921 et seq. The Global Change Research Act of 1990. Establishes the United States Global Change Research Program aimed at understanding and responding to global change, including the cumulative effects of human activities and natural processes on the environment, to promote discussions toward international protocols in global change research, and for other purposes.

15 U.S.C. 5631 et seq. Land Remote Sensing Policy Act of 1992. Enables the United States to maintain leadership in land remote sensing by providing data continuity for the Landsat program. Assigns responsibility for the "National Satellite Land Remote Sensing Data Archive" to the Department of the Interior. Authorizes and encourages the Department of the Interior and other Federal agencies to carry out research and development programs in applications of these data and makes Landsat data available to the public.

Title 16 – Conservation

16 U.S.C. 17 et seq. National Park Service Organic Act of 1916. Parts of Title 16, Conservation, as amended and supplemented, apply to the USGS. Notably, the Outdoor Recreation Act of 1936 authorizes the Secretary of the Interior to sponsor, engage in, and assist in research relating to outdoor recreation, directly or by contract or cooperative agreements, and make payments for such purposes; undertake studies and assemble information concerning outdoor recreation; and cooperate with educational institutions and others to assist in establishing education programs and activities and to encourage public use and benefits from outdoor recreation.

16 U.S.C. 661 et seq. Fish and Wildlife Coordination Act of 1934. Authorizes the Secretary of the Interior to prepare plans to protect wildlife resources, to conduct surveys on public lands, and to accept funds or lands for related purposes; authorizes the investigation and reporting of proposed Federal actions that affect the development, protection, rearing, and stocking of all species of wildlife and their habitat in controlling losses, minimizing damages, and providing recommendations to minimize impacts on fish and wildlife resources. National Wildlife Refuge System Improvement Act of 1997 (P.L. 105–57) amends the National Wildlife Refuge System Administration Act of 1966 to improve the management of the National Wildlife Refuge System, and for other purposes.

16 U.S.C. 703–712 Migratory Bird Treaty Act of 1918, as amended. Implements four international treaties that individually affect migratory birds common to the United States, Canada, Mexico, Japan, and the former Soviet Union. Establishes Federal responsibility for protection and management of migratory and nongame birds, including the establishment of season length based on scientific information relative to zones of temperature, distribution, abundance, breeding habits and times and lines of migratory flight of migratory birds. Establishes the Secretary of the Interior's responsibility for bag limits and other hunting regulations and issuance of permits to band, possess, or otherwise make use of migratory birds.

16 U.S.C. 715 Migratory Bird Conservation Act of 1900. Establishes the Migratory Bird Conservation Commission; authorizes the Secretary of the Interior to conduct investigations and publish documents related to North American birds.

16 U.S.C. 742(a) et seq. Fish and Wildlife Act of 1956. Authorizes the Secretary of the Interior to conduct investigations, prepare and disseminate information, and make periodic reports to the public regarding the availability and abundance and the biological requirements of fish and wildlife resources; provides a comprehensive national fish and wildlife policy and authorizes the Secretary of the Interior to take steps required for the development, management, advancement, conservation, and protection of fisheries and wildlife resources through research, acquisition of refuge lands, development of existing facilities, and other means.

16 U.S.C. 742(l) Fish and Wildlife Improvement Act of 1978, as amended by P.L. 95–616. Authorizes the Secretary of the Interior to enter into cooperative agreements with colleges and universities, State fish and game agencies, and nonprofit organizations for the purpose of developing adequate, coordinated, cooperative research and training programs for fish and wildlife resources.

16 U.S.C. 797(c) Following language supports Appropriations language "and Federal Energy Regulatory Commission licensees." States that, "To cooperate with the executive departments and other agencies of States or National Governments in such investigations; and for such purposes the several departments and agencies of the National Government are authorized and directed upon the request of the commission, to furnish such records, papers and information in their possession as may be requested by the commission, and temporarily to detail to the commission such officers or experts as may be necessary in such investigations."

16 U.S.C. 931–939 Great Lakes Fishery Act of 1956. Implements the Convention on Great Lakes Fisheries between the United States and Canada; authorizes construction, operation, and maintenance of sea lamprey control works; sets forth procedures for coordination and consultation with States and other Federal agencies; and establishes the Great Lakes Fisheries Commission.

16 U.S.C. 1131 and 1133 Wilderness Act of 1964, as amended. Requires the USGS to assess the mineral resources of each area proposed or established as wilderness. The studies are to be on a planned and recurring basis. The original series of studies has been completed, and no recurring studies have been requested or funded.

16 U.S.C. 1361 et seq. Marine Mammal Protection Act of 1972, as amended. Establishes a responsibility to conserve marine mammals with management authority vested in the Department of the Interior for the sea otter, walrus, polar bear, dugong, and manatee.

16 U.S.C. 1451 et seq. Coastal Zone Management Act of 1976. Provides that each department, agency, and instrumentality of the Executive Branch of the Federal Government may assist the Secretary of Commerce, on a reimbursable basis or otherwise, in carrying out research and technical assistance for coastal zone management.

16 U.S.C. 1531 et seq. Endangered Species Act of 1973, as amended. Provides for the conservation of threatened and endangered species of fish, wildlife, and plants, and authorizes establishment of cooperative agreements and grants-in-aid to States that establish and maintain active and adequate programs for endangered and threatened wildlife and plants.

16 U.S.C. 1604. Forest and Rangeland Renewable Resources Planning Act of 1974, as amended by the National Forest Management Act of 1976. The USGS is a party in an interagency agreement with the Forest Service to assess the mineral resources of National Forests.

16 U.S.C. 2801 et seq. National Aquaculture Act of 1980. Directs the Secretary of the Interior to participate in the development of a National Aquaculture Development Plan and authorizes research, development, and other activities to encourage the development of aquaculture in the United States.

16 U.S.C. 3141 et seq. Alaska National Interest Lands Conservation Act of 1980. Designates certain public lands in Alaska as units of the National Park, National Wildlife Refuge, Wild and Scenic Rivers, National Wilderness Preservation and National Forest Systems, resulting in general expansion of all systems and provided comprehensive management guidance for all public lands in Alaska. Section **3141** requires the Secretary of the Interior to assess the oil and gas potential of Federal lands (other than submerged lands on the Outer continental Shelf) in Alaska north of 68 degrees north latitude and east of the western boundary of the National Petroleum Reserve–Alaska (NPRA), other than lands included in the NPRA and in conservation system units established by the Act. Also authorizes the Secretary of the Interior to initiate and carry out a study of all Federal lands in designated areas of Alaska; the study is to assess the potential oil and gas resources of these lands; review the wilderness characteristics; and study the wildlife resources of these lands. Section **3142** provides for a comprehensive and continuing inventory and assessment of the fish and wildlife resources of the coastal plain of the Arctic National Wildlife Refuge. Also states that the USGS "has made and may be called upon to make water studies pertinent to implementation of the Act." Section **3148** authorizes the Secretary to conduct studies, or collect and analyze information obtained by permittees, of the oil and gas potential of non-North Slope Federal lands and environmental characteristics and wildlife resources that would be affected by the exploration for and development of such oil and gas. Section **3150** requires that the Secretary of the Interior assess the oil, gas, and other mineral potential on all public lands in the State of Alaska to expand the database with respect to the mineral potential of such lands. This responsibility has been delegated to the USGS. Section **3151** requires an annual minerals report be presented to Congress; the preparation of this report was delegated to the USGS. The annual reporting requirement was terminated, effective May 15, 2000, pursuant to section 3003 of P.L. 104–66, as amended.

16 U.S.C. 3501 et seq. Coastal Barrier Resources Act of 1982. Designates various underdeveloped coastal barrier islands depicted by specific maps for inclusions in the Coastal Barrier Resource System. **P.L. 106–514** Coastal Barrier Resources Reauthorization Act of 2000. Reauthorizes and amends the Coastal Barrier Resources Act of 1999. Section **6** authorizes cooperative efforts between the Secretary of the Interior and the Director of FEMA to provide existing digital spatial data, including digital orthophotos, and shoreline, elevation, and bathymetric data of the John H. Chafee Coastal Barrier Resource System maps. If data do not exist to carry out this pilot project, the USGS, in cooperation with other Federal agencies, as appropriate, will obtain and provide the data required to the Secretary. In addition, all data used or created to carry out this section shall comply with the National Spatial Data Infrastructure established by Executive Order 12906 (59 Fed. Reg. 17671 (April 13, 1994)); and any other standards established by the Federal Geographic Data Committee established by Office of Management and Budget Circular A–16.

16 U.S.C. 4701 et seq. Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990. Establishes a Federal program to prevent introduction and control the spread of introduced aquatic nuisance species.

Title 22 – Foreign Relations and Intercourse

22 U.S.C. 3201 et seq. Nuclear Non-Proliferation Act of 1978. Provides that under Title V, United States Assistance to Developing Countries, the USGS assists, through the State Department and the Agency for International Development, in evaluation of nuclear facilities sites in other countries.

Title 25 – Indians

25 U.S.C. 450 et seq. Tribal Self-Governance Act of 1994. The USGS participates in the Tribal Self-Governance Program by identifying USGS activities that may be available for tribal operation under the Self-Governance Act. The USGS discusses programs and activities with interested tribal governments.

Title 29 – Labor

29 U.S.C. 651 Occupational Safety and Health Act of 1970. Provides criteria "… to assure so far as possible every working man and woman in the Nation safe and healthful working conditions …."

Title 30 – Mineral Lands and Mining

30 U.S.C. 21(a) Mining and Minerals Policy Act of 1970. Emphasizes Department of the Interior responsibility for assessing the mineral resources of the Nation.

30 U.S.C. 201 Federal Coal Leasing Amendments Act of 1976. Provides that no lease sale may be held on Federal lands unless the lands containing the coal deposits have been included in a comprehensive land-use plan. Provides that the Secretary is authorized and directed to conduct a comprehensive exploratory program designed to obtain sufficient data and information to evaluate the extent, location, and potential for developing the known recoverable coal resources within the coal lands. The USGS provides data and information from coal research and field investigations, which are useful to the BLM to meet the requirements of the coal leasing program. Further, the Secretary, (**Sec. 208–1(b)**) through the USGS, "... is authorized to conduct seismic, geophysical, geochemical, or stratigraphic drilling, or to contract for or purchase the results of such exploratory activities from commercial or other sources which may be needed to implement the ..." exploratory program.

30 U.S.C. 641 Following language supports Appropriations language "administer the minerals exploration program." Provides that, "The Secretary of the Interior is hereby authorized and directed, in order to provide for discovery of additional domestic mineral reserves, to establish and maintain a program for exploration by private industry within the United States, territories and possessions for such minerals, excluding organic fuels, as he shall from time to time designate, and to provide Federal financial assistance on a participating basis for that purpose." (P.L. 85–701.)

30 U.S.C. 1026 Section **6** of the Geothermal Steam Act Amendments of 1988. Requires the Secretary of the Interior to (1) maintain a monitoring program for significant thermal features within units of the National Park System and (2) establish a research program to collect and assess data on the geothermal resources within units of the National Park System with significant thermal features in cooperation with the USGS. Section **8** requires the USGS to

conduct a study of the impact of present geothermal development in the vicinity of Yellowstone National Park on the thermal features within the park.

30 U.S.C. 1028 Energy Policy Act of 1992. Directs the Secretary of the Interior, through the USGS and in consultation with the Secretary of Energy, to establish a cooperative government-private sector program with respect to hot dry rock geothermal energy resources on public lands. Supports recurring assessments of the undiscovered oil and gas resources of the United States.

30 U.S.C. 1101, 1121, 1123 Geothermal Energy Research, Development, and Demonstration Act of 1974. Provides that the Department of the Interior is responsible for the evaluation and assessment of the geothermal resource base and the development of exploration technologies. The Chairman, acting through the USGS and other appropriate agencies, shall develop and carry out a plan for the inventorying of all forms of geothermal resources of Federal lands; conduct regional surveys; publish and make available maps, reports, and other documents developed from the surveys; and participate with non-Federal entities in research to develop, improve, and test technologies for the discovery and evaluation of geothermal resources.

30 U.S.C. 1201–1202, 1211 Surface Mining Control and Reclamation Act of 1977, as amended. Establishes the Office of Surface Mining Reclamation and Enforcement (OSM). OSM depends in part upon the USGS for a determination of the probable hydrologic consequences of mining and reclamation operations.

30 U.S.C. 1419 et seq. Deep Seabed Hard Mineral Resources Act of 1980. Provides authorization for conducting a continuing program of ocean research that "shall include the development, acceleration, and expansion, as appropriate, of the studies of the ecological, geological, and physical aspects of the deep seabed in general areas of the ocean where exploration and commercial development are likely to occur …." The USGS, based on expertise developed in regional offshore geologic investigations, provides geological and mineral resource expertise in responding to the requirements of the Act.

30 U.S.C 1601 et seq. National Materials and Minerals Policy, Research and Development Act of 1980. Reemphasizes the responsibility of the Department of the Interior to assess the mineral resources of the Nation.

30 U.S.C. 1901–1902 Methane Hydrate Research and Development Act of 2000. Authorizes appropriations for the establishment of a methane hydrate research and development program within the DOE. The DOE is directed to carry out this program in consultation with the U.S. Navy, USGS, Minerals Management Service, and NSF, through grants, contracts, and cooperative agreements with universities and industrial enterprises. Provides for the study of the use of methane hydrate as a source of energy. Sunsets the methane hydrate research and development program at the end of FY 2005.

Title 31 – Money and Finance

31 U.S.C. 501, 901–903 note Chief Financial Officers (CFO) Act of 1990. Section **501** refers to findings and purpose for the CFO Act. Sections **901–903** provide for establishment of a CFO in each agency, describe the authority and functions of agency CFOs, and provide for the establishment of agency Deputy CFOs.

31 U.S.C. 1535 Economy Act of 1932, as amended. Authorizes any agency to obtain goods and services from and reimburse any other agency if certain criteria are met.

31 U.S.C. 3302 The custody and possession of public money by Federal officials is dealt with in this section. (P.L. 97–258.)

31 U.S.C. 3501 et seq. Budget Accounting and Procedures Act of 1950. Federal Managers' Financial Integrity Act of 1982.

31 U.S.C. 3512 Federal Financial Management Improvement Act of 1996. Provides for the implementation of financial management systems that comply with Federal financial management systems requirements, applicable Federal accounting standards, and the U.S. Government Standard General Ledger at the transaction level.

31 U.S.C. 3701–3720(e) Debt Collection Improvement Act of 1996. Maximizes collections of delinquent debts owed to the Federal Government; describes policies and requirements.

31 U.S.C. 3901–3907 Prompt Payment Act of 1982, as amended. Requires Federal agencies to pay interest penalties on overdue payments to businesses for property or services, and requires the Office of Management and Budget to prescribe regulations to implement provisions of the act and subsequent amendments.

31 U.S.C. 6301–6308 Federal Grant and Cooperative Agreement Act of 1977. Provides criteria for distinguishing between contract, grant, and cooperative agreement relationships and provides discretionary authority to vest title to equipment or other tangible personal property purchased with contract, grant, or cooperative agreement funds in nonprofit research or higher education institutions.

31 U.S.C. 7501 Single Audit Act of 1984, as amended. Provides for audits of Federal awards administered by non-Federal entities.

31 U.S.C. 9701 Independent Office Appropriations Act of 1952; Title 5, Fees and charges for Government services and things of value. Encourages Federal services and products ("things of value") to be as financially self-sustaining as possible. Authorizes costs to be charged for Federal services and products based on the costs to the Government, the value of the service or thing to the recipient, and the public policy or interest served.

Title 33 – Navigation and Navigable Waters

33 U.S.C. 883(a) Great Lakes Shoreline Mapping Act of 1987. Section **3202(a)** requires that the Director of the National Oceanic and Atmospheric Administration "... in consultation with the Director of the United States Geological Survey, shall submit to the Congress a plan for preparing maps of the shoreline of the Great Lakes under section 3203." Section **3203** requires that "... subject to authorization and appropriation of funds, the Director, in consultation with the Director of the United States Geological Survey, shall prepare maps of the shoreline areas of the Great Lakes."

33 U.S.C. 1251–1274, 2901 Federal Water Pollution Control Act Amendments of 1972, Clean Water Act of 1977, and Water Quality Act of 1987, authorize extensive water quality planning, studies, and monitoring under the direction primarily of the EPA. Section **1254** authorizes the Administrator of the EPA to establish national programs for the prevention, reduction, and

elimination of pollution including the establishment of a water quality surveillance system for the purpose of monitoring the quality of the navigable waters and ground waters, utilizing the resources of the USGS and others. The USGS is called upon to participate in many of these activities, partly by the EPA and partly by State agencies in the Federal-State Cooperative Program [now called the Cooperative Water Program]. The Act of 1987 includes water quality work in Chesapeake Bay, the Great Lakes, Estuary and Clean Lakes Programs, and studies of water pollution problems in aquifers. Estuaries and Clean Waters Act of 2000. Amends the Federal Water Pollution and Control Act (commonly known as the Clean Water Act) to include authorization for the following: Title I, Estuary Restoration; Title II, Chesapeake Bay Restoration; Title III, National Estuary Program; Title IV, Long Island Sound Restoration; Title V, Lake Pontchartrain Basin Restoration; Title VI, Alternative Water Sources; Title VII, Clean Lakes; and Title VIII, Tijuana River Valley Estuary and Beach Cleanup. (The Clean Water Act charges States and Tribes with setting specific water-quality criteria appropriate for their waters and for developing pollution control programs to meet the criteria. States and Tribes utilize USGS hydrologic data collection and monitoring to help meet Clean Water Act requirements. The USGS also is a key Federal partner in both the Chesapeake Bay Program and the National Estuary Program.)

33 U.S.C. 1271 Water Resources Development Act of 1992. Establishes a National Contaminated Sediment Task Force, with USGS as a member, to conduct a comprehensive national survey of aquatic sediment quality.

33 U.S.C. 2201 et seq. Water Resources Development Act of 1990. Authorizes a program for planning, construction, and evaluation of measures for fish and wildlife habitat rehabilitation and enhancement; cooperative effort and mutual assistance for use, protection, growth, and development of the Upper Mississippi River system; implementation of a long-term resource monitoring program; and implementation of a computerized inventory and analysis systems.

33 U.S.C. 2701, 2761 Oil Pollution Act of 1990. Section **2761** authorizes the establishment of an Interagency Coordinating Committee on Oil Pollution Research, of which the Department of the Interior is a member, to develop a plan for the implementation of the oil pollution research, development, and demonstration program.

Title 40 – Public Buildings, Property, and Works

40 U.S.C. 471 Federal Property and Administrative Services Act of 1949. Provides for management, utilization, and disposal of government property.

40 U.S.C. 601 Public Buildings Amendment Act of 1972. Prohibits construction of buildings except by the Administrator of General Services.

40 U.S.C. 606 Public Buildings Act of 1959. Establishes criteria for the approval of proposed construction, alteration, acquisition, and lease of public buildings by Congress, over a designated threshold of cost.

40 U.S.C. 1401 Clinger-Cohen Act, formerly known as the Information Technology Management Reform Act of 1996, along with the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.). Provides the opportunity to improve significantly the way the Federal Government acquires and manages information technology. Agencies have the clear authority and responsibility to make measurable improvements in mission performance and service delivery to the public through the

strategic application of information technology. Executive Order 13011, July 16, 1996, provides policy and procedures regarding implementation of this Act.

Title 41 – Judicial Review of Administrative Decisions

41 U.S.C. 251 et seq. Competition in Contracting Act of 1984. Provides direction regarding agency procurements, including support for small businesses, acquisition thresholds regarding soliciting bids, etc.

41 U.S.C. 433 Federal Acquisition Reform Act of 1996. Mandates the continued career development and training of the acquisition workforce.

41 U.S.C. 601–613 Contract Disputes Act of 1978. Describes procedures regarding the resolution of contract disputes.

Title 42 – The Public Health and Welfare

42 U.S.C. 300(f) et seq. Safe Drinking Water Act Amendments of 1996. Authorizes research "... relating to the causes, ... treatment, ... prevention of ... impairments of man resulting directly or indirectly from contaminants in water, or to the provision of a dependably safe supply of drinking water ...." The USGS and EPA have an interagency agreement covering aquifer studies conducted by the USGS relating to sole source aquifers.

42 U.S.C. 2021(b) et seq. Low-Level Radioactive Waste Policy Act of 1980. Requires intra-State or regional arrangements for disposal of low-level radioactive waste by July 1986. The USGS provides geohydrologic research and technology to Federal and State agencies developing plans for low-level waste management. The amending Act of 1985 included approval of seven interstate compacts.

42 U.S.C. 2210(b), 2231 Nuclear Regulatory Commission Authorization Act. Requires the Secretary of Energy to monitor and report to the President and Congress on the viability of the domestic uranium industry. Under a Memorandum of Understanding between the Department of Energy and the Department of the Interior, the USGS provides information on domestic uranium resources to the Energy Information Agency.

42 U.S.C. 4321 et seq. National Environmental Policy Act of 1969, as amended. Requires prior-to-action determination that any major Federal action will not have a significantly adverse effect upon the environment. The USGS is called upon to provide technical review or inputs to resource-related actions proposed by other Federal agencies.

42 U.S.C. 5121, 5132 Disaster Relief Act of 1974, Section **202(a).** States that "The President shall ensure that all appropriate Federal agencies are prepared to issue warnings of disasters to State and local officials." In addition, Section **202(b)** states that "The President shall direct appropriate Federal agencies to provide technical assistance to State and local governments to insure that timely and effective disaster warning is provided."

42 U.S.C. 5845(c) Energy Reorganization Act of 1974. Directs all other Federal agencies to "... (2) ... furnish to the (Nuclear Regulatory) Commission ... such research services ... for the performance of its functions; and (3) consult and cooperate with the Commission on research development matters of mutual interest and provide such information and physical access to its facilities as will assist the Commission in acquiring the expertise necessary to perform its

licensing and related regulatory functions." The USGS conducts geological mapping in areas where nuclear reactor construction is anticipated and conducts investigations of geologic processes that could imperil the safe operation of the reactors or other critical energy facilities.

42 U.S.C. 6217 Energy Act of 2000. Extends energy conservation programs under the Energy Policy and Conservation Act through FY 2003. Specifically for the USGS, Section **604,** "Scientific Inventory of Oil and Gas Reserves," instructs the Secretary of the Interior, in consultation with the Secretaries of Agriculture and Energy, to conduct and update regularly an inventory of all onshore Federal lands. The inventory will identify (1) USGS reserve estimates of the oil and gas resources underlying these lands, (2) restrictions or impediments to development of such resources, and (3) furnish such inventory data to the House Committee on Resources and the Senate Committee on Energy and Natural Resources. Authorizes appropriations as necessary for implementation.

42 U.S.C. 6901 et seq. Resource Conservation and Recovery Act of 1976 and Hazardous and Solid Waste Amendments of 1984. Requires the EPA to promulgate guidelines and regulations for identification and management of solid waste, including disposal. The expertise of the USGS is a present and potential source of assistance to the EPA in defining and predicting the hydrologic effects of waste disposal.

42 U.S.C. 7418, 7401, 7470. Clean Air Act of 1977, as amended. Requires Federal facilities to comply with air quality standards to the same extent as non-governmental entities. Establishes requirements to prevent significant deterioration of air quality and to preserve air quality in national parks, national wilderness areas, national monuments and national seashores.

42 U.S.C. 7701 et seq. Earthquake Hazards Reduction Act of 1977. Sets as a national goal the reduction in the risks of life and property from future earthquakes in the United States through the establishment and maintenance of a balanced earthquake program encompassing prediction and hazard assessment research, seismic monitoring and information dissemination. Subsequent public laws established a National Earthquake Hazards Reduction Program, of which the USGS is a part. P.L. 96–472 authorizes the establishment of a National Earthquake Prediction Evaluation Council. P.L. 101–614 (National Earthquake Hazards Reduction Program Reauthorization Act), P.L. 105–47, and P.L. 106–503 (Earthquake Hazards Reduction Authorization Act of 2000) reauthorize the 1977 Act, repeal some sections, and add new language in some sections including the establishment of an Advanced National Seismic Research and Monitoring System.

42 U.S.C. 8901 et seq. Acid Precipitation Act of 1980. Authorizes an "Acid Precipitation Program and Carbon Dioxide Study," including the establishment of an Acid Precipitation Task Force (of which the Department of the Interior is a member) and a comprehensive 10-year research program. Title IX of the Clean Air Act Amendments of 1990 (P.L. 101–549) calls for continuation of the National Acid Precipitation Assessment Program (NAPAP) established under the Acid Precipitation Act of 1980. The USGS is an active participant in the research program and coordinates interagency monitoring of precipitation chemistry. The USGS National Coal Resources Data System was named by the EPA as the official database for information on coal quality. The EPA, utility companies, and coal mining industries use the database to estimate the amount of air pollution derived from coal combustion. The USGS is a participant in studies of acid precipitation as a result of prior work in this field.

42 U.S.C. 9601 et seq. Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). Establishes a Hazardous Substance Superfund (26 U.S.C. 9507) to

help finance the massive cleanup programs needed at sites that are heavily contaminated with toxic wastes. The USGS is called upon by the EPA and State agencies to investigate and determine the extent of contamination and remedial measures at some of these sites.

42 U.S.C. 10101 et seq. Nuclear Waste Policy Act of 1982. Defines the DOE as lead agency with responsibility for siting, building, and operating high-level radioactive waste repositories. Requires participation by the USGS in a consultative and review role to the DOE. The Nuclear Waste Policy Amendments Act of 1987 (Title V of the Omnibus Budget Reconciliation Act of 1987) identifies Yucca Mountain, NV, as the first site to be studied to ascertain suitability for disposal of high level nuclear waste. The 1987 Act provides that the DOE conduct a survey of potentially suitable sites for a monitored retrievable storage facility.

42 U.S.C. 10301 et seq. Water Resources Development Act of 1986. Amends the Water Resources Research Act of 1984 (P.L. 98–242) by adding a new Title III, "Ogallala Aquifer Research and Development." P.L. 104–147 amends the Water Resources Research Act of 1984 to extend authorization of appropriations through FY 2000. P.L. 106–374 amends the act to extend authorization of appropriations through FY 2005. The Water Resources Research Act of 1984, as amended, provides for water resources research, information transfer, and student training in grants and contract programs that will assist the Nation and the States in augmenting their science and technology to discover practical solutions to water shortage and quality deterioration problems. Establishes 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.

Title 43 – Public Lands

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 geological 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 by and with the advice and consent of the Senate. P.L. 102–285, Sec. 10(a) establishes the official name as the United States Geological Survey.

Particularly: Section **4** of the Continental Scientific Drilling and Exploration Act of 1988. Requires that "The Secretary of the Department of Energy, the Secretary of the Department of the Interior through the United States Geological Survey, and the Director of the National Science Foundation assure an effective, cooperative effort in furtherance of the Continental Scientific Drilling Program of the United States."

And: 43 U.S.C. **31(a–h).** National Geologic Mapping Act of 1992. Establishes in the USGS a National Cooperative Geologic Mapping Program. States "The objectives of the geologic mapping program shall include (1) determining the Nation's geologic framework through systematic development of geologic maps at scales appropriate to the geologic setting and the perceived applications, such maps to be contributed to the national geologic map database; (2) development of a complementary national geophysical-map database, geochemical-map database, and a geochronologic and paleontologic database that provide value-added descriptive and interpretive information to the geologic-map database; (3) application of cost-effective mapping techniques that assemble, produce, translate and disseminate geologic-map information and that render such information of greater application and benefit to the public; and (4) development of public awareness for the role and application of

geologic-map information to the resolution of national issues of land use management." Section **31(g)** requires the Secretary of the Interior to provide biennial reports on the status of the program, progress in developing the national geologic map database, and any recommendations the Secretary may have for legislative or other action to achieve the purposes of the Act to the Committee on Resources of the House of Representatives and the Committee on Energy and Natural Resources of the Senate. The Act was reauthorized in 1997 (P.L. 105–36) and 1999 (P.L. 106–148). **31(i)** Requires the National Academy of Sciences to review and report on the resource research activities of the USGS. **31(j)** FY 1997 Omnibus Appropriations Act. Requires that, beginning in FY 1998 and once every five years thereafter, the National Academy of Sciences shall review and report on the biological research activity of the USGS.

43 U.S.C. 32 Authorizes the Secretary of the Interior to authorize one of the geologists to act as Director of the USGS in his/her absence.

43 U.S.C. 34 States that the scientific employees of the USGS shall be selected by the Director, subject to the approval of the Secretary of the Interior exclusively for their qualifications as professional experts.

43 U.S.C. 36 Authorizes the purchase of professional and scientific books and periodicals needed for statistical purposes by the scientific divisions of the USGS and that the purchases may be paid for out of appropriations made for the USGS. **36(a)** The Director of the USGS is authorized "… to acquire for the United States, by gift or devise, scientific or technical books, manuscripts, maps, and related materials, and to deposit the same in the library of the United States Geological Survey for reference and use as authorized by law." **36(b)** "The Secretary of the Interior may, on behalf of the United States and for the use by the United States Geological Survey in gaging streams and underground water resources, acquire lands by donation or when funds have been appropriated by Congress by purchase or condemnation ...." Following language supports Administrative Provisions language "acquisition of lands for gauging stations and observation wells;": Provides that, "The Secretary of the Interior may, on behalf of the United States and for the use by the Geological Survey in gaging streams and underground water resources, acquire lands by donation or when funds have been appropriated by Congress by purchase or condemnation ...." **36(c)** Acceptance of contributions from public and private sources; cooperation with other agencies in prosecution of projects. States that "In fiscal year 1987 and thereafter the United States Geological Survey is authorized to accept lands, buildings, equipment, and other contributions from public and private sources and to prosecute projects in cooperation with other agencies, Federal, State, or private."

43 U.S.C. 38 Topographic surveys; marking elevations. Provides for the establishment and location of permanent benchmarks used in the making of topographic surveys.

43 U.S.C. 41 Publications and reports; preparation and sale. Provides for the publication of geological and economic maps, illustrating the resources and classification of the lands, and reports upon general and economic geology and paleontology. Provides for the scientific exchange and sale of such published material.

43 U.S.C. 42 et seq. Distribution of maps and atlases, etc. Authorizes and directs the Director of the USGS, upon the approval of the Secretary of the Interior, to distribute topographic and geologic maps and atlases of the United States. The prices and regulations are to be fixed by the Director with the approval of the Secretary. Provides that copies of each map or atlas, not to exceed five hundred, shall be distributed gratuitously among foreign governments, departments of our own Government, literary and scientific associations, and to educational

institutions or libraries. States that "In fiscal year 1984 and thereafter, all receipts from the sale of maps sold or stored by the United States Geological Survey shall be available for map printing and distribution to supplement funds otherwise available, to remain available until expended."

43 U.S.C. 43 Copies to Senators, Representatives and Delegates. Provides that one copy of each map and atlas shall be sent to each Senator, Representative, and Delegate in Congress, if published within his term, and that a second copy be placed at the disposal of each.

43 U.S.C. 44 Sale of transfers or copies of data. Provides that the USGS may furnish copies of maps to any person, concern, institution, State, or foreign government.

43 U.S.C. 45 Production and sale of copies of photographs and records; disposition of receipts. Authorizes the USGS to produce and sell on a reimbursable basis, copies of aerial or other photographs, mosaics, and other official records. Discusses the disposition of the receipts from those sales.

43 U.S.C. 49 Extension of cooperative work to Puerto Rico. Authorizes the making of topographic and geological surveys and conducting investigations relating to mineral and water resources in Puerto Rico by the USGS.

43 U.S.C. 50 Provides that the share of the USGS in any topographic mapping or water resources investigations carried on in cooperation with any State or municipality shall not exceed 50 percent of the cost thereof. **50(b)** Recording of obligations against accounts receivable and crediting of amounts received; work involving cooperation with State, Territory, etc. "Before, on, and after October 18, 1986, in carrying out work involving cooperation with any State, Territory, possession, or political subdivision thereof, the United States Geological Survey may, notwithstanding any other provision of law, record obligations against accounts receivable from any such entities and shall credit amounts received from such entities to this appropriation." (Note U.S.C. states that "this appropriation" refers to USGS annual appropriation as contained in the Department of the Interior and Related Agencies Appropriations Act.) Following language supports Appropriations language "Provided further, that, heretofore and hereafter, in carrying out work involving cooperation with any State, Territory, possession, or political subdivision thereof, the Geological Survey may, notwithstanding any other provisions of law, record obligations against accounts receivable from any such entities and shall credit amounts received from such entities to this appropriation." **50(c)** Payment of costs incidental to utilization of services of volunteers. "Appropriations herein and on and after December 22, 1987, made shall be available for paying costs incidental to the utilization of services contributed by individuals who serve without compensation as volunteers in aid of work of the United States Geological Survey, and … Survey officials may authorize either direct procurement of or reimbursement for expenses incidental to the effective use of volunteers such as, but not limited to, training, transportation, lodging, subsistence, equipment, and supplies: Provided further, That provision for such expenses or services is in accord with volunteer or cooperative agreements made with such individuals, private organizations, educational institutions, or State or local government." **50(d)** Services of students or recent graduates. "The United States Geological Survey may on and after November 19, 1999, contract directly with individuals or indirectly with institutions or nonprofit organizations, without regard to section 5 of title 41, for the temporary or intermittent services of students or recent graduates, who shall be considered employees for the purposes of chapters 57 and 81 of title 5, relating to compensation for travel and work injuries, and chapter 171 of title 28, relating to tort claims, but shall not be considered to be Federal employees for any other purposes."

43 U.S.C. 51 Funds for mapping and investigations considered intragovernmental funds. "Beginning October 1, 1990, and thereafter, funds received from any State, territory, possession, country, international organization, or political subdivision thereof, for topographic, geologic, or water resources mapping or investigations involving cooperation with such an entity shall be considered as intragovernmental funds as defined in the publication titled 'A Glossary of Terms Used in the Federal Budget Process.'"

43 U.S.C. 364 et seq. Board on Geographic Names, 1947. Establishes the Board on Geographic Names to provide for uniformity in geographic nomenclature and orthography throughout the Federal Government and to promulgate in the name of the Board decisions with respect to geographic names and principles of geographic nomenclature and orthography.

43 U.S.C. 371 Reclamation Projects Authorization and Adjustment Act of 1992. Public Law 104–46 amends the 1992 law to add Section **3001,** "Western Water Policy Review Act of 1992." Directs the President to undertake a comprehensive review of Federal activities in the 19 western States that directly or indirectly affect the allocation and use of resources, whether surface or subsurface. The Secretary of the Interior, "... given … responsibilities for … investigations and reviews into ground water resources through the Geologic Survey (now United States Geological Survey) ..." and the Secretary of the Army "have the resources to assist in a comprehensive review ...."

43 U.S.C. 1334 et seq. Outer Continental Shelf (OCS) Lands Act. Authorizes the Secretary of the Interior to prescribe rules and regulations to provide for the prevention of waste and conservation of the natural resources of the OCS; to conduct geological and geophysical explorations of the OCS; directs the Secretary of the Interior to conduct a study of any region in any gas and oil lease sale to obtain information necessary for assessment and management of environmental impacts on human, marine and coastal areas which may be affected by oil and gas development on such areas.

43 U.S.C. 1801 et seq. OCS Lands Act Amendments of 1978. Provides for management of oil and natural gas in the Outer Continental Shelf and for other purposes. The Minerals Management Service is responsible for carrying out all functions in direct support of management of the OCS program. The USGS provides indirect support to the Department's management activities through the basic mission to examine the geological structure, mineral resources, and products of the national domain, which, offshore, includes the EEZ.

Title 44 – Public Printing and Documents

44 U.S.C. 1318 Classes and sizes of publications; report of mineral resources; number of copies; reprints; distribution. Provides for publication, by the Geological Survey, of various reports, including a report of mineral resources of the United States, bulletins and professional papers, and monographs. Also specifies, in some instances, numbers of copies to be printed and the distribution thereof.

44 U.S.C. 1319 Specific appropriations required for monographs and bulletins. Scientific reports known as monographs and bulletins of the USGS may not be published until specific, detailed estimates, and specific appropriations based on these estimates, are made for them.

44 U.S.C. 1320 Distribution of publications to public libraries. The Director of the USGS shall distribute to public libraries that have not already received them, copies of sale publications on

hand at the expiration of 5 years after date of delivery to the Survey document room, excepting a reserve number not to exceed two hundred copies.

44 U.S.C. 1903 Distribution of publications to depositories; notice to Government components; cost of printing and binding. Upon request of the Superintendent of Documents, components of the Government ordering the printing of publications shall either increase or decrease the number of copies of publications furnished for distribution to designated depository libraries and State libraries so that the number of copies delivered to the Superintendent of Documents is equal to the number of libraries on the list.

44 U.S.C. 3105–3107, 3301–3324 Federal Records Act, as amended. Establishes procedures for records management by Federal agencies, including disposal of records.

44 U.S.C. 3501 Paperwork Reduction Act. Establishes polices regarding Federal information, including minimizing the paperwork burden for all persons and organizations.

44 U.S.C. 3504 Government Paperwork Elimination Act of 1998, included as Title XVII of the Omnibus Consolidated and Emergency Supplemental Appropriations Act of 1999. Provides for the development of procedures for use and acceptance of electronic signatures by executive agencies.

Title 50, Appendix – War and National Defense

50 U.S.C. 98 Strategic and Critical Materials Stock Piling Act of 1946 as amended by the Revision Act of 1979. Supports the USGS programs for assessment of domestic minerals, especially for strategic and critical minerals, to complement the Federal mineral stockpile program. Section **98(g)** following language supports Appropriations language "and to conduct inquiries into the economic conditions affecting mining and materials processing industries ... and related purposes as authorized by law and to publish and disseminate data …." Provides for scientific, technologic, and economic investigations concerning the development, mining, preparation, treatment, and utilization of ore and other mineral substances.

Public Laws

P.L. 81–82, P.L. 82–231 Arkansas River Compact and Yellowstone River Compact, respectively. Congress has granted consent to many interstate water compacts. For such compacts, the USGS provides administrative support for the Federal representative, usually appointed by the President. Also, the USGS collects hydrologic data for 25 interstate compacts. The data collection is supported partly by the Federal Program and partly by the Water Resources Investigations Activity.

P.L. 93–322 Special Energy Research and Development Appropriation Act of 1975. Provides funds "for energy research and development activities of certain departments …." The USGS water resources investigations in coal hydrology support that legislation.

P.L. 106–291 FY 2001 Interior and Related Agencies Appropriations Act. Supports Appropriations language "of which ( ) shall be available until September 30, ( ), for the operation and maintenance of facilities and deferred maintenance …."

P.L. 106–498 Klamath Basin Water Supply Enhancement Act of 2000. Authorizes the Bureau of Reclamation to conduct feasibility studies to augment water supplies for the Klamath Project,

Oregon and California, and for other purposes. The Secretary of the Interior is directed to complete ongoing hydrologic surveys in the Klamath River Basin that are currently being conducted by the USGS. Since 1992, USGS scientists have been conducting hydrological and biological research on many of the factors affecting Klamath Basin water resources. These studies include water-quality and quantity issues, endangered species and other fishery issues, and decreased water supply to wetland areas in National Wildlife Refuges.

P.L. 106–541 Water Resources Development Act of 2000. Authorizes appropriations to the Secretary of the Army for the conservation and development of water and related resources to construct various projects for improvements to rivers and harbors of the United States, and for other purposes. Sections of interest to the USGS: Section **403** (33 U.S.C. 652) Upper Mississippi River Basin Sediment and Nutrient Study. Section **509**, CALFED Bay-Delta Program Assistance, California. Section **542**, Lake Champlain Watershed, New York and Vermont. Section **601**, Comprehensive Everglades Restoration Plan. Section **701**, Missouri River Valley, Missouri (Missouri River Valley Improvement Act).

P.L. 107–63 FY 2002 Interior and Related Agencies Appropriations Act.

P.L. 107–347 E-Government Act of 2002. Establishes a broad framework of measures that require using Internet-based information technology to enhance citizen access to Government information and services. Title III, the Federal Information Security Management Act of 2002, lays out a framework for ensuring the effectiveness of information security controls over information resources that support Federal operations and assets and for other purposes.

P.L. 108–7 FY 2003 Interior and Related Agencies Appropriations Act. Consolidated Appropriations Resolution, 2003. Following language included in Administrative Provisions of the USGS part of the public law: "Provided further, that notwithstanding the provisions of the Federal Grant and Cooperative Agreement Act of 1977 (31 U.S.C. 6301–6308), the United States Geological Survey is authorized to continue existing, and hereafter, to enter into new cooperative agreements directed towards a particular cooperator, in support of joint research and data collection activities with Federal, State, and academic partners funded by appropriations herein, including those that provide for space in cooperator facilities."

P.L. 108–108 FY 2004 Interior and Related Agencies Appropriations Act.

P.L. 108–360 Earthquake Hazards Reduction Authorization Act of 2004. Authorizes appropriations through fiscal year 2009 and establishes an Interagency Coordinating Committee on Earthquake Hazards Reduction, of which the USGS is a member.

P.L. 108–447 FY 2005 Consolidated Appropriations Act. Division E contains the Department of the Interior and Related Agencies Appropriations Act, 2005. Following language is included: "of which $1,600,000 shall be available until expended for the deferred maintenance and capital improvement projects that exceed $100,000 in cost…."

P.L. 109–54 Department of the Interior, Environment, and Related Agencies Appropriations Act, 2006.