

2016 ANNUAL REPORT



WEST VIRGINIA

Cover Photos

Top: Thin section of a basalt sample collected near Sugar Grove, WV
polarized light image, 2.5X magnification

Inset: Indian Pipe (*Monotropa uniflora*) without
chlorophyll growing in decaying leaf litter in the
Monongahela National Forest near Alvon, WV. *Geologists
don't always just step on plants!*

*Photos in this report were taken by WVGES personnel
unless noted otherwise.*



Flood damage in Clendenin, WV, June 25, 2016 (Photo by Kara Lofton, West Virginia Public Broadcasting)

Our hearts go out to the victims of the June 23, 2016 flooding when flash floods of historic proportions devastated parts of West Virginia. The forces of nature acting on humanity resulted in 23 deaths, with many people losing their homes, and millions of dollars of property lost or damaged.

EXECUTIVE SUMMARY

Michael E. Hohn, Ph.D., Director and State Geologist

The mission of the West Virginia Geological and Economic Survey (WVGES) is to conduct long-term analysis of the geological resources of the state, especially coal, oil, and gas, and to provide expertise and information to the citizens of West Virginia regarding geological resources and the environment through direct contact, publications, and web-based applications.

To realize this mission, WVGES conducts original geological research on current issues concerning energy, mineral resources, and the environment, and supports the development of effective, efficient state-wide geographic information systems (GIS) through the office of the GIS Coordinator.

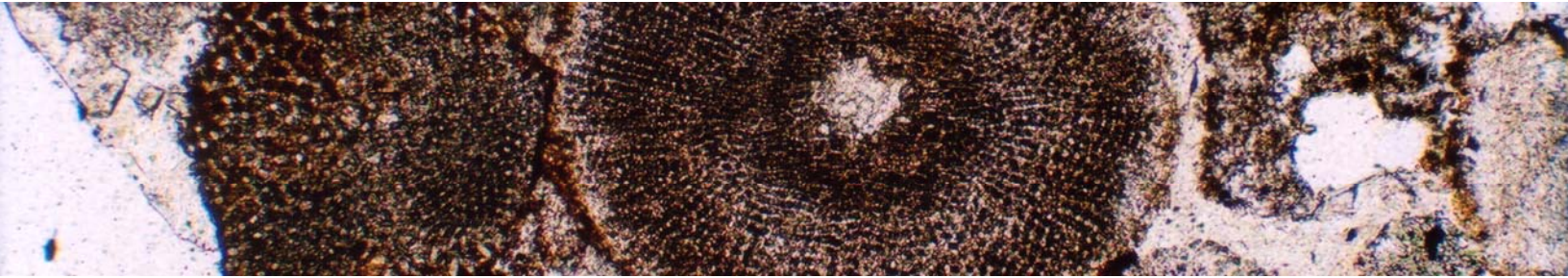
The Year in Review

During Fiscal Year 2016, we at WVGES

- continued working toward the long-term goal to map all significant coal seams in the state and presenting all results on our website in an interactive mapping application;
- continued research on carbon storage and capture, with new emphasis on utilization of carbon dioxide for enhanced recovery in old oil fields;
- completed geological mapping in five 7.5 minute quadrangles and started mapping in four new quadrangles;
- reviewed underground injection control permit applications for the WV Department of Environmental Protection;
- completed a resource assessment of oil and gas in the Utica Shale in the Appalachian region, including both original hydrocarbon-in-place and the technically recoverable resource;
- completed research funded by the U.S. Department of Energy on brine disposal capacity in the region;
- updated maps and spreadsheets of Marcellus Shale permitted and completed wells for download from our website;
- created an interactive map of LiDAR coverage in the state as an aid to preparing proposals for funding from the US Geological Survey and other sources;
- continued support for mineral parcel mapping in the WV Property Tax Division and the www.mapwv.gov website created and hosted by the WV Geographic Information Systems Technical Center at West Virginia University;
- added a full-size model of a juvenile dinosaur, *Allosaurus*, to our geologic mini-museum; and
- achieved operational efficiencies and cost reduction by consolidating offices at WVU and in Charleston to our headquarters at Mont Chateau outside Morgantown.

Public outreach in FY2016:

- **1,499,803** website visits
- **18,880,676** website page views
- Website has more than **3,000** static & dynamic web pages
- **929,397** website files downloaded
- “Visiting Geologist” programs at 5 state parks
- Responded to > **5,100** requests for information
- **55** Facebook posts, reached **9,300** people
- More than **170** resources for science teachers on the website
- **info@geosrv.wvnet.edu** email for public queries



Fossil sea lily fragments in the Dingess Limestone

COAL RESOURCES

Fiscal Year 2016 was a busy and productive year for the Coal Program with staff involved in a wide range of projects, many not necessarily in traditional coal disciplines, but all related to the Mountain State's geology.

Coal Bed Mapping

Coal Program staff have been engaged in a long-term effort to remap the Coal Measures of the state. Most of the state has been addressed, with small areas in the central and eastern areas yet to be completed. Current efforts revolve around updating mined areas, addressing newly acquired industry data, extracting coal bed site-specific data from mine maps to fine tune coal thickness maps, and disseminating coal-chemistry data, especially rare earth elemental (REE) analyses. Maps for more than 80 individual coal beds and splits include structure contours, outcrops, general occurrence (study) area, total bed thickness, total coal thickness, total parting thickness, and mined areas by methodology.

- Work continued on the Coal Bed Mapping Program (CBMP), the first generation of which is nearly finished. In large parts of the Coal Measures, staff are taking a detailed look at data distribution. Thousands of new mine map control points, needed to better define coal thickness and structure, were added to the Oracle database. Staff continue to update coal bed parameter maps and serve all products out via the Survey's website:
<http://www.wvgs.wvnet.edu/www/coal/cbmp/coalims.html>.
- The Coal Program has worked to acquire mine maps from various parties, annually updating mined areas provided by the West Virginia Department of Revenue-Property Tax Division (WVDR-PTD) and the West Virginia Office of Miners Health, Safety and Training (WVOMHST). In addition to documenting mined-areas-by-method, new information such as coal bed thickness and elevation data are incorporated into the various CBMP products. The Survey's coal Mine Information Database System (MIDS) is continually updated and is publicly available at http://www.wvgs.wvnet.edu/www/coal/MIDS_Index.htm.



Mariopteris nervosa, a fossil plant in the Upper Kittanning coal bed

Records available for public access:

- digital records for **171,335** oil and gas wells, accessed online via our "**pipeline**" web application
- scanned records for **53,839** oil and gas wells
- e-logs scanned for **25,281** oil and gas wells
- nearly **1,000** publications & maps on the geology of WV
- **26,178** scanned files of coal field records
- **55,606** scanned mine maps for **75,438** coal mines
- more than **16,000** air photos for WV, 56% of which have been scanned
- **geologic hazards:** landslide maps, mine subsidence, earthquakes/seismicity



Waterfall in the Hampshire Formation, Tucker County

COAL RESOURCES *(continued)*

Coal Bed Mapping *(continued)*

- To enhance mine-map acquisition, the Coal Program provided letters of support and a promise of “employee match” time to WVOMHST for a grant proposal submitted to the Office of Surface Mining (OSM) to collect, scan, and curate mine maps currently unavailable for use.
- In FY2016 staff began high-resolution scanning of older mine maps, most of which are on poor-quality acid paper and are deteriorating. The Survey takes great pride and responsibility in the stewardship and preservation of these priceless resources. Creating digital images of these old maps will preserve the information they provide while enhancing their legibility and enabling their use in digital computing.
- Much effort was spent integrating coal bed chemistry into the Oracle coal stratigraphic database this fiscal year. In addition to traditional coal chemistry data, rare earth element (REE) data were collated and analyzed as part of the increasing interest in producing REEs as a separate product stream from coal mines. The Survey provided samples for REE analyses from its large Coal Sample Library to Battelle Memorial Institute in Ohio and the US Department of Energy’s National Energy Technology Laboratory (NETL) in Morgantown. The analyses provided by Battelle and NETL were added to the Survey’s coal analytical database to enhance the understanding of the distribution of rare earth elements in the state’s Coal Measures. Additional research opportunities involving REEs are being developed.



Geologist measuring strike and dip.

STATEMAP and ElkMap – Geologic Mapping Projects

- Staff continued working on the Survey-sponsored ElkMap project in FY2016. Field work mapping the bedrock geology of the Elkins, Junior, Beverly East, and Beverly West 7.5-minute quadrangles in the central part of the state is complete. Production of the final maps is underway, and the maps are expected to be available in FY2017.
- Coal Program staff completed bedrock geologic maps for the Cuzzart, Bowden, Valley Point, and the West Virginia portion of the Sang Run 7.5-minute quadrangles, as part of the USGS-sponsored STATEMAP program.
- Also under the STATEMAP program, staff initiated geologic mapping on the Parsons, Kingwood, Terra Alta, and the West Virginia portion of the Oakland 7.5-minute quadrangles. Final maps will be delivered to USGS in FY2017.

Sample repositories:

- **28,000+** feet of core, from **160+** oil and gas wells
- Cuttings/samples from **4,570** oil and gas wells
- **more than 1,500** drawers of plant fossil specimens
- **49,300** coal samples, with one or more analyses
- **43,366** sulfur analyses of coals
- **3,169** major element analyses of coals; **1,464** trace element analyses



Jointing and dissolution in the Greenbrier Limestone, Tucker County

COAL RESOURCES *(continued)*

Professional Activities and Appointments

- Program Head Dr. Bascombe M. Blake, Jr. provided several field trip stop descriptions and served as stop leader for the Corridor H (US 48) Field Trip and Guidebook during the 2015 Geological Society of America (GSA) Annual Meeting in Baltimore, Maryland. Section descriptions include the interesting “Dragon’s Tongue” exposure of syndepositional slumping in the Bakerstown coal interval of the Upper Pennsylvanian Conemaugh Group and a discussion of the Mississippian-Pennsylvanian boundary section and the Upper Mississippian Mauch Chunk Formation section exposed along Corridor H in the vicinity of the Mount Storm power plant.
- Dr. Blake peer-reviewed several articles for professional journals on aspects of Middle and Upper Pennsylvanian (Carboniferous) paleobotany and stratigraphy.
- **Paleontology services:** Professional staff are always available to identify rocks, minerals and fossils for interested parties. The Coal Program is fortunate to have a professional paleobotanist/paleontologist on staff to aid in fossil identification. Nonetheless, most of the Program geologists can make routine identifications as needed. Services provided by staff in FY2016 include:
 - Fossil identification for the public;
 - Paleontological impact statements prepared for pipeline companies to meet Federal guidelines for pipeline construction;
 - Peer-review of paleobotanical articles for publication in professional journals;
 - Professional-quality photographs of Dunkard Group fossil footprints for researchers at the New Mexico Museum of Natural History;
 - “Stump the Paleontologist” semiannual show at the Moundsville archeological site.
- Several professional staff teach evening and weekend classes for Fairmont State University, Pierpont Community and Technical College, and West Virginia University. Dr. Blake and Senior Research Geologist Bill Grady hold appointments as Adjunct Professors of Geology at West Virginia University. In addition, Dr. Blake is a Research Associate in Carboniferous Paleobotany at the Natural History Museum of the Smithsonian Institution.
- Staff members serve on various steering committees. Senior Geologist Ken Ashton is currently serving a two-year term as President of the Highway Geology Symposium National Steering Committee, and Dr. Blake is a long-standing member of the Mine Map Steering Committee of the US Office of Surface Mining.



COAL RESOURCES *(continued)*

Professional Activities and Appointments *(continued)*

- Ken Ashton attended the Annual Highway Geology Symposium in September at no cost to the State.
- Dr. Blake is a gubernatorial appointee serving on the WV Department of Environmental Protection (WVDEP) Environmental Quality Board.

Visiting Geologist Program

Ken Ashton gave talks on West Virginia geology along with nature walks, discussing various aspects of the local geology, at Blackwater Falls, North Bend, Watoga, Cacapon, and Pipestem State Parks.

Service Activities and Outreach

- One of the Coal Program's main responsibilities is to disseminate information to all parties with interest in or questions about West Virginia's Coal Measures and other rocks. The largest number of queries is related to mining and mine subsidence, followed by tax-related coal resource questions. Other commonly asked questions include aspects of general geology, paleontology, karst, non-fuel minerals, landslides, and other subjects such as, "Is this a meteorite?" or, "Where can I find gold in West Virginia?"
- Professional staff geologists routinely speak to classes and other social groups either on-site at the Survey or at schools and venues. Discussions include many aspects of rocks, minerals, fossils, and topics requested by the individual groups.



Geologists inspect the Reynolds Limestone, Grant County

- Staff routinely present poster displays and talks on West Virginia geology and presentations at professional regional and national meetings, such as the American Association of Petroleum Geologists and the Geological Society of America, and at general venues such as the annual Gem and Mineral Show in Morgantown (October), Monongalia County Schools Career Day (April), and the I-68 rest area for Tourism Week (May).

COAL RESOURCES *(continued)*

Service Activities and Outreach *(continued)*



- Interagency cooperation is an important aspect of much of the Coal Program's work. Program staff cooperated with WVOMHST, WVDR-PTD, WV Division of Highways, and WVDEP by providing information, data, and cogent discussions on aspects of Carboniferous stratigraphy, coal geology, and general geology. Professional staff provided information and stratigraphic guidance to a consultant drilling test borings for the Morgantown Utility Board's planned water storage reservoir on Cobun Creek near Morgantown. Staff helped log cores and provided stratigraphic information on the distribution of the Upper Freeport coal bed that shallowly underlies the proposed reservoir.

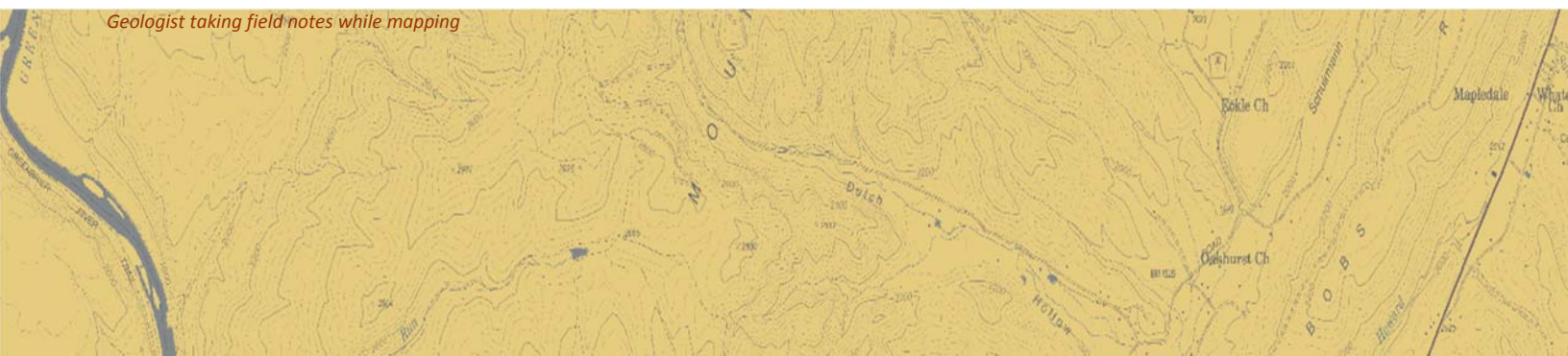
- ESIC (Earth Science Information Center) manager Paul Liston provided expertise and products on aerial photographs, topographic features, geographic place names, various "corporate" boundaries, etc. ESIC maintains a large collection of legacy aerial photographs of several vintages and makes these photographs available to the public. These invaluable and irreplaceable photographs are being scanned at 1200 dpi and copies are available to all interested parties. Currently there is no plan to serve these scans online due to the very large size of the individual digital images.

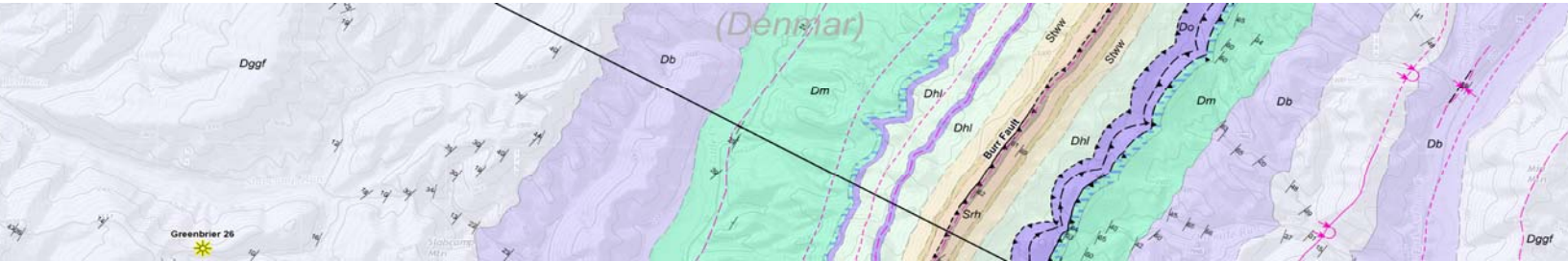
- The Coal Program is continuing its long-standing cooperative coal studies with the US Geological Survey's National Coal Resources Data System (NCRDS) program, providing data, GIS shapefiles, and expertise on an as-needed basis.

Closure of the Coal Analytical Laboratory

To increase efficiency and save costs, WVGES closed its coal petrography laboratory in Brooks Hall at West Virginia University, allowing the space to revert to the Geology and Geography Department for new faculty. While the closure of the coal analytical facility resulted in the loss of laboratory capabilities for WVGES, moving a geologist from WVU to Mont Chateau resulted in increased efficiency in agency office operations.

Geologist taking field notes while mapping





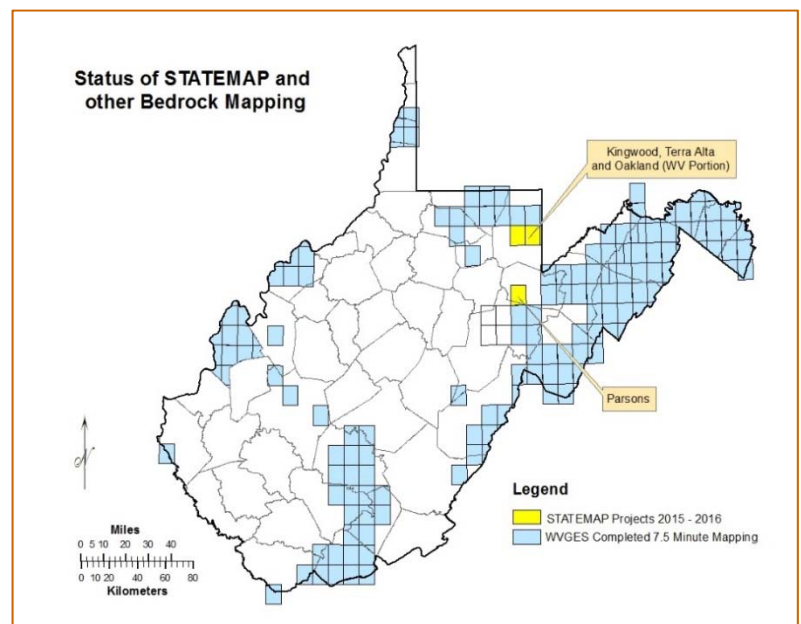
Portion of the bedrock geology map for the Alvon, WV quadrangle

GEOSCIENCE PROGRAM

Geologic Mapping

Geologic Mapping at WVGES consists of the direct acquisition of new geological information through field reconnaissance and the conversion of new and existing geological information from hard copy (paper, mylar, etc.) to digital format.

- Acquisition of new geological data is carried out under the auspices of the STATEMAP program funded jointly by the United States Geological Survey (USGS) and WVGES. During the summer and fall of 2015 and spring of 2016, field work was conducted on five 7.5-minute topographic quadrangles in central and eastern West Virginia (Alvon, Bowden, Valley Point, Cuzzart, and Sang Run (WV portion)). Published as WVGES Open File Reports, the data are currently available as paper maps, PDF files, and geographic information system (GIS) geodatabases. In September 2015, the STATEMAP Advisory Committee, composed of individuals from industry, government, and academia, met to evaluate new potential map areas within WV for the upcoming 2016 field season. In November 2015, a multi-project proposal was successfully submitted to the USGS and mapping of the Parsons, Kingwood, Terra Alta, and Oakland (WV portion) quadrangles was partially funded. Fieldwork on new STATEMAP projects began in June 2016.
- The 2009 Statewide Geologic Mapping Plan is being updated for 2016. This Plan is updated every five to ten years to reflect changes in mapping priorities. The Statewide Mapping Panel met in 2015 and 2016 to discuss updates to the Plan, and the document itself will be completed in 2016 (Fiscal Year 2017).



Current and completed STATEMAP projects

Uses for Digital Geologic Maps:

- Planning and construction of highways, bridges, etc.
- Economic development, land-use planning
- Resource assessment and management
- Environmental studies; geologic hazards; karst areas
- Coal resources and mining; natural gas reserves



Contorted bedding above a fault surface in the Devonian Millboro Shale near Neola, WV

GEOSCIENCE PROGRAM (*continued*)

Environmental Geoscience and Geochemistry

Environmental and geochemical work at WVGES deals primarily with the evaluation of geologic site characteristics for Underground Injection Control (UIC) permits for injection of fluids into subsurface rock formations; the assembly of a database of selected metals content of the State's rock formations; and responding to inquiries regarding geology, surface water, groundwater, geologic hazards, and bedrock chemistry.

Seismic Monitoring

Six stations (not counting the permanent station at WVGES) remaining at the end of the Transportable Project continue to operate as part of the Central and Eastern United States Network operated by the Incorporated Research Institutions for Seismology with funding from the National Science Foundation. Funding for this network is expected to continue through 2017. Twenty-four hours of seismic records can be viewed by interactively selecting individual stations on the WVGES website at:

http://www.wvgs.wvnet.edu/www/earthquakes/WV_seismic_stations.html

- Under West Virginia State Code §22-11-11, the Director of WVGES furnishes consultation to the State's Department of Environmental Protection (WVDEP) concerning UIC draft permits. During FY2016, WVGES provided input regarding geologic conditions at injection sites for 36 Class V UIC draft permits.

- Geochemical analyses for 16 rock samples collected during STATEMAP mapping reconnaissance were added to the existing stratigraphic geochemical database, bringing the number of samples up to 1,082 and

covering West Virginia rock units ranging in age from Precambrian through the Pennsylvanian. The database is available as a GIS layer that can be combined with or superimposed on other maps of West Virginia for use in environmental and economic assessments of the near-surface bedrock of a particular geographic location.

Quadrangles Mapped:

- 103 quadrangles digitally mapped at 1:24,000- scale
- Interpretative cross-sections included

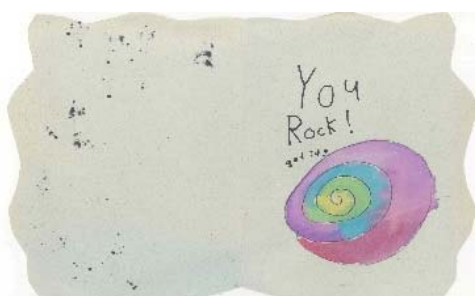
GEOSCIENCE PROGRAM *(continued)*

Outreach Activities

- Geoscience personnel participated in internet webinars and attended local and regional meetings featuring topics including geological hazards, induced seismicity, and environmental issues related to oil and gas exploration and development, mine pool groundwater resources, protection of groundwater resources in karst regions, hazard mitigation, and disaster preparedness.
- Two posters related to bedrock mapping were presented at the national 2015 Geological Society of America Meeting in Baltimore, MD: *Using Fossils to Aid in Bedrock Mapping: Examples From West Virginia* and *Bedrock Geology of the New River Gorge National River, West Virginia: Mapping Ten Quadrangles in the New River Gorge for the National Park Service*.

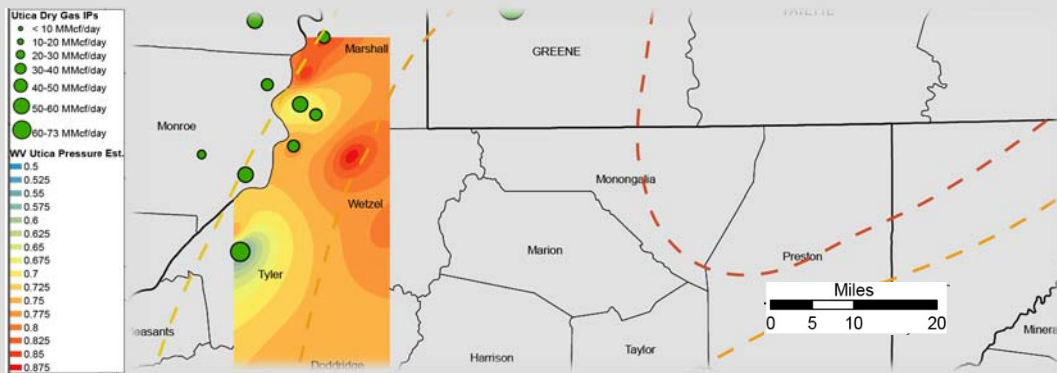
Geoscience Education Outreach

Geoscience Education Outreach operates a completely digital program providing K-12 teachers with products designed for their classroom use. More than 170 resources for educators are available on the WVGES GeoEducation website at <http://www.wvgs.wvnet.edu/www/geoduc/geoeduc.htm>.



Thank-you card from Erica Mark's class in Pocahontas County

- A member of the Geoscience staff gave an oral presentation related to geological hazards at the 2015 Technical Forum for Geohazards Impacting Transportation in Appalachia in Huntington, WV: *Conceptual Framework for Development of a Multiple Geohazard GIS for West Virginia*.
- Staff conducted a field geology mentorship for a senior student from Pocahontas County High School. The student assisted in bedrock mapping and sample collection in Pocahontas and Greenbrier counties, WV as part of a STATEMAP project (Alvon).
- In September 2015, Survey geologists conducted a fossil identification workshop at the Grave Creek Mound Museum Complex in Moundsville, WV.
- Geoscience personnel taught evening classes in Geological Hazards and Historical Geology at Fairmont State University.



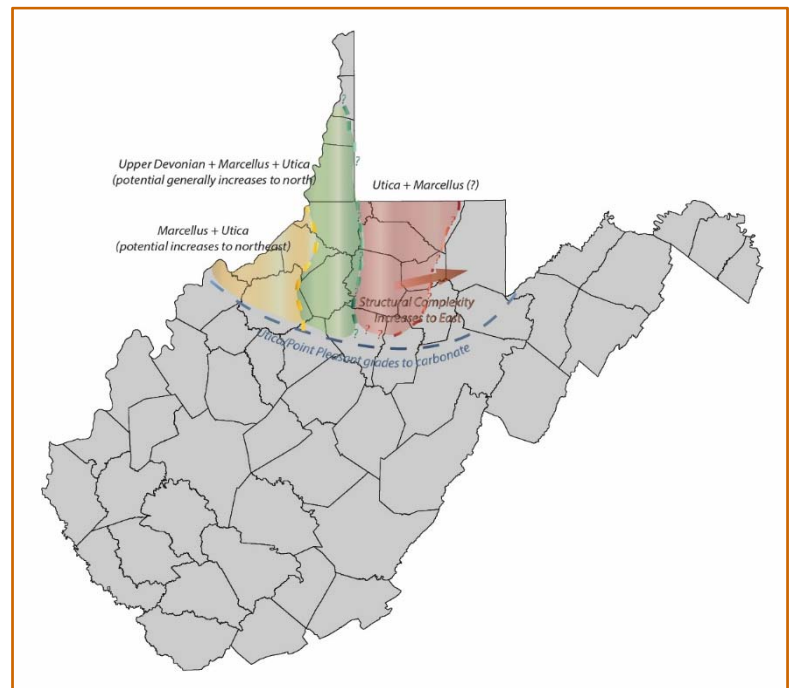
Utica Shale gas pressure map

OIL and GAS PROGRAM

Appalachian shale gas: not just the Marcellus anymore

As technologies advance in the drilling and development of shale gas reservoirs, several additional plays have emerged as viable targets for development, often within a similar geographic footprint. Foremost among these is the older (and deeper) Utica Shale.

- Despite its name, the Utica shale play is neither Utica nor shale. The actual drilling target is the Middle Ordovician Point Pleasant Formation, a subsurface unit previously unrecognized in West Virginia. The Point Pleasant consists of alternating thin beds of limestone and organic shale. The thin beds and lack of permeability created an exceptional trapping mechanism for gas generated as the reservoir matured.
- During FY2016, drilling permits were issued for fourteen Utica/Point Pleasant wells, and one additional well was completed. This well, drilled by Noble Energy in Marshall County, reported an initial production (IP) volume of 39.1 million cubic feet (MMcf) of gas per day.
- The high initial production rates may be related to the extremely high reservoir pressures in the Utica/Point Pleasant, as reported by operators to WVDEP. A reservoir is considered normally pressured if the pressure gradient (a measure of change in reservoir pressure with unit of depth) measures around 0.43 psi/ft. Reservoir pressures in Utica/Point Pleasant wells in northern West Virginia commonly exceed 0.7 psi/ft and are considered to be highly over-pressured.



Upper Devonian, Marcellus, and Utica/Point Pleasant "Fairway"

Oil and Gas Numbers for FY2016:

- 14 permitted Utica/Point Pleasant wells
- 1 Utica/Point Pleasant well completed
- 11 horizontal wells permitted in "Upper Devonian"
- 116 horizontal wells were completed in the Marcellus
- 313 Marcellus drilling permits issued
- 1 "Upper Devonian" well and 1 Rogersville well completed

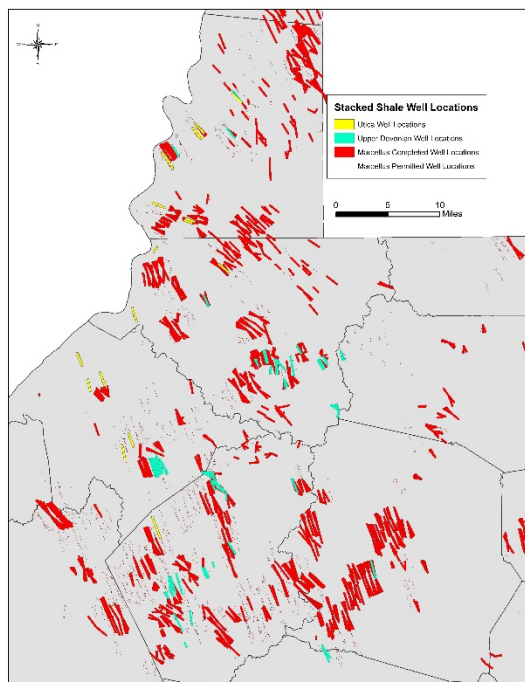


Portion of an Appalachian Basin graphic from the RPSEA Project

OIL and GAS PROGRAM *(continued)*

Another shale gas play receiving increased attention is the “Upper Devonian.” This shale play is actually a group of individual Devonian shale units, including the Burket/Geneseo, Rhinestreet, and/or Middlesex shales. During FY2016, eleven horizontal drilling permits were issued for “Upper Devonian” shale wells, and one well was completed. With the advancement of drilling technology in the Appalachian basin, it is now possible to design a drilling pad to include horizontal wells in one or more of these “stacked” units.

While the Marcellus, Utica, and Upper Devonian shale gas plays share a similar geographic footprint, an additional shale unit is being tested in southern West Virginia. This unit, the Cambrian Rogersville Shale, is encountered only in the deep subsurface of West Virginia. At a target vertical depth of nearly 20,000 feet, the Rogersville is a deeper target than any of the other shale plays. During FY2015, Cabot Oil and Gas completed a vertical test to the Rogersville in Putnam County. This well produced just over 233 MMcf during the 2015 reporting period.



Horizontal well laterals with stacked shale potential in northern WV

These new and emerging shale plays hold great potential, but the Marcellus Shale continues to be the main driver of gas production trends in West Virginia. During FY2016, 116 horizontal wells were completed in the Marcellus, and 313 drilling permits were issued. This number reflects the overall decrease in gas production across the basin; during FY2015 208 Marcellus wells were completed and 615 permits were issued.

Utica Resource Assessment

From 2011 to 2014, WVGES participated in a multi-state research consortium to study the Utica Shale. The results from the study were released to the public in July of 2015. Accompanying this release was an update of two resource assessments conducted by WVGES geoscientists—a volumetric analysis of original-gas-in-place and a probabilistic assessment of technically recoverable resources. The estimates derived from the

duo of assessments is staggering: nearly 3,200 trillion cubic feet (Tcf) of gas-in-place with 889 Tcf technically recoverable. These numbers suggest drilling activity observed in the Utica is only the beginning. The report and associated data can be found at www.wvgs.wvnet.edu/utica.

Oil and Gas Online interactive mapping applications:

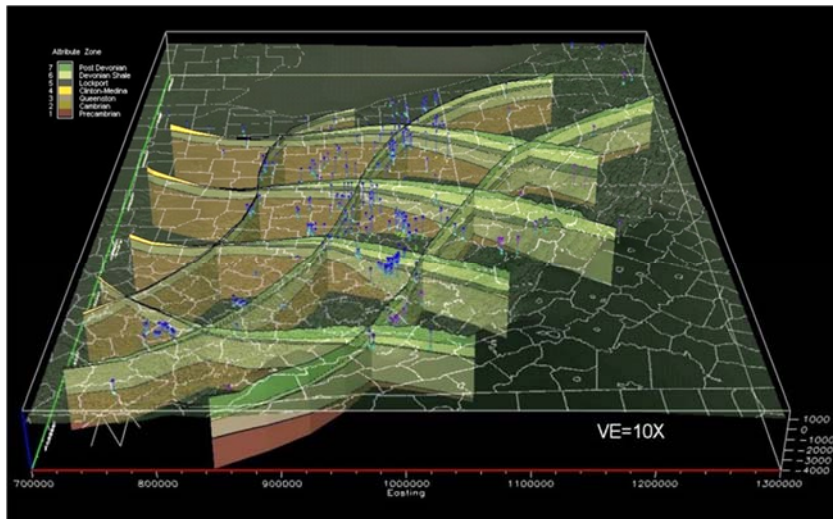
- **WV Oil and Natural Gas Wells** (more than 163,000 wells, mapped with basic header information per well)
- **Geology of the Marcellus Shale** (5,900+ completions & permits; horizontal & vertical wells; thickness, structure)
- **Utica Shale Play** (5 states, 2 formations, cross-sections, thickness & structure maps)
- **Appalachian Basin Tight Gas Plays** (2 states, 6 plays, 160,000 wells, cross-sections, thickness & structure maps)

OIL and GAS PROGRAM *(continued)*

RPSEA Brine Disposal

This project, which concluded in October of 2015, characterized brine disposal frameworks throughout the tri-state area of West Virginia, Ohio, and Pennsylvania. The project was funded by the U.S. Department of Energy's RPSEA (Research Partnerships to Secure Energy for America) Program. The final report for the project, which was administered by Battelle Memorial Institute, can be accessed at <http://www.rpsea.org/files/4828>. Some key findings from the research include:

- The northern Appalachian Basin has an estimated 2.8 billion barrels brine disposal capacity in existing depleted oil and gas fields.
- The storage capacity in abandoned oil and gas fields equates to 150 years of disposal at an annual injection rate of ~17.6 million barrels.
- Deep saline disposal capacity is estimated to be 480 billion barrels.
- Approximately 10 barrels of brine were disposed per million cubic feet of gas produced.
- Injection simulations conducted over multiple horizons, including the Big Injun, Weir, and Clinton/Medina (Tuscarora) siliciclastic units suggest relatively small zones of influence adjacent to wells.



Fence diagram across the Appalachian Basin created for the RPSEA Brine Disposal Project

MRCSP

One of the longest-running research projects in the Oil and Gas Program is the Midwest Regional Carbon Sequestration Partnership, or MRCSP. The project focuses on the most efficient ways to inject, store, and/or utilize carbon dioxide in the subsurface across a wide geographic area. The ten-state MRCSP region spans from the New Jersey coast to the Appalachian and Michigan basins, which provides numerous potential sites for Carbon Capture Utilization and Storage (CCUS) opportunities. During FY2016, geoscientists in the Oil and Gas Program continued to collect reservoir data in support of a ranking of opportunities for enhanced oil recovery via CO₂ floods. Sources of data are widely disparate, and many reservoir parameters, such as permeability, are critically underrepresented in the regional database. In an effort to increase data density across the region, a regression equation to estimate API oil gravity was developed, and data derived from the Geoscience Program's geothermal database were added to the MRCSP regional dataset. This increased data density enables inclusion of more fields into the ranking, which will highlight fields with high storage capacities located in proximity to CO₂ point sources.

More online interactive mapping applications:

- **Coal Bed Mapping Project** (80 coal seams: elevation, thickness, overburden, mining types)
- **WV Geothermal Map** (temperature at depth, depth to temperature, structure maps, power infrastructure)
- **Topographic Map Index** (locations of 495 topographic maps covering the state)
- **Broadband Mapping Project** (statewide broadband coverage maps by service type & speed)

OIL and GAS PROGRAM *(continued)*

Wellbore Integrity

Funded by the U.S. Department of Energy and administered by the Battelle Memorial Institute, this project focuses on obtaining information related to the type, diameter, and installation characteristics of casing strings used in wells that inject or withdraw carbon dioxide. The Indian Creek field in Kanawha County, which produces naturally-occurring CO₂ along with methane, provides a natural analog for this research. In support of this research, Battelle has developed a testing kit to measure sustained casing buildup over time. This testing kit, which can be installed by an operator without shutting down a well, produces data used to determine cement permeability, location of leaks, and the nature of leakage processes.

Other Awards

The Oil and Gas Program received an extension of an educational grant from IHS in the form of a seven-seat networked license for Kingdom® subsurface mapping software. This software package enables our geoscientists to compile and correlate geophysical well logs and create a variety of industry-level map products. The three-year, multi-seat license has a value of more than \$400,000.



The WVGES Oil and Gas Program assisted the West Virginia Land Trust in assessing the impact of horizontal well development beneath this conservation easement. As a result, no virgin timber was disturbed.

Service and Outreach Highlight: West Virginia Land Trust

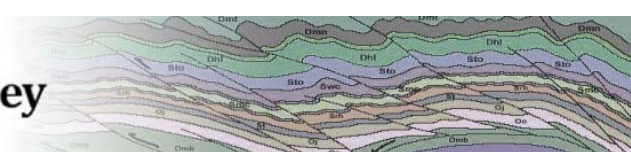
In addition to funded research projects and analysis of drilling activity and trends, geoscientists in the Oil and Gas Program take great pride in responding to individual requests for information from the people of West Virginia. These requests for service originate in many sectors, from the general public to industry to academia and sister agencies. This high level of personal service can be difficult to achieve during busy times, but the act of helping others provides immeasurable satisfaction.

An especially gratifying partnership exists with the West Virginia Land Trust, a non-profit organization dedicated to preserving “special places” across the state via conservation easements. Mineral rights are commonly severed from many of the surface tracts the Land Trust considers for acquisition, so the Oil and Gas Program provides reports detailing assessment of risk for future surface destruction from oil and gas drilling. One candidate tract assessed in FY2016 contains stands of virgin timber; horizontal legs from six Marcellus wells underlie the property. This relationship highlights just one way the decreased surface impact of horizontal drilling helps preserve natural landscapes across the state.

13

Ongoing/Recent Funded Cooperative Projects:

- Carbon capture utilization and storage
- Utica Shale Play study
- Subsurface brine disposal in WV
- Mapping National Park Service lands in WV
- Data preservation of well cores and samples
- National Coal Resources Data System



INFORMATION SERVICES PROGRAM

The Information Services Program is responsible for publications, the agency's website and feedback presence, maintaining the agency's network infrastructure and desktop operations, developing interactive mapping applications, and programming applications in support of other programs' projects.

Public-Access Systems and Services:

- **Website:** The following were added to the Survey's website, www.wvges.org, during FY2016:
 - A generalized stratigraphic chart for WV ([Map-29A](#))
 - 2014 oil and gas well [production data](#)
 - 13 items on the [Geoscience Education page](#)
 - [Scientific Posters](#) with abstracts:
 - [Bedrock Geology of the New River Gorge National River, West Virginia: Mapping Ten Quadrangles in the New River Gorge for the National Park Service](#), Paula J. Hunt, Gayle H. McColloch, Jane S. McColloch, Bascombe M. Blake, Jr., Robert L. Peck, and David L. Matchen; Geological Society of America (GSA) Annual Meeting, November 2015
 - [Using Fossils to Aid in Bedrock Mapping: Examples from West Virginia](#), Ronald R. McDowell, Paula J. Hunt, Mary Sue Burns, Goldie McClure; GSA Annual Meeting, November 2015
 - [Evaluation of Potential Stacked Shale-Gas Reservoirs Across Northern and North-Central West Virginia](#), Jessica P. Moore, Susan E. Pool, Philip A. Dinterman, J. Eric Lewis, and Ray Boswell; Eastern Section of the American Association of Petroleum Geologists (AAPG) Meeting, September 2015
- **Research Reports:**
 - Agency staff members Philip Dinterman, Eric Lewis, and Jessica Moore contributed to the [Development of Subsurface Brine Disposal Framework in the Northern Appalachian Basin](#)
 - [2014 Marcellus Shale Production and Utica Information](#) -- by Philip Dinterman

New Publications in FY2016

OF-1501 – Surficial Geologic Map of the New River Gorge National River, West Virginia, by M.K. Yates and J. S. Kite

OF-1502 – Bedrock Geologic Map of the Bowden 7.5' Quadrangle, West Virginia, by J.S. Chapman, J.W. Perkins, R.J. Johnson, B.L. Nugent, J.Q. Britton, G.W. Daft, Jr., and Digital Cartography by S. E. Gooding

OF-1503 – Bedrock Geologic Map of the Alvon 7.5' Quadrangle, West Virginia, by P.J. Hunt, R.R. McDowell, G.J. McClure, M.S. Burns, and Digital Cartography by S.E. Gooding

OF-1504 – Bedrock Geology of the Valley Point, Cuzzart, and Sang Run (WV Portion) 7.5' Quadrangles, West Virginia, by G.H. McColloch, J.S. McColloch, S.E. Gooding, and Digital Cartography by S.E. Gooding

OF-1404 – Bedrock Geologic Map of Lake Sherwood and the WV Portion of Mountain Grove 7.5' Quadrangles, WV – VA, by P.J. Hunt, R.R. McDowell, M.S. Burns, J.M. Sutton, and Digital Cartography by S.E. Gooding

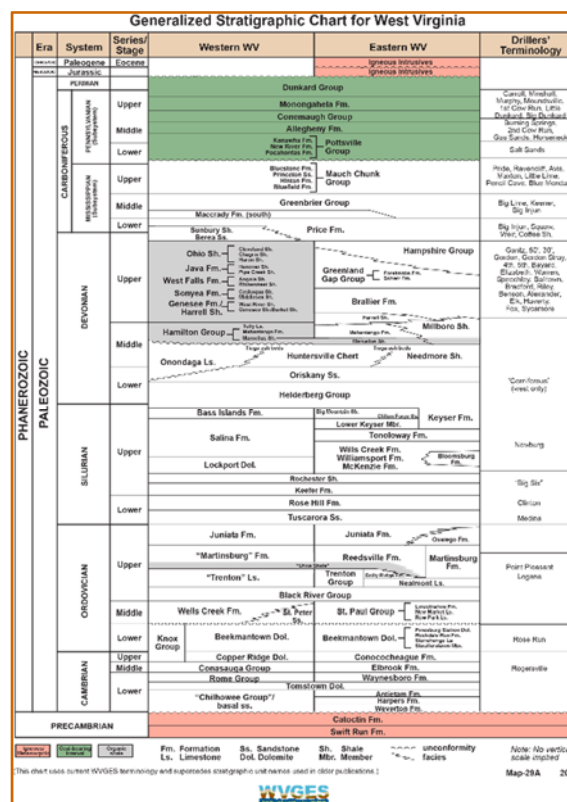
Most active web pages in FY2016:

- **"pipeline"** access to oil and gas well data – 17,310,319 page views (95% of all access)
- **oil and gas well data search** – 455,466 page views
- **MIDS coal mine map viewer** – 147,932 page views
- **coal bed mapping** – 141,855 page views

INFORMATION SERVICES PROGRAM (continued)

Public-Access Systems and Services (continued):

- **Website pages** updated during the fiscal year include [Geothermal Energy](#), [Earthquakes/Seismicity](#), the oil and gas well “[pipeline](#)” service, and “[Pipeline-Plus.](#)”
- **Web-based services** updated during the fiscal year include a program to create a nearly dynamic daily update of Excel spreadsheets for [Marcellus shale wells](#) and for [horizontal wells](#).
- **Web-based interactive mapping** applications updated during FY2016 include:
 - [Geology of the Marcellus Shale](#), [Utica Shale Play](#), and [Broadband Mapping Program](#).
 - [GIS REST](#) (Representational State Transfer) services were added for the Utica Shale, coal mining, the Coal Bed Mapping Project, and Broadband.
 - Other interactive mapping applications on the WVGES website include: [All \(Coal\) Mining Map](#) and [Coal Bed Mapping Project](#), [WV Oil and Natural Gas Wells](#), [Appalachian Basin Tight Gas Plays](#), [Regional Geology of the Ordovician Trenton-Black River Formations](#), [WV Geothermal Map](#), and the [Topographic Map Index](#).
- **Page-size maps** in PDF format updated during FY2016 include:
 - [Marcellus Shale](#), [Oil and Gas Wells in WV](#) with separate inset maps showing the locations of gas, oil, and combination wells, and [Earthquake Epicenters of WV](#).
- **Facebook page:** total posts – 55, total reach – 9,300 people, total clicks on the posts – 953, total “Likes”/Comments/Shares of the posts - 275
- **Updates** made to the “[pipeline](#)” online access system to oil and gas well data reflect additions made to the well database.



Generalized Stratigraphic Chart for West Virginia (Map 29A)

More active web pages in FY2016:

- **Marcellus & other Devonian shales** – 43,447 page views
- **Utica Shale** – 39,699 page views
- **WV geology page** – 38,554 page views
- **Broadband and broadband maps** – 15,250 page views



Survey geologist integrating a Marcellus Shale cross section into a map

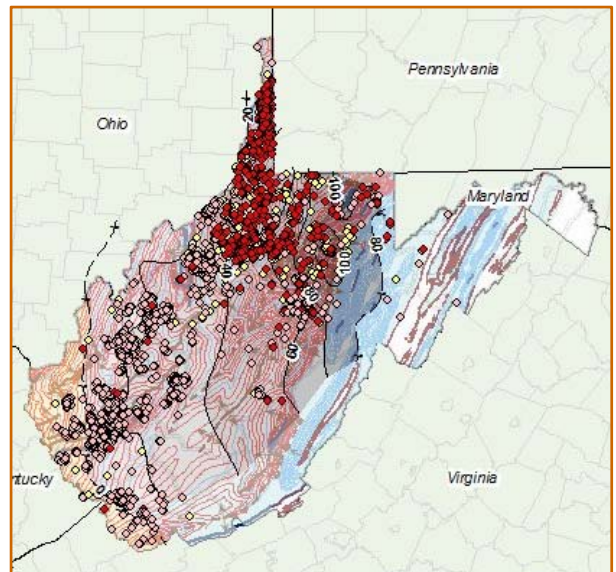
INFORMATION SERVICES PROGRAM *(continued)*

Publications:

- Publications updated during FY2016 include:
 - [DDS-5](#) – **WVGES Oil and Gas Well Data for West Virginia**
 - [Map-29A](#) – **Generalized Stratigraphic Chart for West Virginia**

IT Support and Professional Development:

- Program staff expanded programming to support the development and enhancement of project applications, databases, interactive mapping applications, and management of network infrastructure. Staff also migrated and consolidated server functionality to upgrade WVGES servers to a newer operating system.
- The Survey purchased a new storage server, and Program staff set up, installed, and migrated all central file storage and backup to the new server, as the operating system on the previous unit was past end-of-life and was not upgradeable. An additional hardware purchase included a new CD/DVD publishing unit to replace the old, nonfunctioning unit.
- Program staff presented papers and posters at the Utica Shale workshop and the biennial state GIS Conference, and co-authored a poster presented at the 2015 Eastern Section-AAPG meeting.
- Geologist/GIS Programmer-Analyst Susan Pool is co-authoring a manuscript and associated GIS webpage on the lithostratigraphy of Upper and Middle Devonian organic shales in West Virginia, an extension of her earlier work on the Marcellus Shale in the state.



Interactive Marcellus Shale map

API Number	County Code	County Name	Pmt Number	Suffix	Status	Pmt Issued Date	Operator at Completion	Surface Owner Name	Mineral Owner	Company Number	Well Name	7.5' Quad Name	Surface Loc UTM	Surface Loc UTMN	Surface Loc Longitude	Surface Loc Latitude	Btm Hole Flag	Btm Hole Loc UTM	Btm Hole Loc UTMN	Btm Hole Loc Longitude	Btm Hole Loc Latitude	Elevation (ft)	Datum	Deepest Target Fm on Pmt	Target Fm TVD on Pmt	Target Fm TVD on Pmt	Target Fm Est Pressure (psi)	Spud Date	Completion Date	TVD on Cmpl Rpt	
4700102885	1	Barbour	2885	Original Location	Completed	07/27/2007	Seneca-Upshur Petroleum Corp.	Henry G & Barbara J Watson	Seneca Upshur Petroleum Inc		2	Belington	58841.6	4318182.7	-79.97391	39.008158							2128	Ground Level	Marcellus Shale	7742	10182		8/13/2007	7/16/2008	7890
4700102981	1	Barbour	2981	Deviated Original Location	Completed	08/01/2008	EXCO - North Coast Energy Eastern	Robert R Jones	North Coast Energy Eastern Inc		3HN	Audra	57745.6	4322196.4	-80.108525	39.045433	As Proposed	576504.4	4322716	-80.115876	39.050171	1595	Ground Level	Marcellus Shale	7742	10182		8/30/2008	12/24/2008	7462	
4700102985	1	Barbour	2985	Original Location	Completed	12/05/2008	Dominion Exploration & Production	Edward C Frey	Ira McBe		33306	Phillipi	584560.5	4339891.9	-80.020647	39.20418							1297	Ground Level	Marcellus Shale	7470			7/30/2009	8/28/2009	7560
4700102994	1	Barbour	2994	Original Location	Completed	11/06/2008	Petroleum Development Corp.	City of Phillipi	Badger Coal Co		7	Phillipi	584961.2	4337811.5	-80.016268	39.185397							1377	Ground Level	Marcellus Shale	7200			1/17/2009	2/20/2009	7754
4700103013	1	Barbour	3013	Original Location	Completed	01/30/2009	Petroleum Development Corp.	Josanne V Smith	Michael Stein Trustee for Linda Wald		4	Brownston	571562.9	4342851.6	-80.170851	39.232015							1371	Ground Level	Marcellus Shale	7500			7/15/2009	11/18/2009	7908
4700103028	1	Barbour	3028	Original Location	Completed	05/01/2009	Petroledge Energy, LLC	Stella B Farenine	Rubin Resources		PR-1	Belington	588785.2	4325965.1	-79.962109	39.070071							1916	Ground Level	Marcellus Shale	7650			8/11/2009	1/5/2010	7816
4700103072	1	Barbour	3072	Original Location	Completed	09/21/2009	Dominion Exploration & Production	Gary McCauley	U S Steel Company		33914	Phillipi	584001.6	4337832.3	-80.027374	39.185678							1296	Ground Level	Marcellus Shale	7380			10/8/2009	11/21/2009	7515
4700103104	1	Barbour	3104	Deviated Worked Over	Completed	09/14/2012	ATO Energy, Inc.	A M & Jean W Ward et al	Aquilla C & Trudy D Ward		2241	Brownston	567783.4	4332310.5	-80.215984	39.137341							1284	Ground Level	Marcellus Shale	7100	9850		1/14/2011	10/4/2012	7590
4700103133	1	Barbour	3133	Deviated Worked Over	Completed	09/13/2012	ATO Energy, Inc.	A M & Jean W Ward	A C & T D Ward		2245H	Brownston	567788.7	4332312.5	-80.215632	39.137359							1284	Ground Level	Marcellus Shale				12/2/2011	10/1/2012	7666
4700103141	1	Barbour	3141	Original Location	Completed	07/29/2010	Petroleum Development Corp.	Clarice Thornburg & Rebecca	Rebecca McNeil		1M	Nestorville	592177	4343990.7	-79.931889	39.240333							1579	Ground Level	Oriskany Sandstone	8700			9/24/2010	11/12/2010	7953
4700103147	1	Barbour	3147	Deviated Original Location	Completed	06/23/2010	CNX Gas Co. LLC (North)	Mary Morris Wander	Merle J McVicker et al		405833	PHLIA6	584777.3	4338515.9	-80.018309	39.191762	As Proposed	583764.2	4340479.1	-80.029795	39.209548	1324	Ground Level	Marcellus Shale	7460	14710		1/14/2011	8/14/2011	7466	
4700103149	1	Barbour	3149	Deviated Original Location	Completed	06/23/2010	CNX Gas Co. LLC (North)	Mary Morris Wander	M McVicker/US Steel J Phillips/ Mc		405837	PHLIC6	584780.1	4338504.4	-80.018277	39.191658	As Proposed	583942.3	4339768.6	-80.027821	39.203129	1327	Ground Level	Marcellus Shale	7500	13000		3/17/2011	8/13/2011	7462	
4700103152	1	Barbour	3152	Original Location	Completed	07/19/2010	Denise Petroleum Corp.	Judy Hodgkinson	Judy Hodgkinson		1	Nestorville	592042.6	4335271.9	-79.934633	39.161796							1640	Ground Level	Marcellus Shale	7500			3/21/2011	4/27/2011	7640
4700103220	1	Barbour	3220	Deviated Drilled Deeper	Completed	02/20/2013	CNX Gas Co. LLC (North)	Randall McCauley	The Daywood Foundation/P C Sjoberg		PHL346H5	Phillipi	585270.4	4341385.2	-80.012237	39.217565	As Drilled	586225.5	4340334	-80.00131	39.208	1520	Ground Level	Marcellus Shale	7820	18000		10/25/2011	11/2/2013	7843	
4700103221	1	Barbour	3221	Deviated Drilled Deeper	Completed	02/11/2013	CNX Gas Co. LLC (North)	Randall McCauley	J L Morrell/The Daywood Foundation		PHL338H5	Phillipi	585265	4341382.4	-80.0123	39.217574	As Drilled	587116.7	4339182.9	-79.991137	39.19754	1520	Ground Level	Marcellus Shale	7820	18800		10/8/2011	10/30/2013	7843	

[Downloadable spreadsheet of Marcellus Shale well completions](#)

INFORMATION SERVICES PROGRAM (continued)

IT Support and Professional Development (continued):

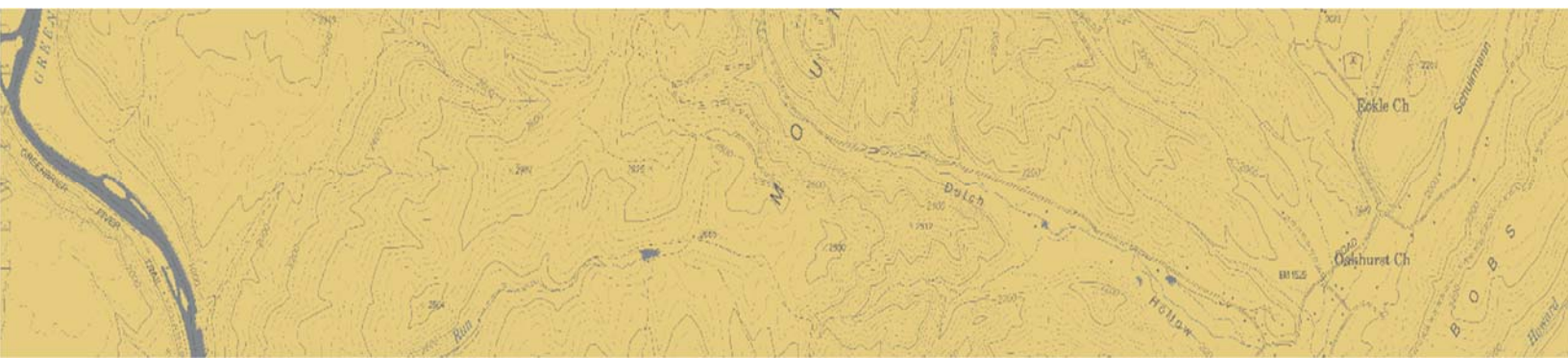
- Staff prepared customized data analysis files requested by the WV Department of Environmental Protection Division of Air Quality for their use in the preparation of reports to federal agencies.
- Program staff serve on the following committees: the State Information Technology Council (representing the Department of Commerce), USGS Community of Use – Geologic Mapping and Hazards Technical Committee, WV GIS Steering Committee, and Monongalia County Planning Commission – GIS Advisory Group.
- Staff designed and staffed a display booth at the biennial WV GIS Conference, and created a 4-page **Earth Day** promotion on the Survey's website and Facebook page.



A model of a juvenile *Allosaurus fragilis* dinosaur was added to the WVGES mini-museum this year.

WVGES Mini-Museum:

The Survey's mini-museum in our office lobby acquired a new full-body, fleshed-out model of a juvenile *Allosaurus fragilis* dinosaur from the Morrison Formation (Jurassic Period) of central Utah. This model joins other dinosaur skeleton models, a large fossil fish head, a replica of the fossil sloth *Megalonyx jeffersoni* (the State fossil), fossil tree trunks, and other rocks, minerals, and small fossils in the museum. The mini-museum contains more than 475 individual specimens on display and is open to the public during our office hours, from 8:00 am until 5:00 pm Monday through Friday (except on State holidays).





GEOGRAPHIC INFORMATION SYSTEM PROGRAM

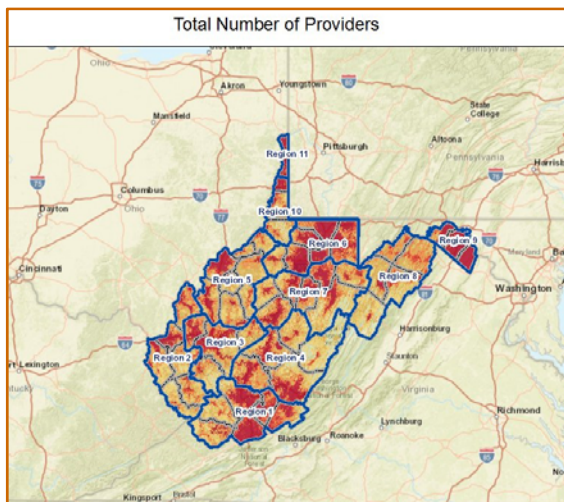
This program is responsible for planning, organizing, coordinating, and delivering high level Geographic Information System (GIS) advice to agencies in state government, and is headed by the State GIS Coordinator, Tony Simental. The office was moved from Charleston to Morgantown in FY2016 due to budgetary constraints. The program continues to make headway in a number of critical areas: promoting data sharing between agencies; providing technical assistance to state, county, and local governments and the public; and fostering efficient and effective use of the state's geospatial capabilities.

Mineral Lands Mapping Program

The GIS Coordinator continued to provide general administrative oversight of the Mineral Lands Mapping Program in collaboration with the Survey's Coal Bed Mapping Project and the State Department of Revenue, Property Tax Division's Mineral Parcels Mapping Project. During the year, the GIS Coordinator assisted in the development of the Property Tax Division's Statewide GIS Cadastral platform.

Support Services

The Coordinator provided support to the Division of Homeland Security, Department of Environmental Protection, the Water Development Authority (WDA), Infrastructure and Jobs Development Council (IJDC), the National Guard, the WV Intelligence Fusion Center - Hazard Mitigation Section, and other state, regional and local agencies in their search for GIS contract services, funding, and GIS application development.



Interactive broadband availability map

Data Exchange

Data exchange protocols to enhance data sharing and exchange among state and local agencies established in the previous years have proven to be successful. The protocol began the inclusion of state and locally produced datasets in the GIS Clearinghouse maintained by the WV GIS Technical Center in Morgantown.

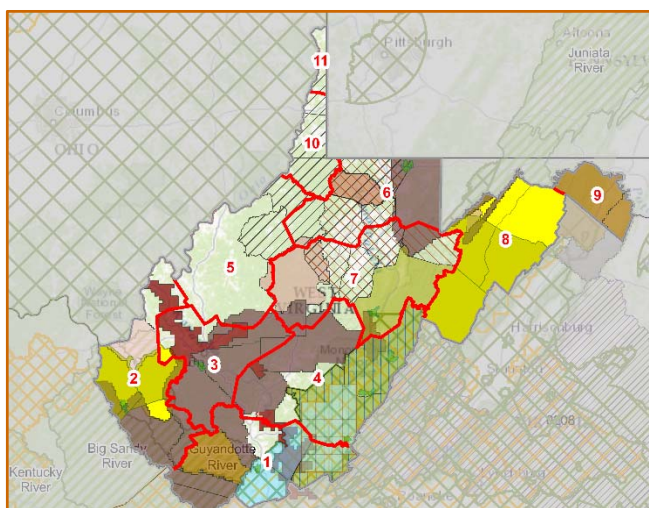
WVGES Inter-agency Cooperation during FY2016 (State agencies):

- WVDEP – Office of Oil and Gas, Division of Air Quality, Environmental Quality Board
- WV Dept. of Revenue – Tax Commission, Property Tax Division
- WV Department of Commerce – Office of Miners Health, Safety and Training, Division of Energy
- WV Department of Commerce – Development Office, Division of Natural Resources, Division of Forestry
- WV Division of Highways
- WV Division of Homeland Security & Emergency Management; National Guard
- WV Water Development Authority
- WV Department of Education and the Arts – Division of Culture and History

GEOGRAPHIC INFORMATION SYSTEM PROGRAM *(continued)*

Meetings and Workshops

The State GIS Coordinator participated in the National Emergency Number Association's GIS Data Stewardship for Next Generation 911 Workgroup. The documents developed by this group will outline the development of a nationwide address spatial data infrastructure. The GIS Coordinator also led workshops with stakeholders to find ways to acquire statewide LiDAR data under the United States Geological Survey's (USGS) 3D Elevation Program (3DEP). Survey staff created an interactive map for planning a [WV proposal for the USGS 3DEP](#) (LiDAR acquisition) initiative.



Interactive 3DEP LiDAR acquisition map

GIS workshops developed and presented in collaboration with the WV Association of Geospatial Professionals, WV GIS Technical Center, WV Department of Revenue - Property Tax Division, County Assessors, and 911 directors continue to be popular among GIS professionals. These workshops are designed to inform, train, and advise county and local government officials who have GIS programs in the latest technology and at the same time educate those officials who have not embraced GIS technology in their own organizations. The workshops emphasize inter-agency collaboration and are given at different locations throughout the state.

The GIS Coordinator also attended sessions and made presentations at the mid-year National States Geographic Information Council (NSGIC) in Annapolis, MD, and the West Virginia Association of Geospatial Professionals 2016 GIS Conference held in Morgantown, WV. The Coordinator participated in sessions of the Geographical Information Systems Certification Institute Board of Directors, NSGIC Leadership Group, WV Information Technology Council, WV Broadband Deployment Council, E911 Council, WV Association of Professional Surveyors, and NSGIC's Next Generation 911 and Broadband workgroups.

Additional WVGES Cooperators for FY2016:

- U.S. Geological Survey
- U.S. Department of Energy
- U.S. Office of Surface Mining
- National Park Service
- IHS
- U.S. Energy Information Administration
- Southern Methodist University, Cornell University
- West Virginia University
- Battelle Memorial Institute
- Texas Bureau of Economic Geology

WV GIS TECHNICAL CENTER

The West Virginia GIS Technical Center (WVGISTC), located in the WVU Department of Geology and Geography, provides focus, direction, statewide coordination, and leadership to users of geographic information systems (GIS), digital mapping and remote sensing within the State of West Virginia. The Center was established by Executive Order 4-93 to provide coordination and technical support in the development and operation of geographic information systems (GIS) for the State.

Web portals

The WVGISTC maintains two major web portals to distribute spatial data and information in the State. The **WV GIS Clearinghouse** (<http://wvgis.wvu.edu>) catalogs over 300 unique datasets valued at more than \$50 million dollars, while **MapWV.gov** (<http://mapwv.gov>) provides a public gateway to online mapping resources in the Mountain State. Web usage statistics reveal that over the last four quarters, the Clearinghouse site hosted a total of 170,150 visits by 60,869 unique visitors, for an average of 464 visitors a day. Its companion site, MapWV.gov, hosted 223,276 unique visitors for an average of 1,229 visits per day.

Geospatial Data Layers

To reduce the duplication of costly data development efforts among organizations, the WVGISTC plays a crucial role in not only serving critical spatial data to state users but also in updating and integrating local geospatial data within state and national geospatial databases. These framework data layers are utilized by almost all state agencies, communities, and the general public for emergency response, risk assessment, economic development, energy resource exploitation and management, transportation, natural resources, community planning, tax assessments, and health studies to name a few. This past year the Center focused on the development of the geospatial data layers listed in Table 1 to enhance the State's Spatial Data Infrastructure. The continued development and publishing of GIS layers through a state clearinghouse node hosted by the WVGISTC supports the Mineral Lands Mapping Program and other vital programs in the State that depend on current and accurate base mapping layers.

Table 1: Statewide Base Layer Data Services provided by Center

DATA LAYER	PURPOSE
Aerial Imagery	Integrated hi-resolution aerial imagery from 21 counties into a statewide leaf-off imagery web map service
Parcels	Integrated parcel data from 15 counties into statewide parcel web layer for WV Flood Tool
Addresses	Integrated addressing data for 25 counties into statewide addressing layers for address matching services and online applications
Public Lands	Updated county and state public lands for the national Protected Areas Database
Hydrography	Updated stream geometries for three watersheds that changed due to mining or new roads for the National Hydrography Dataset
Other Layers	Updated statewide recreational trails and advisory flood heights for Approximate Zone A flood hazard areas

WV GIS TECHNICAL CENTER *(continued)*

GIS Applications

The WVGISTC also supports multiple state agencies with e-governance applications to meet their regulatory, communication, and information exchange goals (Table 2). The very successful WV Flood Tool (www.mapwv.gov/flood) provides floodplain managers, insurance agents, developers, real estate agents, local planners and citizens with an effective means by which to make informed decisions about the degree of flood risk for a specific area or property. Importantly, the WV Flood Tool is recognized by the WV Division of Homeland Security and Emergency Management (WV DHSEM) and FEMA as the authoritative source for advisory flood height determinations in the State; it was widely used during the June 2016 floods, which was reflected in the doubling of the web application usage during this period. The WVGISTC also provides technical assistance to state agencies for their online mapping applications, including the State Historic Preservation Office (SHPO), WV Division of Natural Resources (WV DNR), and WV Department of Transportation (WV DOT). The WVGISTC also supported federal initiatives for energy carbon sequestration (<http://www.natcarbviewer.org>) and terrestrial biosphere carbon (www.carbonscapes.org).

Table 2: Statewide Map Applications provided by Center

APPLICATION	PURPOSE	AGENCY SUPPORTED
WV Flood Tool	Make flood hazard determinations for flood insurance (www.mapwv.gov/flood)	WV DHSEM
SHPO Map Viewer	Conduct Cultural Resource Section 106 reviews (www.mapwv.gov/SHPO)	SHPO
Statewide Addressing & Mapping System (SAMS)	Update address sites and road centerlines required for emergency response (www.mapwv.gov/address)	WV DHSEM, E-911 Address Coordinators
Hunting and Fishing	Search and identify hunting and fishing destinations (http://www.mapwv.gov/huntfish)	WV DNR
WV Trail Inventory	View publicly accessible recreational trails in the State (http://www.mapwv.gov/trails)	WV DOT
Highway Plans Locator	View archival highway plans (http://www.mapwv.gov/dotplans)	WV DOT
Conservation Planning Interagency Coordination Tool	Determine conservation planning measures for endangered species in support of environmental site evaluations for West Virginia landowners (www.mapwv.gov/ICT)	WV DNR, NRCS

WV State GIS Data Clearinghouse

Keyword Search

Browse By Category

LIST ALL DATA HOLDINGS (CLICK ON SEARCH BI

Search

Options

State Web Services

Other WV State Data Sources

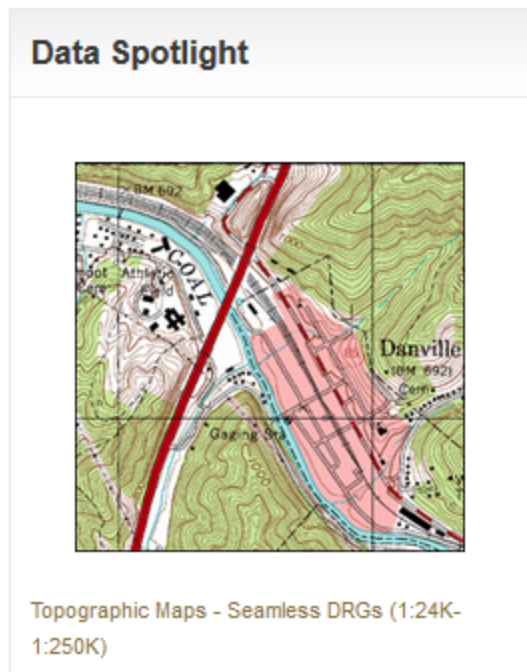
Surrounding State Data Sources

Search form on the Tech Center's website

WV GIS TECHNICAL CENTER *(continued)*

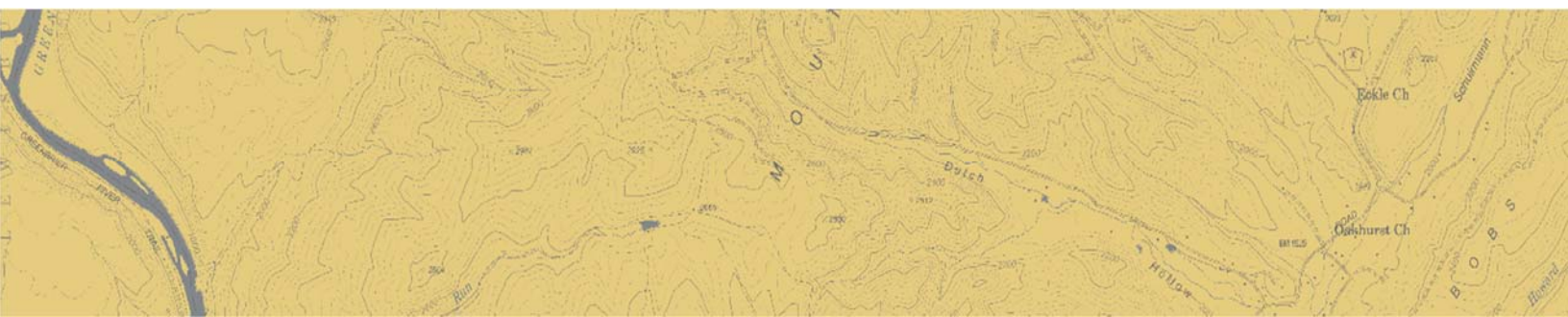
Services

This past year the WVGISTC continued to assist the WV geospatial community of users with advisory services, training programs, and the implementation of new mapping standards. These services are coordinated with the WV Office of GIS Coordination and WV Association of Geospatial Professionals. During the devastating June 2016 floods, the WVGISTC provided technical mapping services at the request of the WV National Guard for emergency response.



Sample of data available for download from the website

- WVGISTC was the lead organizer of the 2016 WV GIS Conference, which was attended by 150 state and county representatives and included presentations from technical and policy leaders.
- Other educational services included organizing and hosting six instructor-led GIS training courses and presenting on the Center's geospatial initiatives and applications at the 2016 WV GIS Conference, WV Floodplain Management Association Conference, Eastern Panhandle GIS Users Group Meeting, WVDOT GIS User Day Meeting, WVDOT/MPO/FHWA Transportation Planning Conference, and mid-year meeting of the WV Association of Geospatial Professionals.
- WVGISTC was instrumental in drafting the new WV189CSR5 "Tax Map Sales" Legislative Rule, which was approved during the 2016 legislative session.



Principal Staff Directory and Points of Contact
June 2016

Director and State Geologist	<i>Michael E. Hohn, Ph.D.</i>
GIS Program and Statewide GIS Coordinator	<i>Tony Simental</i>
Coal Resources	<i>Bascombe M. Blake, Jr., Ph.D.</i>
Geoscience and Mapping	<i>Ronald R. McDowell, Ph.D.</i>
Oil and Gas Resources	<i>Jessica Pierson Moore</i>
Water Issues and Geologic Hazards	<i>Jane S. McColloch</i>
Information Services and Publications	<i>Mary C. Behling</i>
Earth Science Information Center	<i>Paul R. Liston</i>
Public Service	<i>Kenneth C. Ashton</i>



West Virginia Geological and Economic Survey

Mont Chateau Research Center

1 Mont Chateau Road • Morgantown, WV 26508-8079

304.594.2331 • fax: 304.594.2575

www.wvgs.wvnet.edu • info@geosrv.wvnet.edu

39°39'30" N, 79°50'57" W

Hours: 8 a.m. to 5 p.m. Monday through Friday (*closed holidays*)

