

Annual Progress Report to the WV Joint Legislative Oversight Commission on State Water Resources

**West Virginia Department of Environmental Protection
Water Use Section
December 2017**

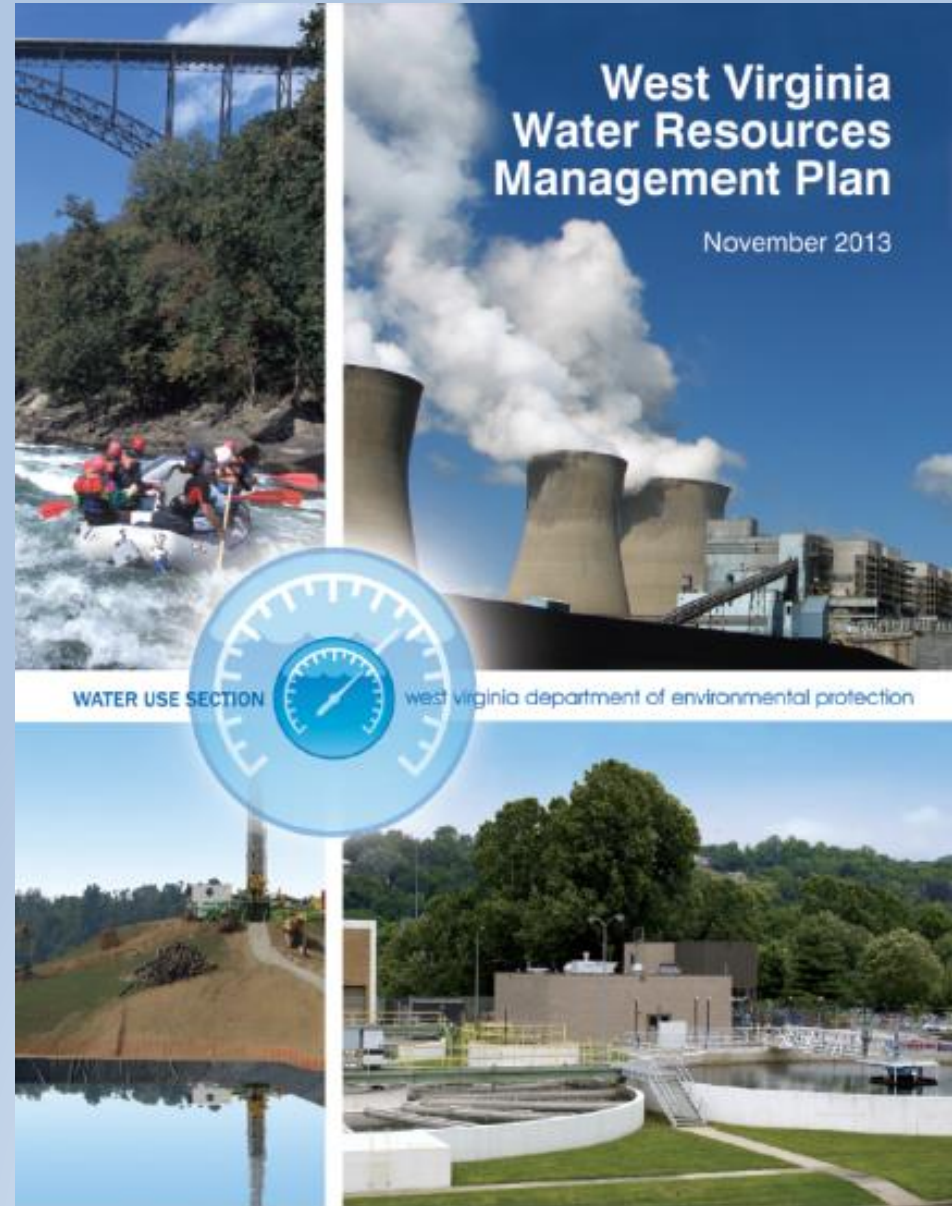


By:
Brian A. Carr, P.G.
Program Manager
Water Use Section



Plan History

- The Act was originally passed in 2004.
- Senate Bill 641 renamed it the Water Resources Protection and Management Act in 2008.
- The Water Use Section was created in 2008 to accomplish the Act's requirements.
- The WV Water Resources Management Plan was submitted on November 22, 2013.
- The Plan was adopted as part of Senate Bill 373 in 2014.
- An addendum to the Plan will be submitted in 2020 containing general updates.
- An new addendum will be submitted on a five year cycle thereafter.





Why collect water use data?

The Act recognized:

The need for the protection and conservation of our state's water resources.

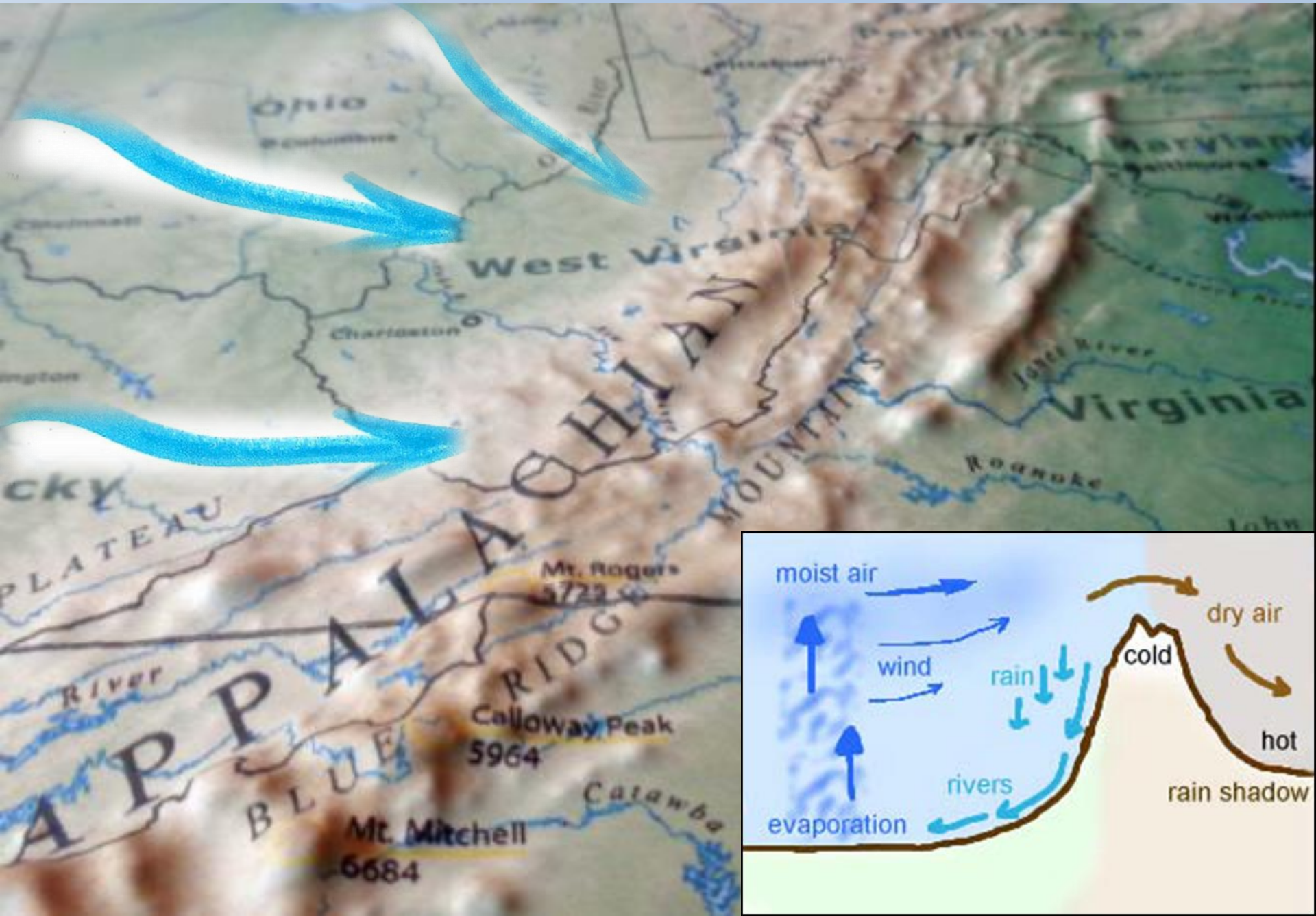
& That

A comprehensive assessment of the availability and use of our states water would benefit the citizens of West Virginia.

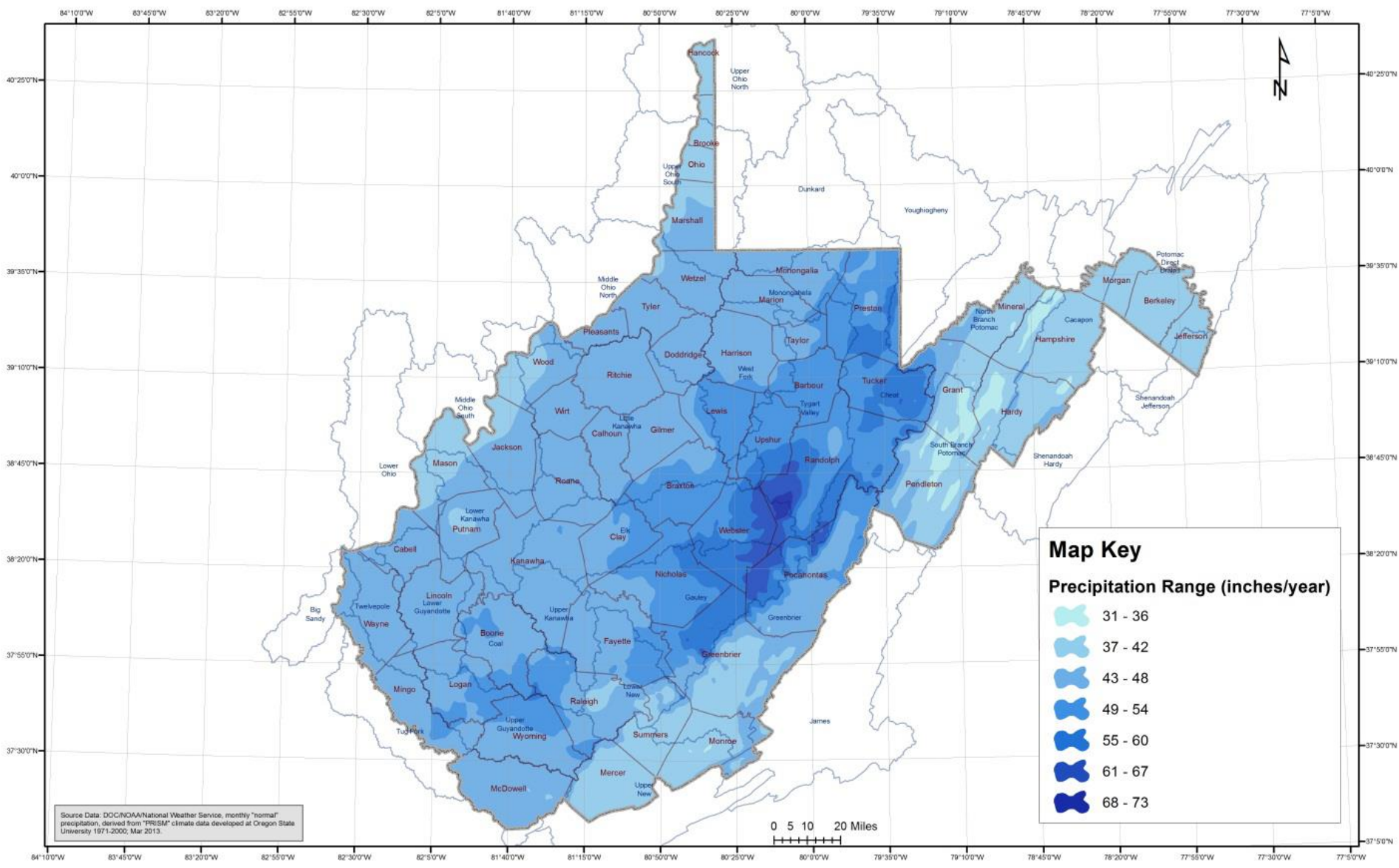
West Virginia Water Facts

- We average 44 inches of precipitation per year
- Record rain event in Rockport WV, July of 1889 was 19.5” over 2 hour
 - (Last June’s event was 10” in 8 hours)
- Maximum storage of lakes - 1 trillion gallons
- Estimated mine pool storage - 1.5 trillion gallons
- Large Quantity Users withdraw approximately 828 billion gallons each year
- We consume 8.5% of the water we withdraw (based on national coefficient’s)
- We have nearly 55 thousand stream miles in our state

The Rain Shadow and the Appalachian Mountains



Average Annual Precipitation

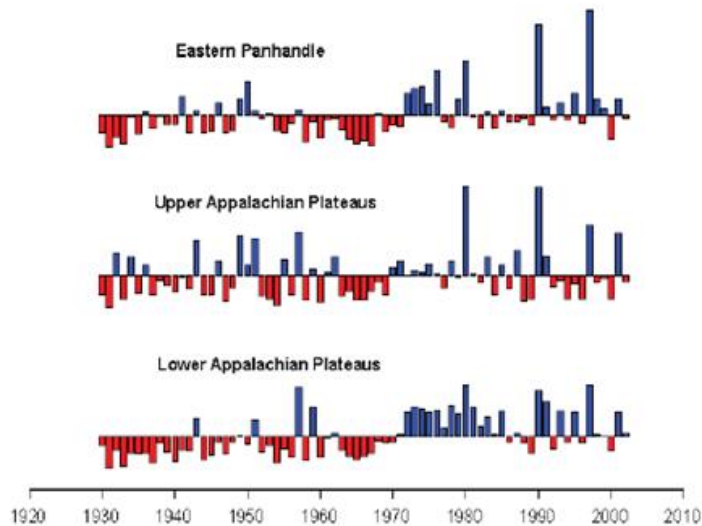


Source Data: DDC/NOAA/National Weather Service, monthly "normal" precipitation, derived from "PRISM" climate data developed at Oregon State University 1971-2000, Mar 2013.

0 5 10 20 Miles

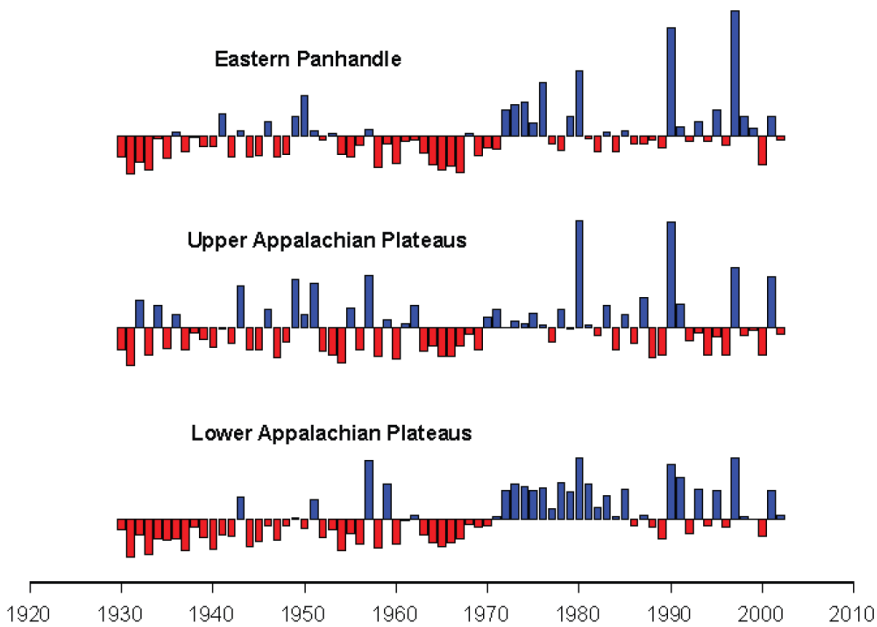
In cooperation with the West Virginia Department of Environmental Protection,
Division of Water and Waste Management

Low-Flow Analysis and Selected Flow Statistics Representative of 1930–2002 for Streamflow-Gaging Stations In or Near West Virginia



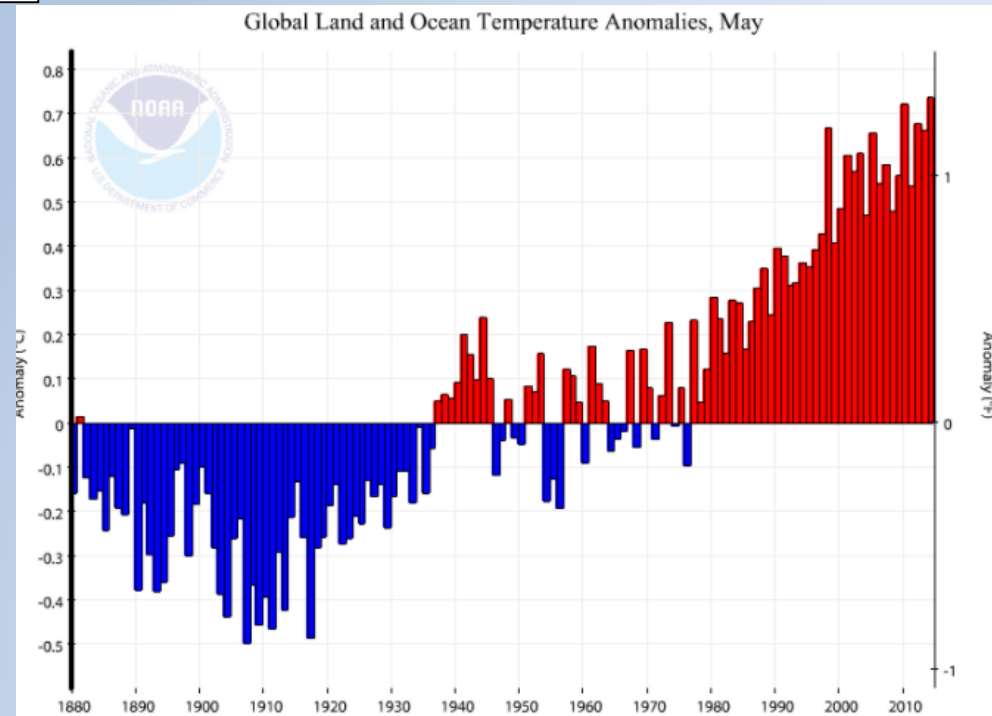
Scientific Investigations Report 2006–5002

Stream flow statistics for streams across the state are continually updated by the USGS at gage.

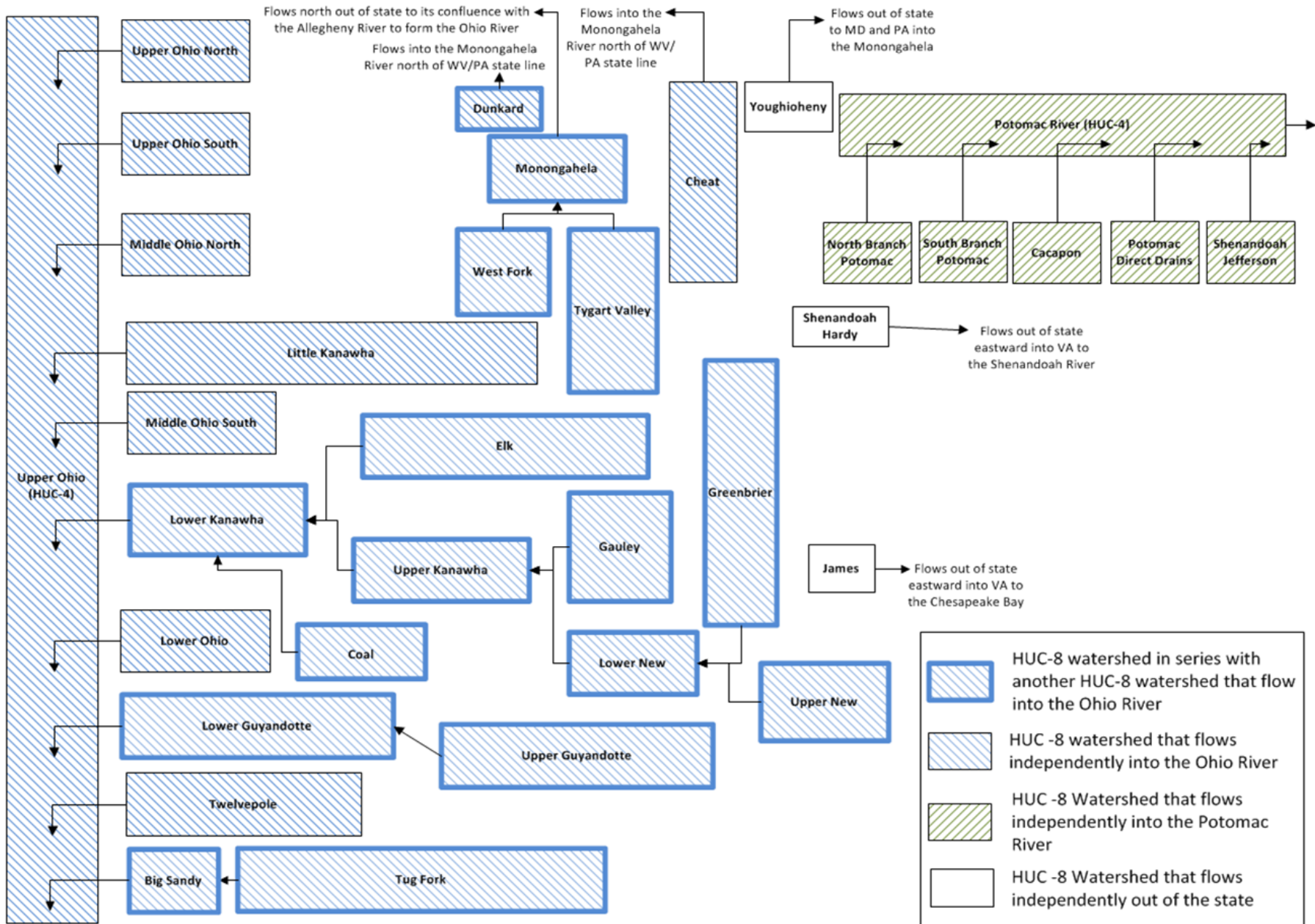


In the 1970's
something changed
and we began
receiving more rain.

Note the trend to
higher temperatures
in the Atlantic Ocean
since the 1970's.



West Virginia HUC – 8 Watershed Connections



The sole intention of this flow chart is to show the connectivity of the HUC 8 watersheds in the state of West Virginia. There is no scale.

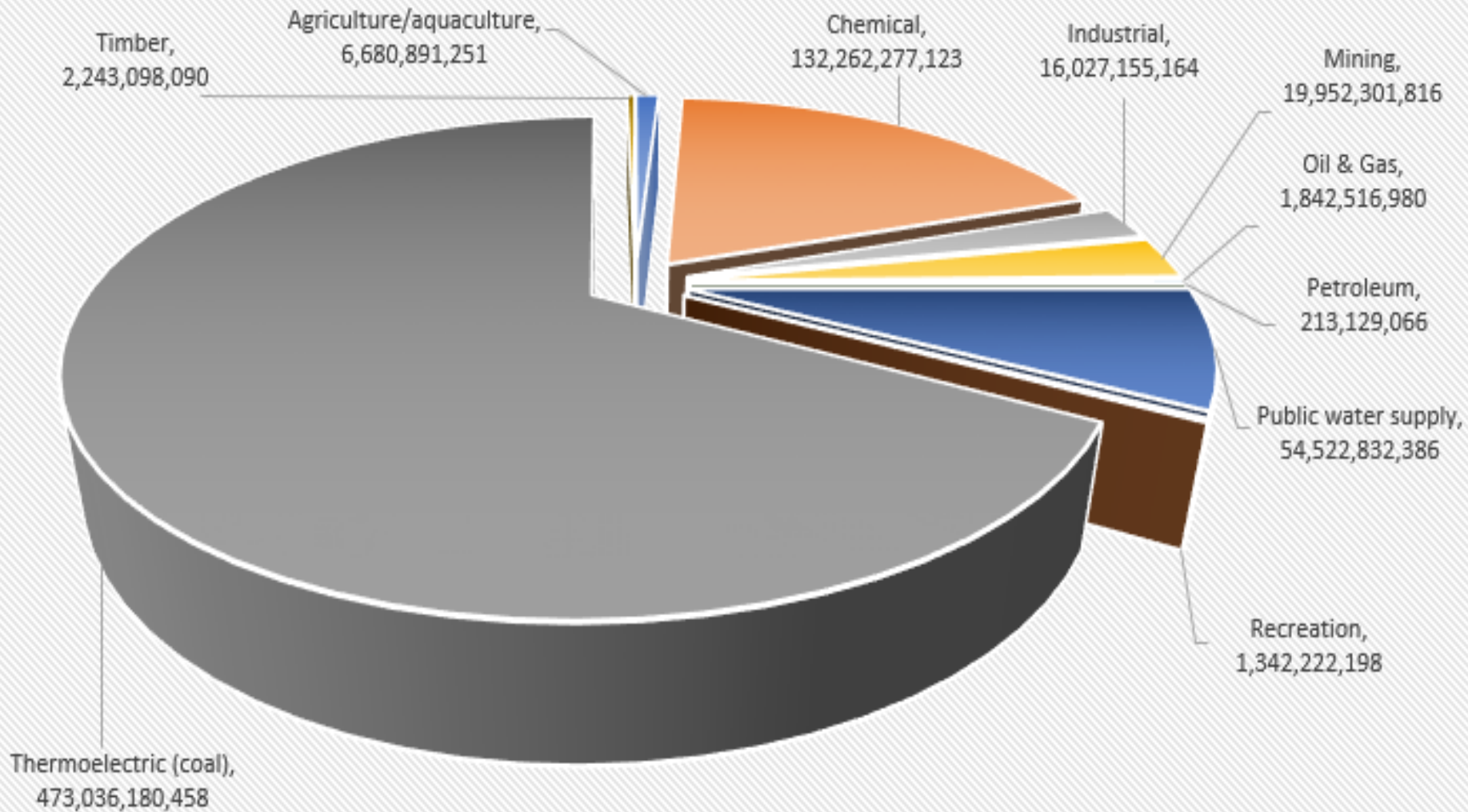
NEW

Large Quantity Users (LQU) Survey now collected on-line

- During 2015 we abandoned the out of date Paper LQU Survey and utilized the DEP Electronic Submission System (ESS) to allow the LQU's to report their total water usage and other required information on-line.
- The ESS has proven to be more efficient, easier to use and has been well received by the LQU community.

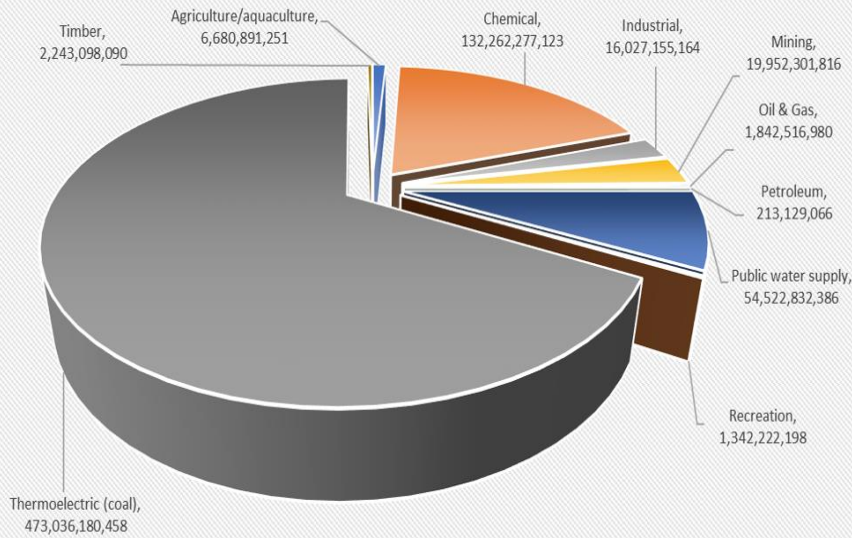
2016 LQU Water Use

2016 Total Annual GW+SW Withdrawals (- Hydroelectric) in Gallons

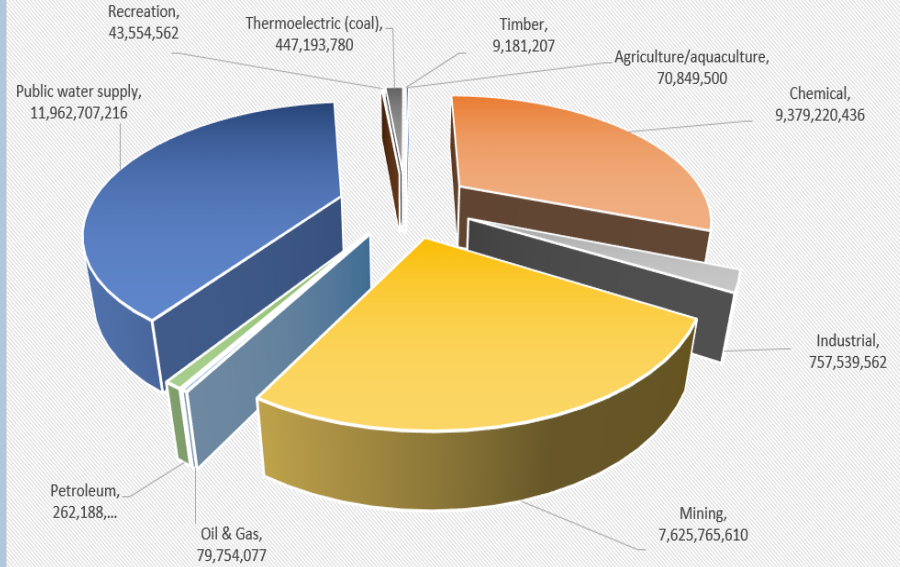


2016 LQU Water Use

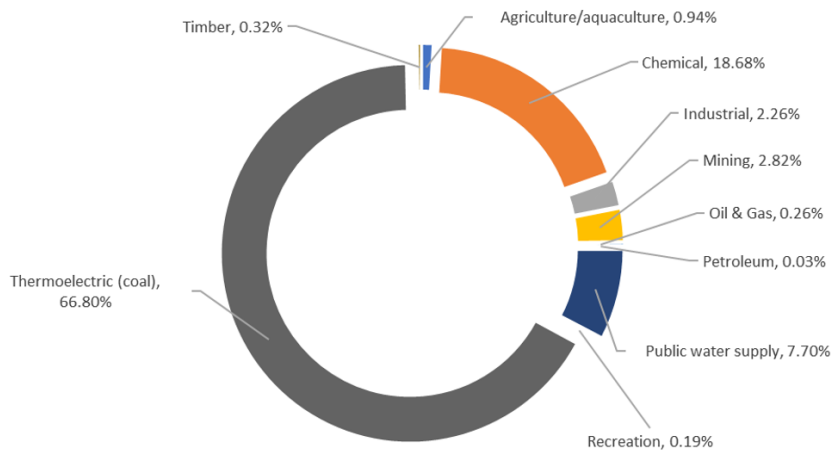
2016 Annual SW Withdrawals (- Hydroelectric) in Gallons



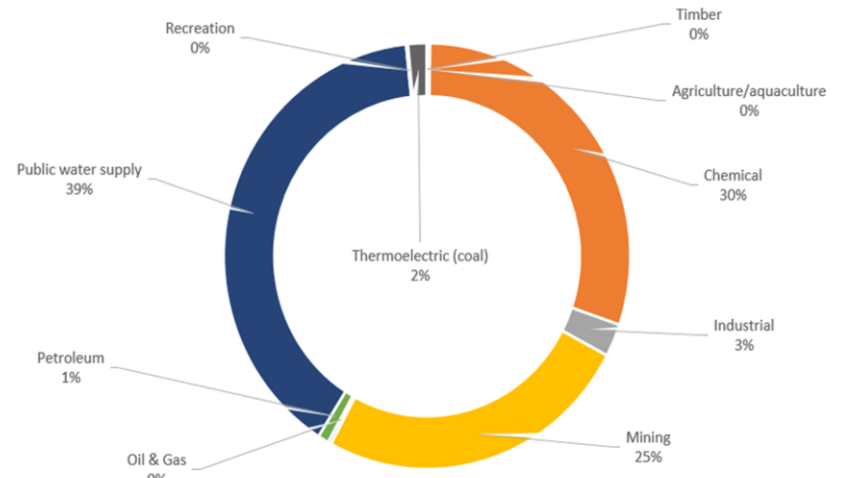
2016 Annual GW Withdrawals in Gallons



2016 Annual SW Withdrawal (- Hydroelectric) by Percentage



2016 Annual GW Withdrawals by Percentage



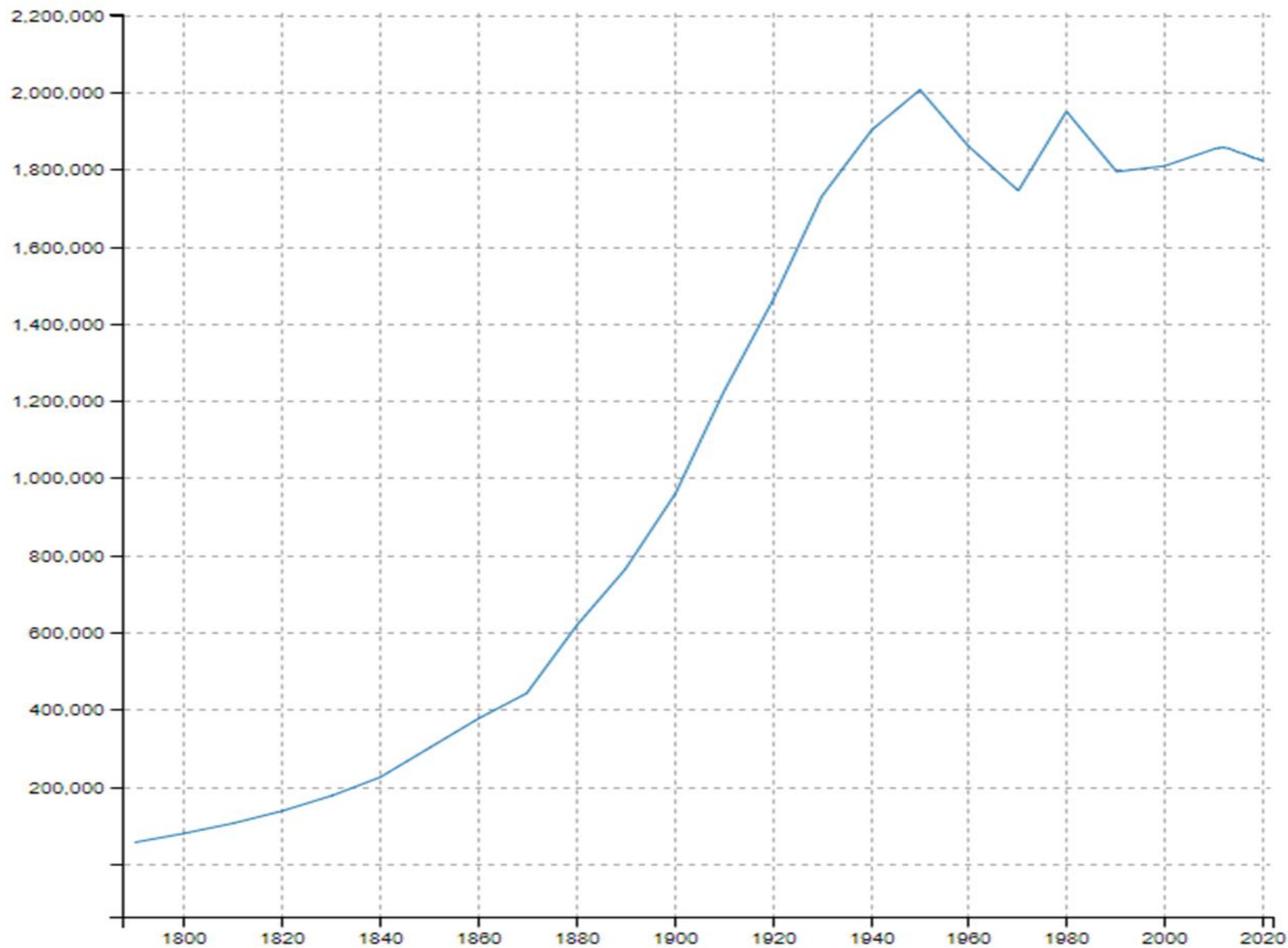
2016 WV Bottled Water in Gal/year



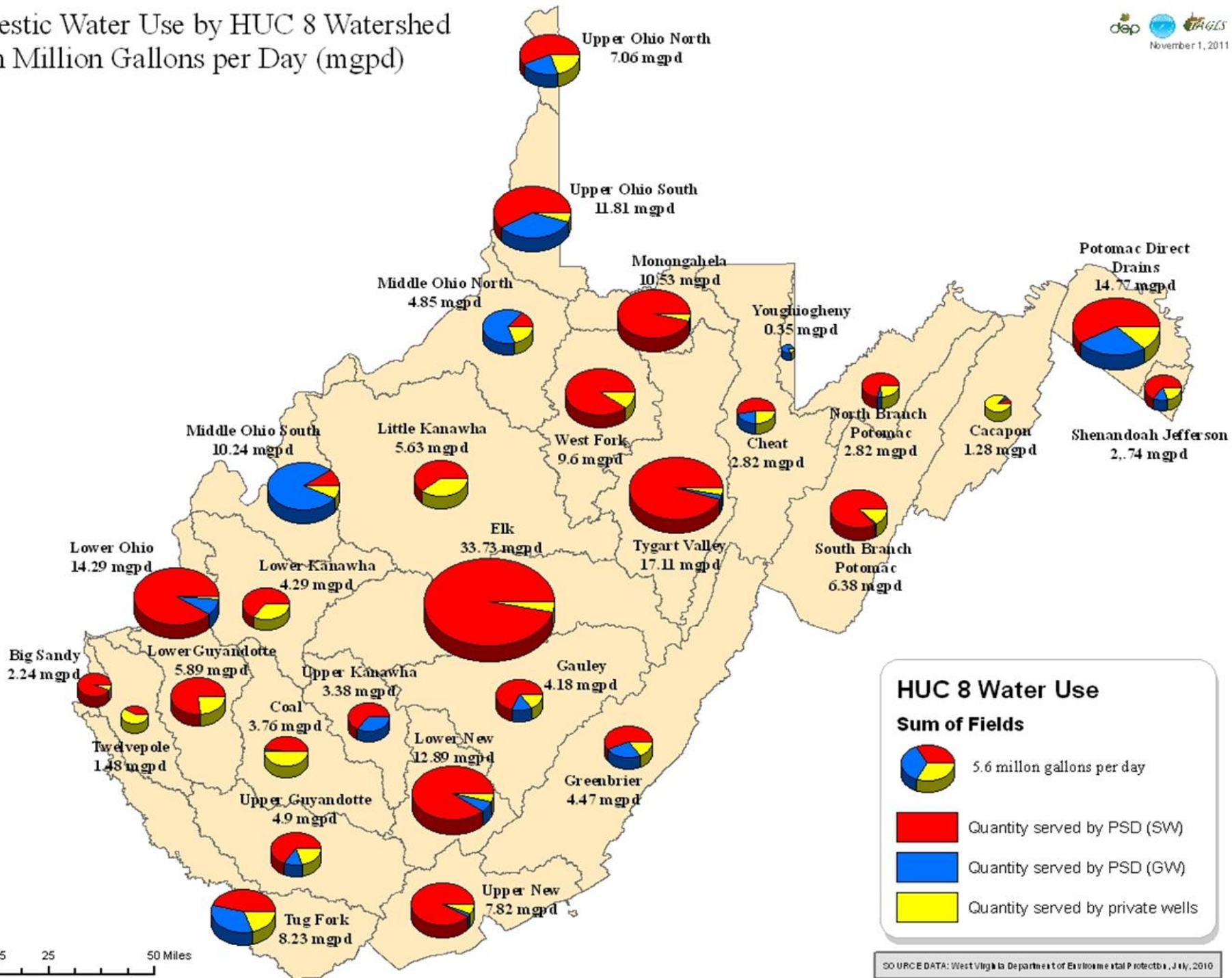
• SWEET SPRINGS VALLEY WATER COMPANY	1,700,000
– Source: Spring	
• BERKELEY CLUB BEVERAGES INC.	743,376
– Source: Spring	
• GREEN ACRES REGIONAL CENTER INC	800,000
– Source: Well	
• UNITED DAIRY, INC. (CHARLESTON)	475,000
– Source: Public Water System	
• WEST VIRGINIA PRIDE OF THE MOUNTAINS CO	175,000
– Source: Spring Closed 11/2016	
• CAPON SPRINGS & FARMS, INC.	16,000
– Source: Spring	
	<hr/>
Total	3,909,376

Allegheny Lodge Enterprises, LLC is Closed.
Tyler Mountain Water now bottled in Oakland PA.

West Virginia Population Chart







Domestic Water Use by HUC 8 Watershed in Million Gallons per Day (mgpd)

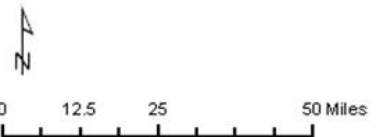


HUC 8 Water Use

Sum of Fields

-  5.6 million gallons per day
-  Quantity served by PSD (SW)
-  Quantity served by PSD (GW)
-  Quantity served by private wells

SO URCE DATA: West Virginia Department of Environmental Protection, July, 2010



Recreation?



Golf Course Water Use Study

West Virginia has 133 golf courses

Stonewall Resort



Snowshoe Resort



Glade Springs Resort



Greenbrier Resort

Golf Course Water Use Study

We plan to use the same model used
in this GCSAA Study...



Golf Course Environmental Profile

Phase II, Volume I
Water Use and Conservation Practices
on U.S. Golf Courses

Landscape Water Requirement (LWR) Equation

$$\text{LWR} = 1/\text{DULQ} \times [(\text{Eto} \times \text{KL}) - \text{Ra}] \times \text{A} \times \text{Cu} \times \text{LF}$$

Where:

LWR = Landscape water requirement (gallons/month)

DULQ = lower-quarter distribution uniformity (dimensionless)

ETo = Local reference evapotranspiration (inches/month)

KL = Landscape coefficient for the highest water-using plant in that hydrozone (dimensionless)

Ra = Allowable rainfall, designated by Water Sense as 25% of the site's peak monthly rainfall

A = Area of the hydrozone (square feet)

Cu = Conversion factor (0.6233 for results in gallons/month)

LF = Leaching Fraction

NEW

New O&G Fracture Water Database



- Captures actual monthly water withdrawal totals from each unique withdrawal location
- Alleviates redundancy: operators are already required to submit some data to fracfocus.org

Horizontal Well

Water Management Plans (WMP's)



- In 2016, this Section reviewed and approved 223 individual WMP's, including 53 WMP's for new well pads.
- 81 WMP's were modifications to existing WMP's in 2016
- Totals for 2017 are expected to exceed 2016

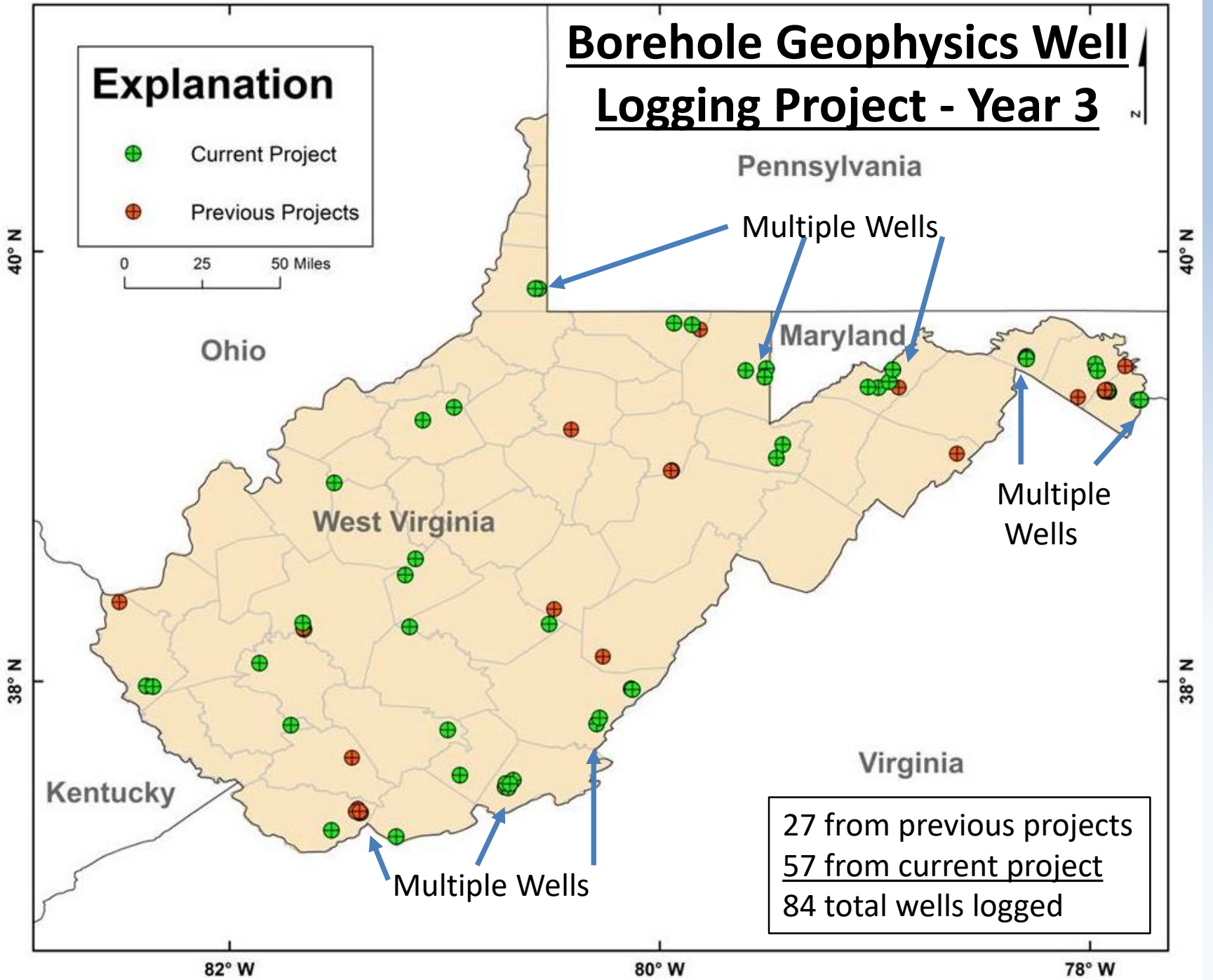
Other Projects and Studies

- Geophysical Well Logging - Groundwater Aquifer Study
- Consumptive Use Study
- Water Withdrawal Tool
- Potential Mine Pool Study – location, quantity, quality and sustainability
- ZCC, ZPC and SWPA's, coordination with BPH
- Water Conservation Award

Borehole Geophysics Well Logging Project - Year 3

Explanation

- Current Project
- Previous Projects



27 from previous projects
57 from current project
84 total wells logged

Water Withdrawal Tool

Zoom In Zoom Out Pan

Water Withdrawal from West Virginia Streams

Full Extent ABOUT PDF

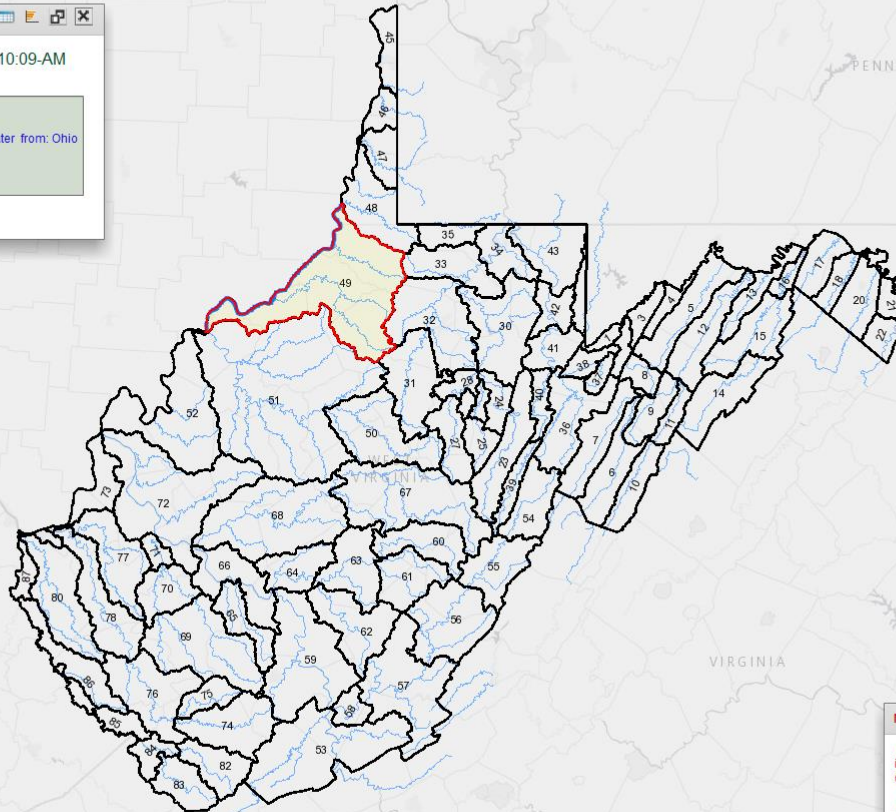
Base Map U.S. Topo Aerial Imagery ESRI Streets

Ohio River at Sewickley, PA(g2)

Current Value :4290 cfs Taken at: 09-03-2015 Time: 10:09-AM

Using best professional judgment, you should be able to withdraw water from: Ohio River

USGS Gauge Web Site



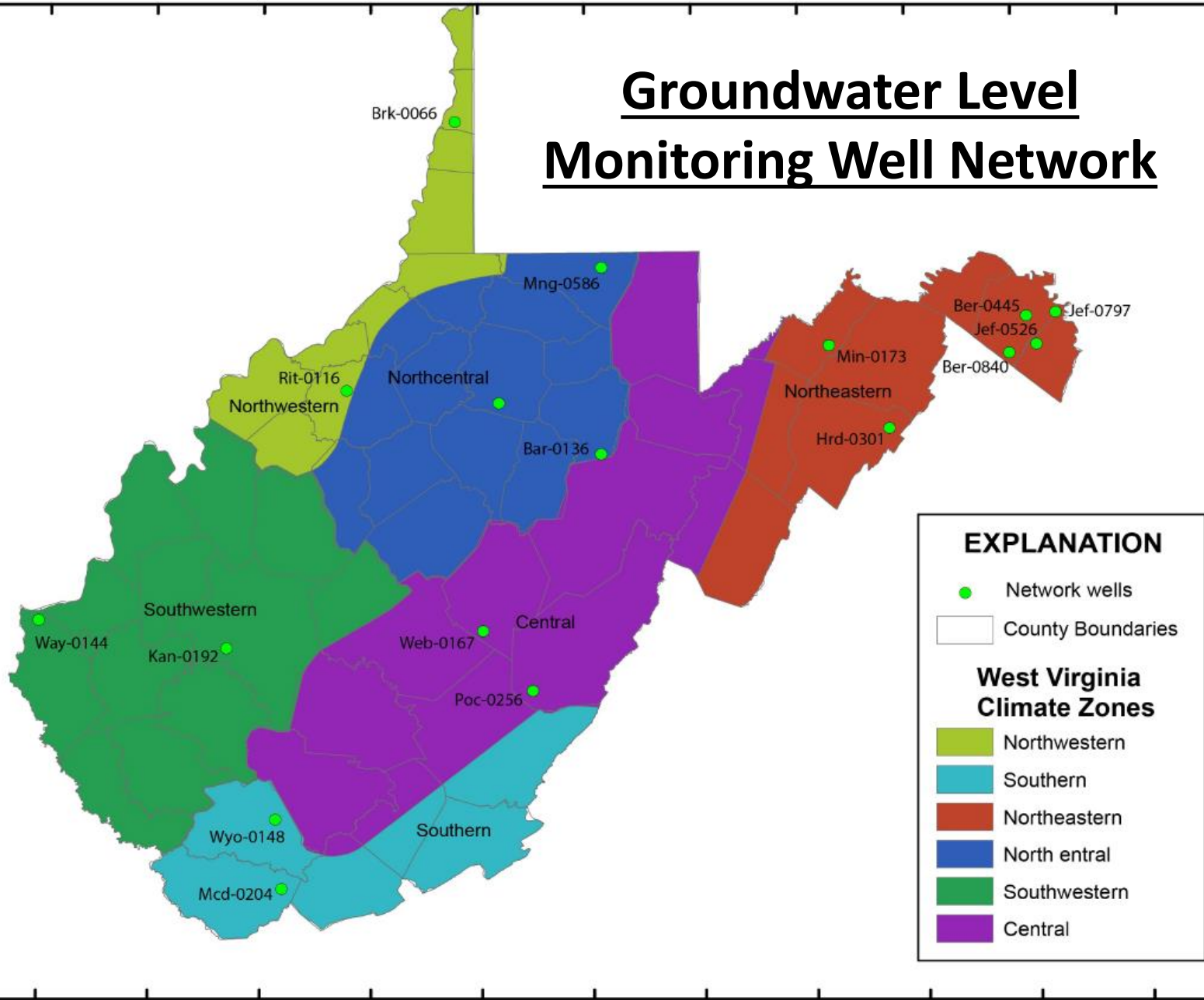
Notice

Be advised this guidance tool is less strict than thresholds incorporated into the water management plan for Oil and Gas Permits.

Approved water management plans include safety margins to account for uncertainties related to ungauged streams. Safety margins also increase based on the distance between the gauge and the potential withdrawal locations.

100 km 100 mi

Groundwater Level Monitoring Well Network

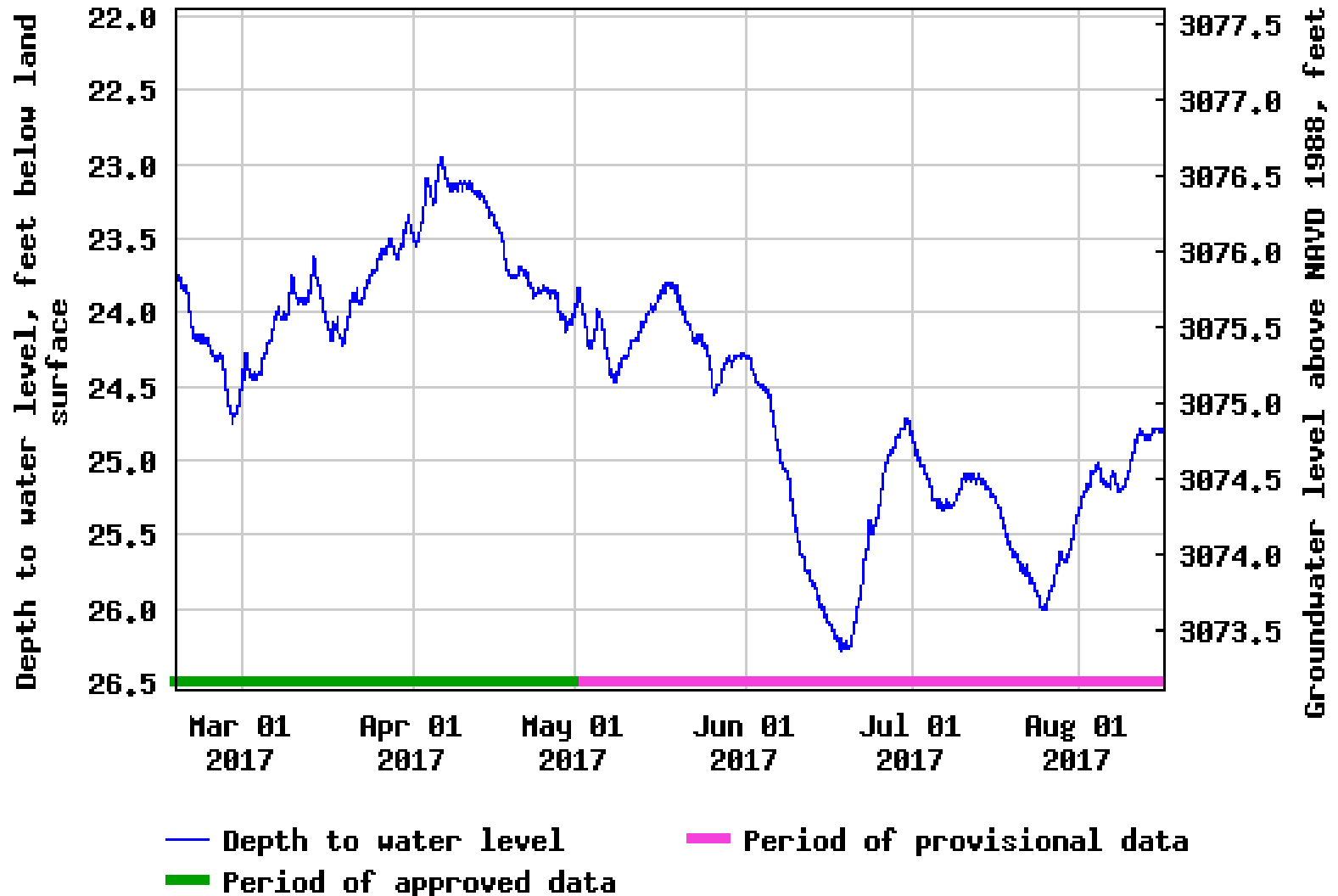


Map showing the location of West Virginia's groundwater level monitoring network

Depth to water level, feet below land surface

Most recent instantaneous value: 24.79 08-16-2017 12:15 EDT

USGS 382008080292801 Meb-0167



WVWRMP Mapping Tool

Google search: wvwaterplan and click the Blue Button

west virginia State Agency Directory | Online Services Search WV DEP

dep west virginia department of environmental protection - Promoting a Healthy Environment

DEP Offices | Agency History | News | Outlook Web Access | Text size A A A

Home > Water and Waste Management > Water Use Section > WV Water Resources Management Plan

West Virginia Water Resources Management Plan

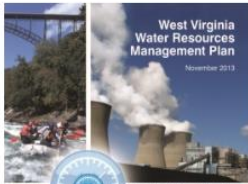
Welcome to the WVDEP Water Use Section Public Information Portal. This website was developed in cooperation with the Center of Environmental, Geotechnical, and Applied Sciences (CEGAS) at Marshall University. It serves as a public information portal for data related to water use in West Virginia. The Water Use Section of the WV DEP was developed as a result of the Water Resources Protection and Management Act of 2008. On this site, you have access to reports from the Large Quantity User and Marcellus Shale Frac Water databases. Additionally, there are many other related datasets displayed for the West Virginia Water Plan Mapping Tool.

Please click the button below to proceed to the mapping tool:


WV Water Resources Management Plan Mapping Tool

To view the "West Virginia Water Resources Management Plan", the "West Virginia Watershed Atlas", or the "West Virginia Watersheds: A Closer Look" documents please click on the corresponding image below.
**Please note that the files are quite large and may take several minutes to load into your browser.*

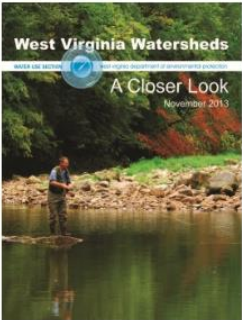
Water Withdrawal Guidance Tool
WV Water Resources Management Plan
Progress Reports - Water Resources Protection & Management Act
State Rules and other related documents
Frac Water Reporting Form
Annual Certification-Large Quantity Users
Mine Pool Atlas
WV Water Laws, Regulations, and Rights
Helpful Links




Filetype: PDF (45 MB)



Link to Watershed Maps



Filetype: PDF (30 MB)



Mine Pool Project Phase 2 Complete!

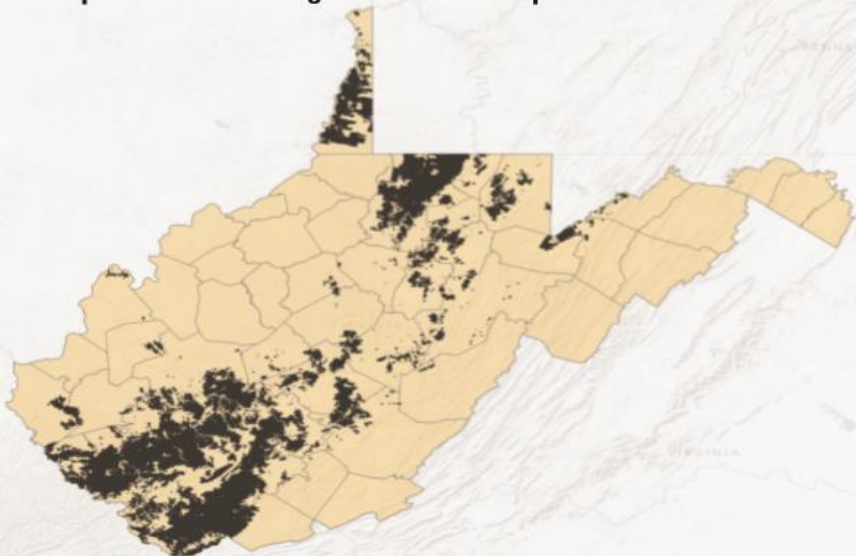
Data Series Report: <https://doi.org/10.3133/ds1069>

The dataset consists of 294 underground mines and 770 water samples.



Prepared in cooperation with the West Virginia Department of Environmental Protection
Division of Water and Waste Management

Groundwater-Quality Data Associated with Abandoned Underground Coal Mine Aquifers in West Virginia, 1973–2016: Compilation of Existing Data from Multiple Sources



Data Series 1069

U.S. Department of the Interior
U.S. Geological Survey

Results of the Compilation 5

Table 2. Number of sites and samples by West Virginia County.

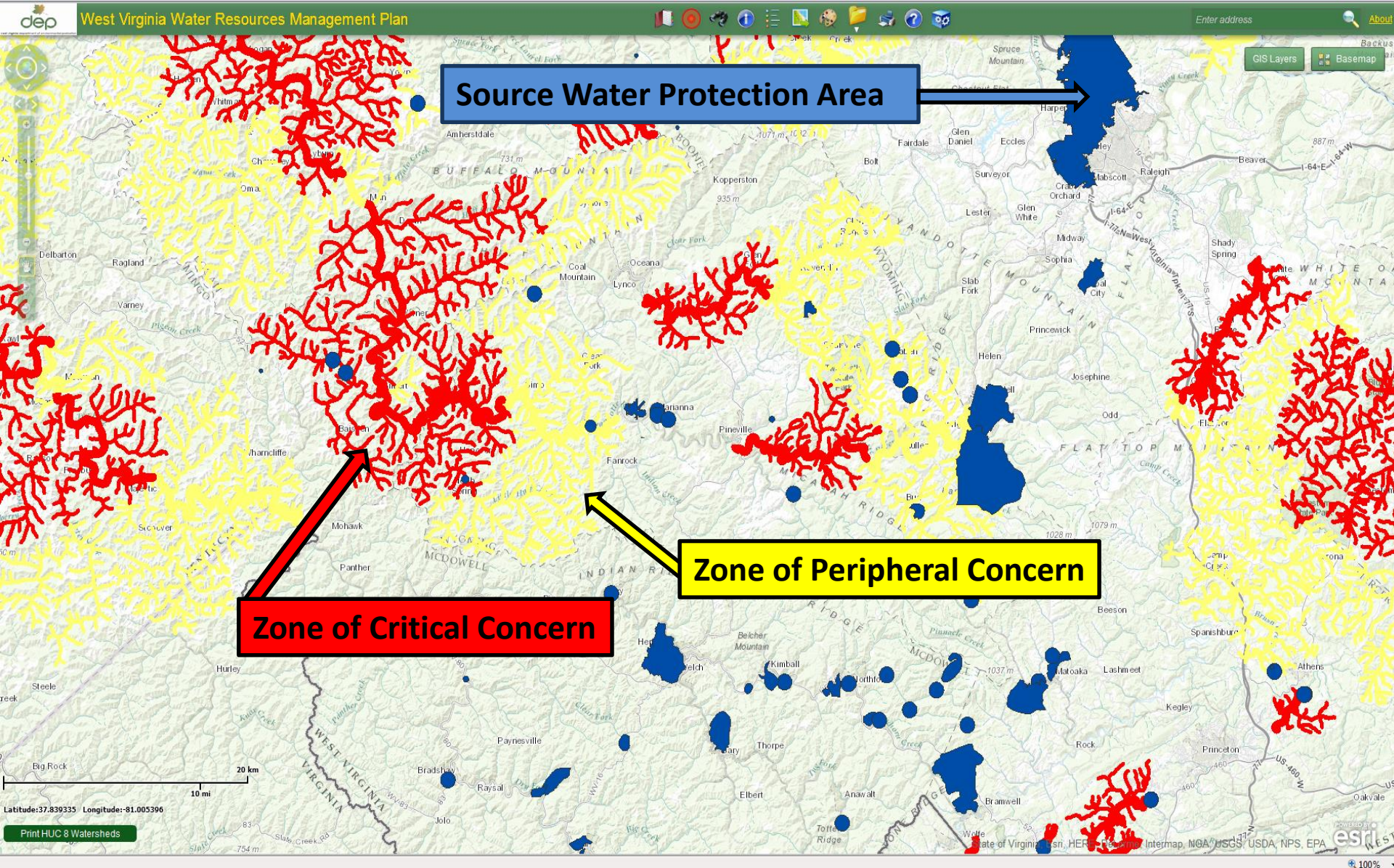
County	Sites	Samples
Barbour	2	4
Boone	13	13
Brooke	1	1
Fayette	17	94
Gilmer	3	11
Grant	8	8
Greenbrier	5	15
Hancock	1	11
Harrison	28	63
Kanawha	10	24
Lincoln	1	1
Logan	7	7
McDowell	12	37
Marion	10	182
Marshall	1	1
Mercer	1	1
Mingo	4	6
Monongalia	37	71
Nicholas	9	13
Ohio	9	19
Preston	42	68
Putnam	9	15
Raleigh	5	5
Randolph	1	1
Taylor	10	10
Tucker	1	1
Upshur	3	4
Wayne	7	29
Wyoming	37	55
Total	294	770

Table 3. Number of sites and water-quality samples by coal seam.

Coal Seam ¹	Sites	Samples
Bakerstown	3	4
Beckley	7	15
Bradshaw	1	1
Cedar Grove	2	2
Coalburg	6	12
Douglas	1	2
Eagle	12	26
Fire Clay	4	4
Fire Creek	1	3
Gilbert	1	1
Little Eagle	1	1
Lower Kittanning	2	12
Number 2 Gas	14	75
Number 5 Block	4	21
Peerless	3	4
Pittsburgh	102	356
Pocahontas 3	23	32
Pocahontas 4	5	28
Pocahontas 6	6	7
Pocahontas 7	6	6
Powellton	3	4
Sewell	22	50
Sewickley	5	5
Stockton	2	2
Upper Freeport	54	93
Williamson	1	1
Winifrede	3	3
Total	294	770

¹Coal Seam nomenclature after West Virginia Geological and Economic Survey (2015).

DHHR ZCC, ZPC and SWPA Layer (data sharing)



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[Climate_Features.zip](#)
[County](#)
[County.zip](#)
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[Dams.zip](#)
[Demographics](#)
[Demographics.zip](#)
[EcoRegions](#)
[EcoRegions.zip](#)
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[Geology_Type.zip](#)
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[Watershed_HUC06](#)
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[Watershed_HUC12.zip](#)
[Wetlands](#)
[Wetlands.zip](#)
[WV_Watersheds](#)

USGS-West Virginia Flood June 2016

FEMA Inundation Documentation and Mapping



Prepared in cooperation with the Federal Emergency Management Agency

**Characterization of Peak Streamflows and Flood
Inundation of Selected Areas in West Virginia from the
June 2016 Flood**

Understanding the Data

16 streamflow sites in WV met the following criteria during the June 2016 flooding event

- Peak flow for the period of record for the station
- Top 5 Peak flows in period of record
- Exceeded NWS Major Flood Stage

Interesting Fact: The June 2016 Flood was a result of 4 different average intensity storms that happened to pass over the same geographical area.

Examples of Period of Record Peaks Recorded at Gaged Sites

- 03190000 Meadow River at Nallen 39,300 cfs,
Previous Maximum Peak Flow 11,200 cfs
- 03190100 Anglins Creek near Nallen 10,200 cfs,
Previous Maximum Peak Flow 6,900 cfs
- 03196800 Elk River at Clay 63,100 cfs,
Previous Maximum Peak Flow 48,000 cfs
- 03197000 Elk River at Queen Shoals 82,700 cfs,
Previous Maximum Peak Flow 72,000 cfs

Examples of Period of Record Peaks Recorded at Gaged Sites

- 03186500 Williams River at Dyer 32,300 cfs,
Previous Maximum Peak Flow 22,000 cfs
- 03188900 Laurel Creek at Fenwick 15,000 cfs,
Max Peak not available (short period of record)
- 03189100 Gauley River near Craigsville 80,000 cfs,
Previous Maximum Peak Flow 63,500 cfs

USGS Flood Event Viewer

https://stn.wim.usgs.gov/fev/

USGS Flood Event Viewer

EVENT: **West Virginia June 2016**
24 Jun 2016 thru 4 Jul 2016

BASEMAPS >

- STREETS
- SATELLITE
- TOPO
- TERRAIN
- GRAY
- NATGEO

FILTERS >

CHANGE FILTERS

Current Filters

EVENT: West Virginia June 2016

GET DATA >

Use buttons to access event-based data, reflecting the filters chosen above.

Sensor Data ▾

High-water Mark Data ▾

Peak Summary Data ▾

Visit the [STN Data Portal](#) for broader data retrieval capability.

POWERED BY WIM

MAP LAYERS

- Real-Time Data
 - Real-time Stream Gage
 - Rapid Deployment Gage
- Observed Data
 - Barometric Pressure Sensor
 - Storm Tide Sensor
 - Meteorological Sensor
 - Wave Height Sensor
 - High Water Mark
- Interpreted Data
 - Peak Summary

HIGH WATER MARK | WEST VIRGINIA JUNE 2016

STN Site No.:	WVKAN16344
Elevation(ft):	616.6
Datum:	NAVD88
Height Above Ground:	2.7
Approval status:	Approved
Type:	Seed line
Marker:	
Quality:	Good: +/- 0.10 ft
Waterbody:	Elk River
County:	Kanawha County
State:	WV
Latitude, Longitude (DD):	38.4499, -81.4564
Description:	Z1_HWM_16. Seed line on tree near AC unit
Full data link:	HWM data page

1:1,155,581 | 9
40.0528 | -78.0661

Stream Gage Network

PLEASE KEEP IN MIND:

The stream gaging network is the most important asset to water resource management.

Our water resource models responsible for flood warning and answering the questions posed by the Act are dependent on data collected by the Stream Gaging Network.

The WV Water Gaging Council has proposed new funding and operation recommendations for the Stream Gage Network this morning to the JLOC on Flooding.

Water Rights On the Potomac River

BRIAN E. FROSH
Attorney General



STATE OF MARYLAND
OFFICE OF THE ATTORNEY GENERAL

FACSIMILE NO.

ELIZABETH F. HARRIS
Chief Deputy Attorney General

CAROLYN QUATTROCKI
Deputy Attorney General

DONNA HILL STATON
Deputy Attorney General

WRITER'S DIRECT DIAL NO.

November 22, 2016

The Honorable Patrick Morrissey
Office of the Attorney General
State Capitol Complex
Building 1, Room E-26
Charleston, WV 25305

Dear Attorney General Morrissey:

We are writing in response to your letter concerning West Virginia's water withdrawals from the Potomac River. Maryland officials have long acknowledged that West Virginia has the same rights on the Potomac River as those described by the Supreme Court in *Virginia v. Maryland*. Since that case was decided in 2003, the Maryland Department of the Environment

QUESTIONS ?



WV department of environmental protection

-Promoting a healthy environment