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

Map Key
Precipitation Range (inches/year)
- 31 - 36
- 37 - 42
- 43 - 48
- 49 - 54
- 55 - 60
- 61 - 67
- 68 - 73

Source Data: NOAA/National Weather Service, monthly "Surface Precipitation," Climate Data Division, National Centers for Environmental Information, for 11,000 sites in the United States.
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

HUC-8 watershed in series with another HUC-8 watershed that flows into the Ohio River
HUC -8 watershed that flows independently into the Ohio River
HUC -8 Watershed that flows independently into the Potomac River
HUC -8 Watershed that flows independently out of the state

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.
• During 2015 we abandoned the out of date Paper LQU Survey and utilized the DEP Electronic Submission System (ESS) to allow the LQU’s to report their total water usage and other required information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

- Timber, 2,243,098,090
- Agriculture/aquaculture, 6,680,891,251
- Chemical, 132,262,277,123
- Industrial, 16,027,155,164
- Mining, 19,952,301,816
- Oil & Gas, 1,842,516,980
- Petroleum, 213,129,066
- Public water supply, 54,522,832,386
- Recreation, 1,342,222,198
- Thermoelectric (coal), 473,036,180,458
2016 LQU Water Use

**2016 Annual SW Withdrawals (-Hydroelectric) in Gallons**
- Agriculture/aquaculture, 6,680,891,251
- Chemical, 132,262,277,123
- Industrial, 16,027,355,164
- Mining, 19,952,301,836
- Oil & Gas, 1,842,536,980
- Petroleum, 213,129,066
- Public water supply, 54,522,832,986
- Recreation, 1,342,222,198
- Thermoelectric (coal), 473,036,180,458

**2016 Annual GW Withdrawals in Gallons**
- Recreation, 43,554,562
- Timber, 9,181,207
- Agriculture/aquaculture, 70,849,500
- Chemical, 9,379,220,436
- Industrial, 757,539,562

**2016 Annual SW Withdrawal (-Hydroelectric) by Percentage**
- Agriculture/aquaculture, 0.94%
- Chemical, 18.68%
- Industrial, 2.26%
- Mining, 2.82%
- Oil & Gas, 0.26%
- Petroleum, 0.03%
- Public water supply, 7.70%
- Recreation, 0.19%
- Thermoelectric (coal), 66.80%

**2016 Annual GW Withdrawals by Percentage**
- Recreation 0%
- Agriculture/aquaculture 0%
- Chemical 30%
- Industrial 3%
- Mining 25%
- Petroleum 1%
- Oil & Gas 0%
- Public water supply 39%
### 2016 LQU Water Use

<table>
<thead>
<tr>
<th>Water Use Category</th>
<th>2016 Total SW &amp; GW in Gallons</th>
<th>% Consumptive</th>
<th>Estimated Consumptive Use (Gal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture/Aquaculture</td>
<td>6,680,891,251</td>
<td>0.12</td>
<td>801,706,950</td>
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<tr>
<td>Chemical</td>
<td>132,262,277,123</td>
<td>0.2</td>
<td>26,452,455,425</td>
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<tr>
<td>Industrial</td>
<td>16,027,155,164</td>
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<td>2,083,530,171</td>
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<td>Mining</td>
<td>19,952,301,816</td>
<td>0.17</td>
<td>3,391,891,309</td>
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<tr>
<td>Oil &amp; Gas</td>
<td>1,842,516,980</td>
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<td>1,842,516,980</td>
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<tr>
<td>Petroleum</td>
<td>213,129,066</td>
<td>0.27</td>
<td>57,544,848</td>
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<td>Public Water Supply</td>
<td>54,522,832,386</td>
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<td>Recreation</td>
<td>1,342,222,198</td>
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<td>671,111,099</td>
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<tr>
<td>Thermoelectric (COAL)</td>
<td>473,036,180,458</td>
<td>0.025</td>
<td>11,825,904,511</td>
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<tr>
<td>Timber</td>
<td>2,243,098,090</td>
<td>0.25</td>
<td>560,774,523</td>
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<tr>
<td><strong>TOTALS</strong></td>
<td><strong>708,122,604,532</strong></td>
<td></td>
<td><strong>57,501,545,645</strong></td>
</tr>
</tbody>
</table>

| Total Gallons Withdrawn in 2016 | 708,122,604,532 |
| Est. Gallons Consumed in 2016   | 57,501,545,645  |
| Est. Total Consumptive Use      | 8.12%           |

Hydroelectric = 233.3 Trillion Gallons (this is flow-through water, 0% consumptive)
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

**Total** 3,909,376

Allegheny Lodge Enterprises, LLC is Closed.
Tyler Mountain Water now bottled in Oakland PA.
Domestic Water Use by HUC 8 Watershed in Million Gallons per Day (mgpd)

HUC 8 Water Use
Sum of Fields
- Quantity served by PSD (SW)
- Quantity served by PSD (GW)
- Quantity served by private wells

SOURCE: 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
We plan to use the same model used in this GCSAA Study...
Landscape Water Requirement (LWR) Equation

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

Where:

- \( \text{LWR} \) = Landscape water requirement (gallons/month)
- \( \text{DULQ} \) = lower-quarter distribution uniformity (dimensionless)
- \( \text{Eto} \) = Local reference evapotranspiration (inches/month)
- \( \text{KL} \) = Landscape coefficient for the highest water-using plant in that hydrozone (dimensionless)
- \( \text{Ra} \) = Allowable rainfall, designated by Water Sense as 25% of the site’s peak monthly rainfall
- \( A \) = Area of the hydrozone (square feet)
- \( \text{Cu} \) = Conversion factor (0.6233 for results in gallons/month)
- \( \text{LF} \) = Leaching Fraction
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

27 from previous projects
57 from current project
84 total wells logged
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 Web-0167

- Depth to water level
- Period of provisional data
- Period of approved data
WVWRMP Mapping Tool

Google search: wvwaterplan and click the Blue Button
Mine Pool Project Phase 2 Complete!

Data Series Report: [https://doi.org/10.3133/ds1069](https://doi.org/10.3133/ds1069)

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

---

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

<table>
<thead>
<tr>
<th>County</th>
<th>Sites</th>
<th>Samples</th>
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<tbody>
<tr>
<td>Barbour</td>
<td>2</td>
<td>4</td>
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<tr>
<td>Boone</td>
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<td>13</td>
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<tr>
<td>Brooke</td>
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<td>Fayette</td>
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<td>Gilmer</td>
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<td>Grant</td>
<td>8</td>
<td>8</td>
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<tr>
<td>Greenbrier</td>
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<td>Hancock</td>
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<tr>
<td>Harman</td>
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<td>Logan</td>
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<td>7</td>
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<td>McDowell</td>
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<td>Ohio</td>
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<td>Preston</td>
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<td>Putnam</td>
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<td>15</td>
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<td>Raleigh</td>
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<tr>
<td>Randolph</td>
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<td>1</td>
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<tr>
<td>Taylor</td>
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<tr>
<td>Tucker</td>
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<tr>
<td>Upshur</td>
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<td>Wayne</td>
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<tr>
<td>Wyoming</td>
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<tr>
<td>Total</td>
<td>294</td>
<td>770</td>
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</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Coal Seam†</th>
<th>Sites</th>
<th>Samples</th>
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</thead>
<tbody>
<tr>
<td>Bunker</td>
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<td>Beckley</td>
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<td>Bradshaw</td>
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<td>1</td>
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<td>Cedar Grove</td>
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<td>2</td>
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<td>Coalburg</td>
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<td>12</td>
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<tr>
<td>Douglas</td>
<td>1</td>
<td>2</td>
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<tr>
<td>Eagle</td>
<td>12</td>
<td>26</td>
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<tr>
<td>Fire Clay</td>
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<td>4</td>
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<tr>
<td>Fire Creek</td>
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<tr>
<td>Gilmer</td>
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<td>1</td>
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<tr>
<td>Little Eagle</td>
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<td>1</td>
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<td>Logan</td>
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<td>12</td>
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<tr>
<td>Number 1 Gas</td>
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<td>Number 5 Block</td>
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<td>Pocahontas</td>
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<td>Pittsburgh</td>
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<td>156</td>
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<td>Pocahontas 3</td>
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<td>Pocahontas 4</td>
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<td>Pocahontas 6</td>
<td>6</td>
<td>7</td>
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<tr>
<td>Pocahontas 7</td>
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<td>6</td>
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<td>Powellites</td>
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<td>Scotts</td>
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<td>Upper Freeport</td>
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<td>Williamson</td>
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<tr>
<td>Windy</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>294</td>
<td>770</td>
</tr>
</tbody>
</table>

DHHR ZCC, ZPC and SWPA Layer
(data sharing)

Source Water Protection Area

Zone of Peripheral Concern

Zone of Critical Concern
Downloadable shape files are available online for individuals, companies, consultants and economic development professionals.
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
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.
November 22, 2016

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

Dear Attorney General Morrisey:

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