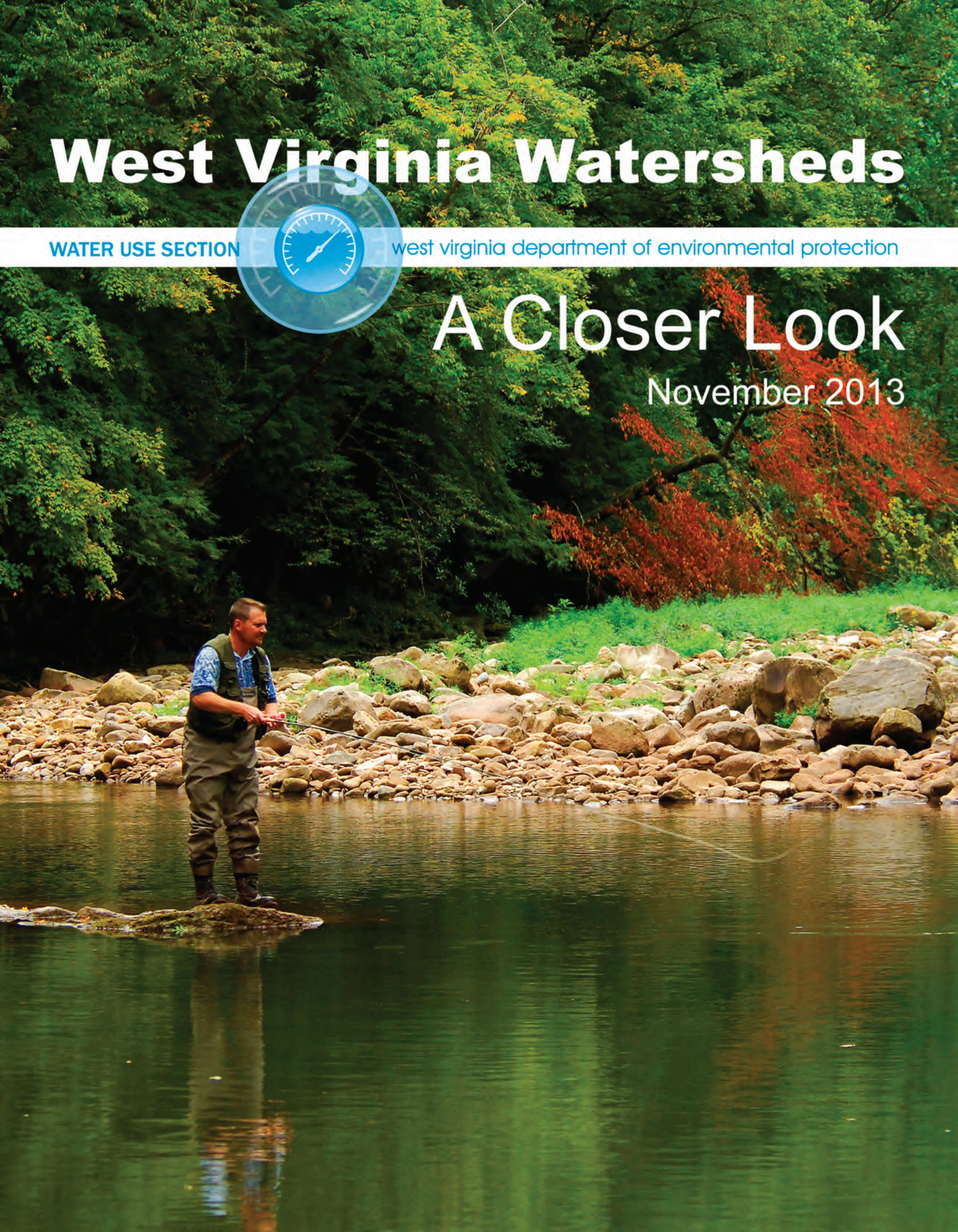
West Virginia Watersheds

WATER USE SECTION west virginia department of environmental protection

A Closer Look

November 2013



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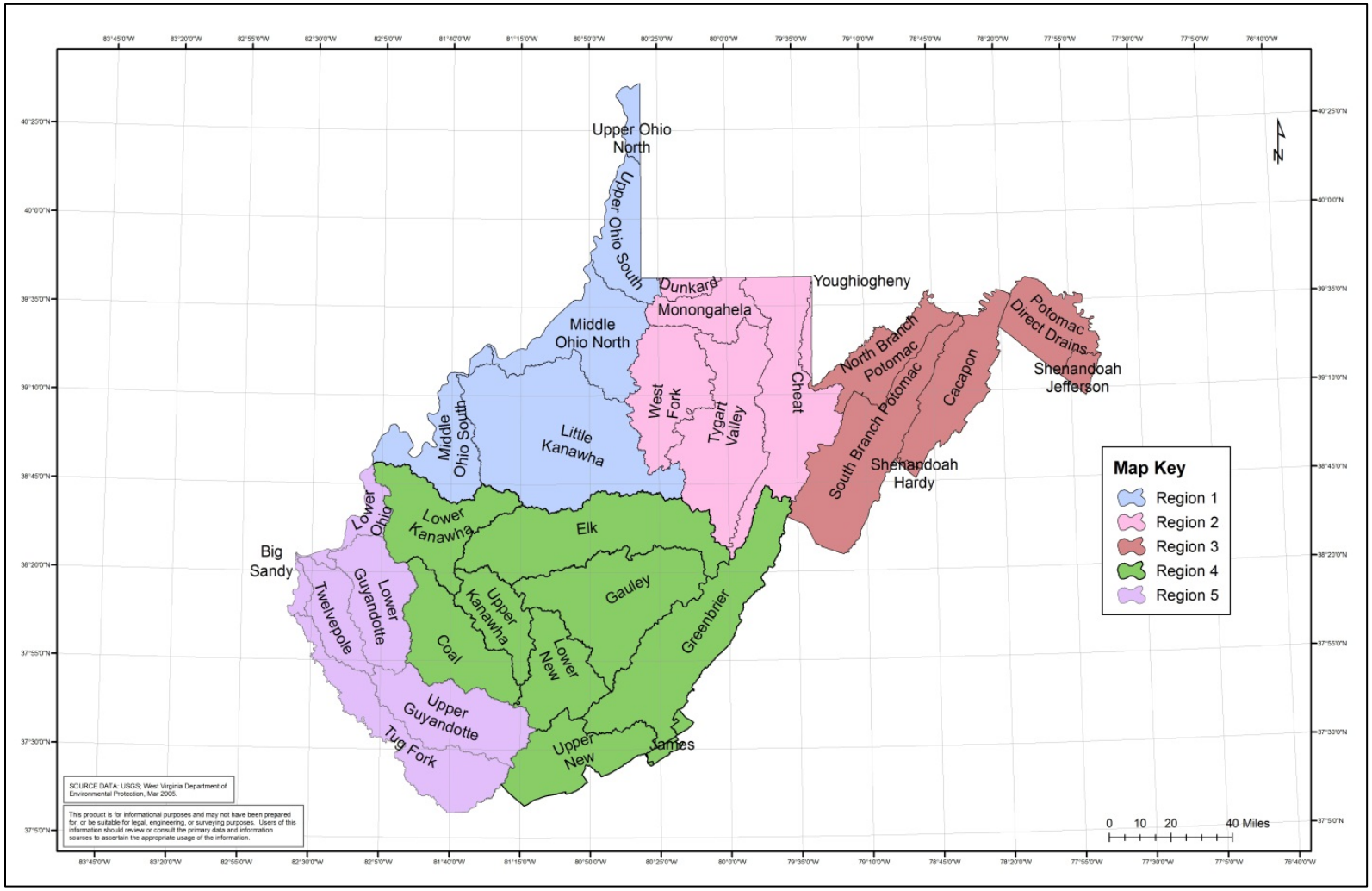
HUC-8 REGIONAL MAP



West Virginia Watershed Descriptions - Overview

The West Virginia Watershed Descriptions companion report to the Water Resources Management Plan provides detailed descriptions for each of the 32 HUC-8 watersheds. Water resources and demands specific to each watershed are presented, as well as a brief summary of sources and suspected (have not been field verified) interbasin transfers. Listed below are statewide statistics that will be discussed in detail in this document.

The HUC-8 watershed that contains the most National Hydrography Dataset (NHD) in-state stream miles is the Little Kanawha River with a total of 5,425 stream miles (Table A-1). The HUC-8 watershed with the least amount of in-state stream miles is the Shenandoah Hardy with 47 total stream miles.

Table A-1 Stream miles by watershed

Watershed Name	Total Stream Miles
Little Kanawha River	5,425
Greenbrier River	3,509
South Branch Potomac	3,476
Tygart River	3,226
Elk River	3,213
Gauley River	3,063
Cheat River	2,538
Middle Ohio North	2,283
Tug Fork	2,249
Coal River	2,232
Upper Guyandotte River	2,200
Upper New River	2,000
Cacapon River	1,971
Lower Kanawha River	1,965
West Fork River	1,888
Middle Ohio South	1,803
Lower Guyandotte River	1,796
Lower New River	1,612
Upper Kanawha River	1,244
Upper Ohio South	1,234
North Branch Potomac	1,173
Twelvepole Creek	1,139
Potomac Direct Drains	1,085
Monongahela River	867
Lower Ohio River	546
Upper Ohio North	246
Dunkard Creek	246
James River	217
Big Sandy River	201
Shenandoah Jefferson	140
Youghiogheny River	127
Shenandoah Hardy	47
Total	**54,961**

There are a total of 144 USGS stream gages in the state (Table A-2). This includes both discharge and stage gages. The HUC-8 watershed with the most USGS stream gages is the Tygart Valley River Watershed with a total of 17. There are currently five HUC-8 watersheds that do not contain any USGS stream gages in the state: the Big Sandy, Dunkard, James, Shenandoah Hardy and Youghiogheny.

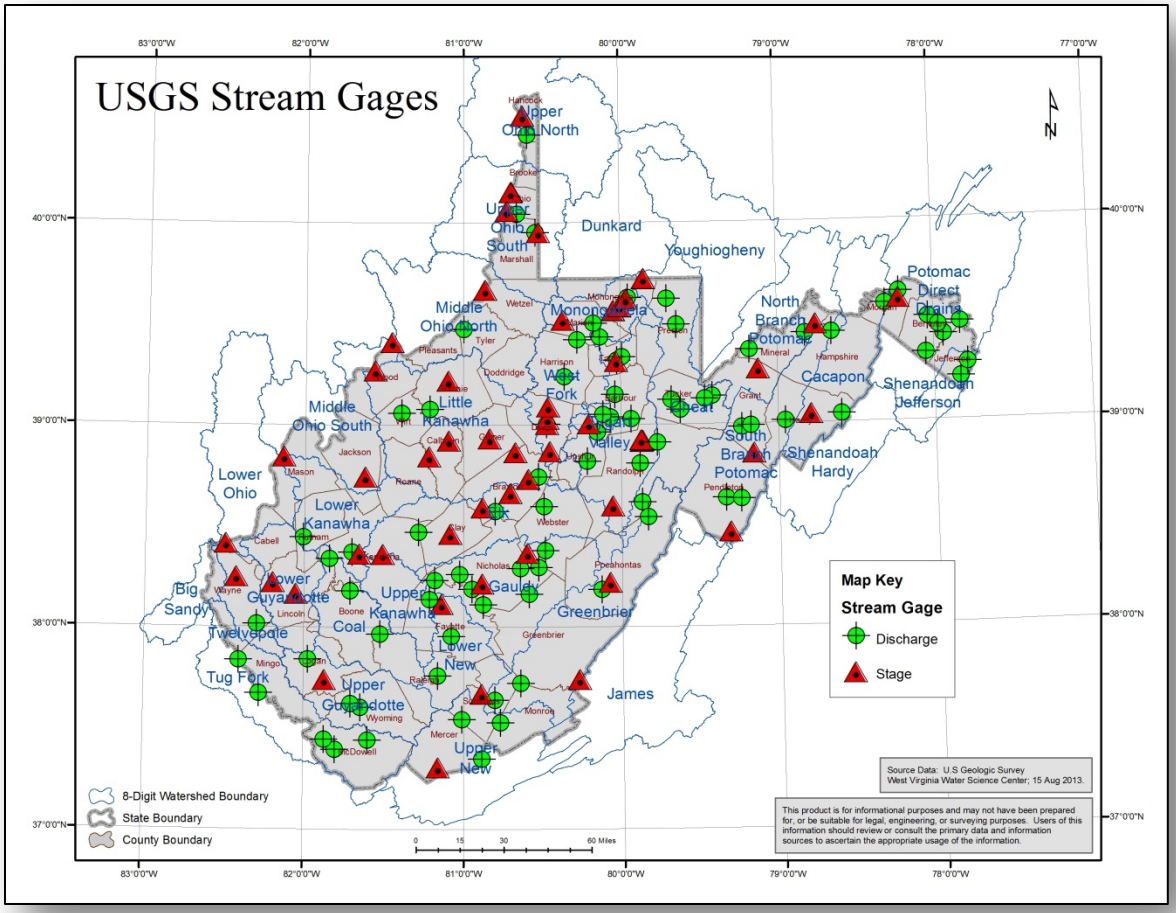
Table A-2 Stream gages by watershed

HUC-8 Watershed (Station Name)	No. in HUC-8	Type
Cacapon River	**3**	
CACAPON RIVER NEAR GREAT CACAPON, WV	1	Discharge
PARKER HOLLOW RUN AT NEEDMORE, WV	1	Stage
WAITES RUN NEAR WARDENSVILLE, WV	1	Discharge
Cheat River	**10**	
BIG SANDY CREEK AT ROCKVILLE, WV	1	Discharge
BLACKWATER RIVER AT DAVIS, WV	1	Discharge
BLACKWATER RIVER NEAR DAVIS, WV	1	Discharge
CHEAT LAKE NEAR STEWARTSTOWN, WV	1	Stage
CHEAT RIVER AT ALBRIGHT, WV	1	Stage
CHEAT RIVER AT LAKE LYNN, PA	1	Discharge
CHEAT RIVER NEAR PARSONS, WV	1	Discharge
DRY FORK AT HENDRICKS, WV	1	Discharge
SHAVERS FORK BELOW BOWDEN, WV	1	Discharge
SHAVERS FORK NR CHEAT BRIDGE, WV	1	Discharge
Coal River	**3**	
BIG COAL RIVER AT ASHFORD, WV	1	Discharge
CLEAR FORK AT WHITESVILLE, WV	1	Discharge
COAL RIVER AT TORNADO, WV	1	Discharge
Elk River	**7**	
BIRCH RIVER AT HEROLD, WV	1	Discharge
ELK RIVER AT CLAY, WV	1	Stage
ELK RIVER AT QUEEN SHOALS, WV	1	Discharge
ELK RIVER AT SUTTON, WV	1	Stage
ELK RIVER BELOW WEBSTER SPRINGS, WV	1	Discharge
ELK RIVER NEAR FRAMETOWN, WV	1	Stage
UNNAMED TRIB TO ELK TWOMILE CR NR CHARLESTON, WV	1	Stage
Gauley River	**10**	
CRANBERRY RIVER NEAR RICHWOOD, WV	1	Discharge
GAULEY RIVER ABOVE BELVA, WV	1	Discharge
GAULEY RIVER AT CAMDEN ON GAULEY, WV	1	Stage
GAULEY RIVER BELOW SUMMERSVILLE DAM, WV	1	Stage
GAULEY RIVER NEAR CRAIGSVILLE, WV	1	Discharge
LAUREL CREEK NEAR FENWICK, WV	1	Discharge
MEADOW RIVER AT NALLEN, WV	1	Discharge
MEADOW RIVER NEAR MT. LOOKOUT, WV	1	Discharge
PETERS CREEK NEAR LOCKWOOD, WV	1	Discharge
WILLIAMS RIVER AT DYER, WV	1	Discharge
Greenbrier River	**6**	
DRY CREEK AT TUCKAHOE, WV	1	Stage
GREENBRIER RIVER AT ALDERSON, WV	1	Discharge
GREENBRIER RIVER AT BUCKEYE, WV	1	Discharge
GREENBRIER RIVER AT DURBIN, WV	1	Discharge
GREENBRIER RIVER AT HILLDALE, WV	1	Discharge
MARLIN RUN AT MARLINTON, WV	1	Stage

HUC-8 Watershed (Station Name)	No. in HUC-8	Type
Little Kanawha	**9**	
LITTLE KANAWHA RIVER AT BURNSVILLE, WV	1	Stage
LITTLE KANAWHA RIVER AT GLENVILLE, WV	1	Stage
LITTLE KANAWHA RIVER AT GRANTSVILLE, WV	1	Stage
LITTLE KANAWHA RIVER AT PALESTINE, WV	1	Discharge
LITTLE KANAWHA RIVER NR WILDCAT, WV	1	Discharge
NORTH FORK HUGHES RIVER NEAR CAIRO, WV	1	Stage
SALTLICK CREEK NEAR FLATWOODS, WV	1	Stage
SOUTH FORK HUGHES RIVER BELOW MACFARLAN, WV	1	Discharge
WEST FORK LITTLE KANAWHA RIVER AT ROCKSDALE, WV	1	Stage
Lower Guyandotte River	**2**	
GUYANDOTTE RIVER AT BRANCHLAND, WV	1	Stage
MUD RIVER AT PALERMO, WV	1	Stage
Lower Kanawha River	**3**	
HURRICANE CREEK AT HURRICANE, WV	1	Discharge
KANAWHA R AT CHARLESTON, WV AUXILIARY (UPPER)	1	Stage
KANAWHA RIVER AT CHARLESTON, WV	1	Discharge
Lower New River	**4**	
NEW RIVER AT HINTON, WV	1	Stage
NEW RIVER AT THURMOND, WV	1	Discharge
NEW RIVER BELOW HAWKS NEST DAM, WV	1	Stage
PINEY CREEK AT RALEIGH, WV	1	Discharge
Lower Ohio River	**1**	
OHIO RIVER AT HUNTINGTON, WV	1	Stage
Middle Ohio North	**4**	
MIDDLE ISLAND CREEK AT LITTLE, WV	1	Discharge
OHIO RIVER AT HANNIBAL LOCK AND DAM (LOWER), OH	1	Stage
OHIO RIVER AT HANNIBAL LOCK AND DAM (UPPER), OH	1	Stage
OHIO RIVER AT MARIETTA, OH	1	Stage
Middle Ohio South	**3**	
OHIO RIVER AT PARKERSBURG, WV	1	Stage
OHIO RIVER AT POINT PLEASANT, WV	1	Stage
TUG FORK AT STATTS MILLS, WV	1	Stage
Monongahela River	**9**	
BUFFALO CREEK AT BARRACKVILLE, WV	1	Discharge
DECKERS CREEK AT MORGANTOWN, WV	1	Discharge
MONONGAHELA R AT HILDEBRAND LOCK & DAM (LOWER), WV	1	Stage
MONONGAHELA R AT HILDEBRAND LOCK & DAM (UPPER), WV	1	Stage
MONONGAHELA R AT MORGANTOWN LOCK & DAM (LOWER), WV	1	Stage
MONONGAHELA R AT MORGANTOWN LOCK & DAM (UPPER), WV	1	Stage
MONONGAHELA R AT OPEKISKA LOCK & DAM (LOWER), WV	1	Stage
MONONGAHELA R AT OPEKISKA LOCK & DAM (UPPER), WV	1	Stage
WHETSTONE RUN NEAR MANNINGTON, WV	1	Stage
North Branch Potomac	**4**	
ABRAM CREEK AT OAKMONT, WV	1	Discharge
LINTON CREEK NEAR LAUREL DALE, WV	1	Stage
PAINTER RUN NEAR FORT ASHBY, WV	1	Stage
PATTERSON CREEK NEAR HEADSVILLE, WV	1	Discharge
Potomac Direct Drains	**7**	
BACK CREEK NEAR JONES SPRINGS, WV	1	Discharge
MILL CREEK AT BUNKER HILL, WV	1	Discharge
OPEQUON CREEK NEAR MARTINSBURG, WV	1	Discharge
ROCKYMARSH RUN AT SCRABBLE, WV	1	Discharge
TUSCARORA CREEK ABOVE MARTINSBURG, WV	1	Discharge
UNNAMED TRIB TO WARM SPR RUN NR BERKELEY SPR, WV	1	Stage
WARM SPRINGS RUN NEAR BERKELEY SPRINGS, WV	1	Discharge

HUC-8 Watershed (Station Name)	No. in HUC-8	Type
Shenandoah Jefferson	**2**	
BULLSKIN RUN BELOW KABLETOWN, WV	1	Discharge
SHENANDOAH RIVER AT MILLVILLE, WV	1	Discharge
South Branch Potomac	**8**	
BRUSHY FORK NEAR SUGAR GROVE, WV	1	Stage
N F SOUTH BRANCH POTOMAC RIVER AT CABINS, WV	1	Discharge
S F SOUTH BRANCH POTOMAC RIVER AT BRANDYWINE, WV	1	Discharge
S F SOUTH BRANCH POTOMAC RIVER NR MOOREFIELD, WV	1	Discharge
SOUTH BRANCH POTOMAC RIVER AT FRANKLIN, WV	1	Discharge
SOUTH BRANCH POTOMAC RIVER NEAR PETERSBURG, WV	1	Discharge
SOUTH BRANCH POTOMAC RIVER NEAR SPRINGFIELD, WV	1	Discharge
SOUTH MILL CREEK NEAR MOZER, WV	1	Stage
Tug Fork River	**5**	
DRY FORK AT BEARTOWN, WV	1	Discharge
PANTHER CREEK NEAR PANTHER, WV	1	Discharge
TUG FORK AT KERMIT, WV	1	Discharge
TUG FORK AT WILLIAMSON, WV	1	Discharge
TUG FORK DOWNSTREAM OF ELKHORN CREEK AT WELCH, WV	1	Discharge
Twelvepole Creek	**2**	
EAST FORK TWELVEPOLE CREEK NEAR DUNLOW, WV	1	Discharge
TWELVEPOLE CREEK BELOW WAYNE, WV	1	Stage
Tygart Valley River	**17**	
BUCKHANNON R AT BUCKHANNON, WV	1	Stage
BUCKHANNON RIVER AT ALTON, WV	1	Discharge
BUCKHANNON RIVER AT HALL, WV	1	Discharge
ELKWATER FORK NEAR SPANGLER, WV	1	Stage
MIDDLE FORK RIVER AT AUDRA, WV	1	Discharge
SAND RUN NEAR BUCKHANNON, WV	1	Discharge
THREE FORK CREEK NR GRAFTON, WV	1	Discharge
TYGART LAKE NR GRAFTON, WV	1	Stage
TYGART VALLEY R ABOVE OUTLET WORKS, ELKINS, WV	1	Stage
TYGART VALLEY R AT TYGART DAM NR GRAFTON, WV	1	Discharge
TYGART VALLEY R BELOW INLET WORKS, ELKINS, WV	1	Stage
TYGART VALLEY R BELOW OUTLET WORKS, ELKINS, WV	1	Stage
TYGART VALLEY RIVER AT BELINGTON, WV	1	Discharge
TYGART VALLEY RIVER AT COLFAX, WV	1	Discharge
TYGART VALLEY RIVER AT PHILIPPI, WV	1	Discharge
TYGART VALLEY RIVER NEAR DAILEY, WV	1	Discharge
TYGART VALLEY RIVER NEAR ELKINS, WV	1	Stage
Upper Guyandotte	**4**	
CLEAR FORK AT CLEAR FORK, WV	1	Discharge
GUYANDOTTE RIVER AT LOGAN, WV	1	Discharge
GUYANDOTTE RIVER AT MAN, WV	1	Stage
GUYANDOTTE RIVER NEAR BAILEYSVILLE, WV	1	Discharge
Upper Kanawha River	**1**	
KANAWHA RIVER AT KANAWHA FALLS, WV	1	Discharge
Upper New River	**4**	
BLUESTONE RIVER NEAR PIPESTEM, WV	1	Discharge
EAST RIVER AT WILLOWTON, WV	1	Discharge
INDIAN CREEK AT RED SULPHUR SPRINGS, WV	1	Discharge
MIDDLE FORK BRUSH CREEK AT EDISON, WV	1	Stage
Upper Ohio North	**3**	
KINGS CREEK AT WEIRTON, WV	1	Discharge
OHIO R AT NEW CUMBERLAND LOCK & DAM (LOWER), OH	1	Stage
OHIO R AT NEW CUMBERLAND LOCK & DAM (UPPER), OH	1	Stage

HUC-8 Watershed (Station Name)	No. in HUC-8	Type
Upper Ohio South	**6**	
DUNKARD FORK NEAR MAJORSVILLE, WV	1	Stage
OHIO R AT PIKE ISLAND DAM NR WHEELING (UPPER), WV	1	Stage
OHIO R AT PIKE ISLAND LOCK & DAM (LOWER), WV	1	Stage
OHIO RIVER AT WHEELING, WV	1	Stage
WHEELING CREEK AT ELM GROVE, WV	1	Discharge
WHEELING CREEK NEAR MAJORSVILLE, WV	1	Discharge
West Fork River	**7**	
STONEWALL JACKSON LAKE NEAR WESTON, WV	1	Stage
WEST FORK R BL STONEWALL JACKSON DAM NR WESTON, WV	1	Discharge
WEST FORK RIVER AT BUTCHERVILLE, WV	1	Stage
WEST FORK RIVER AT ENTERPRISE, WV	1	Discharge
WEST FORK RIVER AT WALKERSVILLE, WV	1	Stage
WEST FORK RIVER AT WESTON, WV	1	Stage
WEST FORK RIVER NEAR MOUNT CLARE, WV	1	Discharge
Grand Total	**144**	
***There are 83 discharge gages and 61 stage gages**		

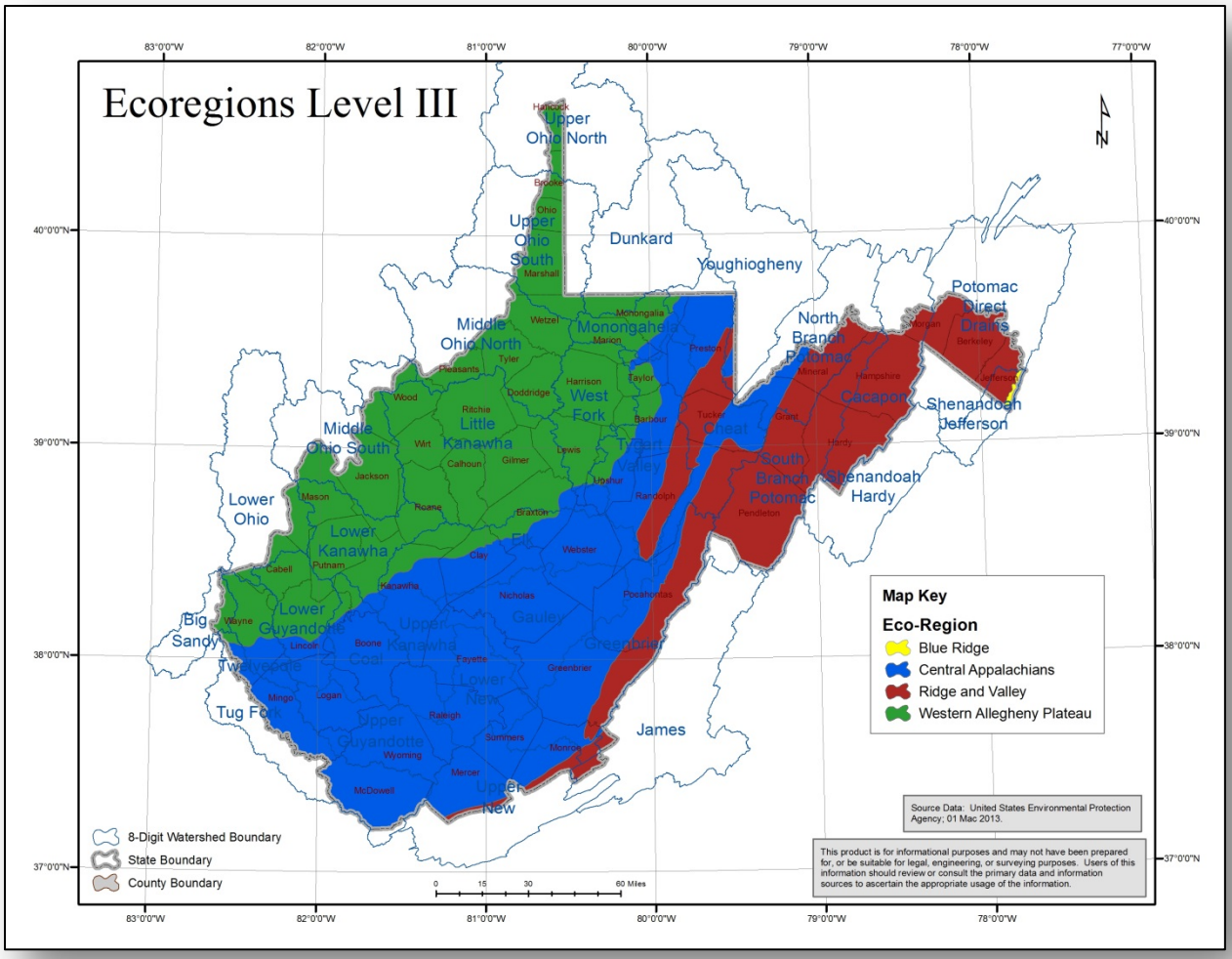


According to the 2010 US Census the region that has the largest population is Region 4, with a total population of 596,480. The region that has the lowest population is Region 3 with 261,043. The HUC-8 watershed with the largest population is the Lower Kanawha River with a population of 162,287. The HUC-8 watershed with the lowest population is the Shenandoah Hardy with 195 (Table A-3).

Table A-3 Population by watershed and region

Region	HUC-8	Population
Region 1	Little Kanawha River	101,091
	Middle Ohio North	41,637
	Middle Ohio South	77,532
	Upper Ohio North	45,130
	Upper Ohio South	89,255
		354,645
Region 2	Cheat River	38,422
	Dunkard	5,029
	Monongahela	121,256
	Tygart Valley	89,478
	West Fork	104,004
	Youghiogheny	3,961
		362,150
Region 3	Cacapon	24,853
	North Branch Potomac	31,736
	Potomac Direct Drains	141,044
	Shenandoah Hardy	195
	Shenandoah Jefferson	31,591
	South Branch Potomac	31,624
		261,043
Region 4	Coal	57,265
	Elk	58,216
	Gauley	42,000
	Greenbrier	43,789
	James	454
	Lower Kanawha	162,287
	Lower New	94,449
	Upper Kanawha	62,451
	Upper New	75,569
		596,480
Region 5	Big Sandy	7,003
	Lower Guyandotte	87,210
	Lower Ohio	54,081
	Tug Fork	48,545
	Twelvepole	30,054
	Upper Guyandotte	51,783
		278,676
	Grand Total	**1,852,994**

The largest EPA Level III Ecoregion in the state is the Central Appalachians which covers an area of 10,458 sq mi. The smallest ecoregion is the Blue Ridge, covering an area of 26 sq mi.

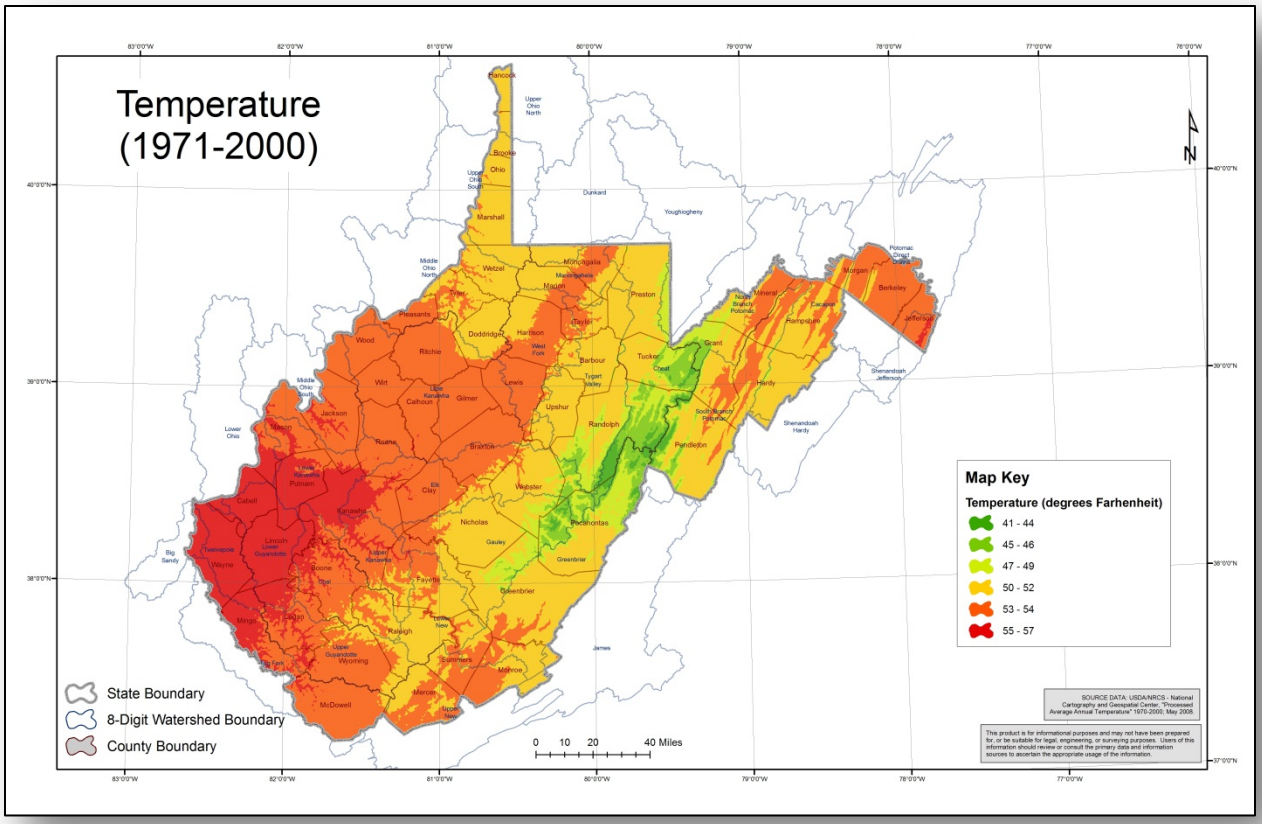


The HUC-8 watershed that receives the highest annual precipitation is the Cheat River with an average of 51.00 inches (Table A-4). The HUC-8 watershed that receives the lowest annual precipitation is the South Branch Potomac with an average of 37.65 inches of precipitation annually.

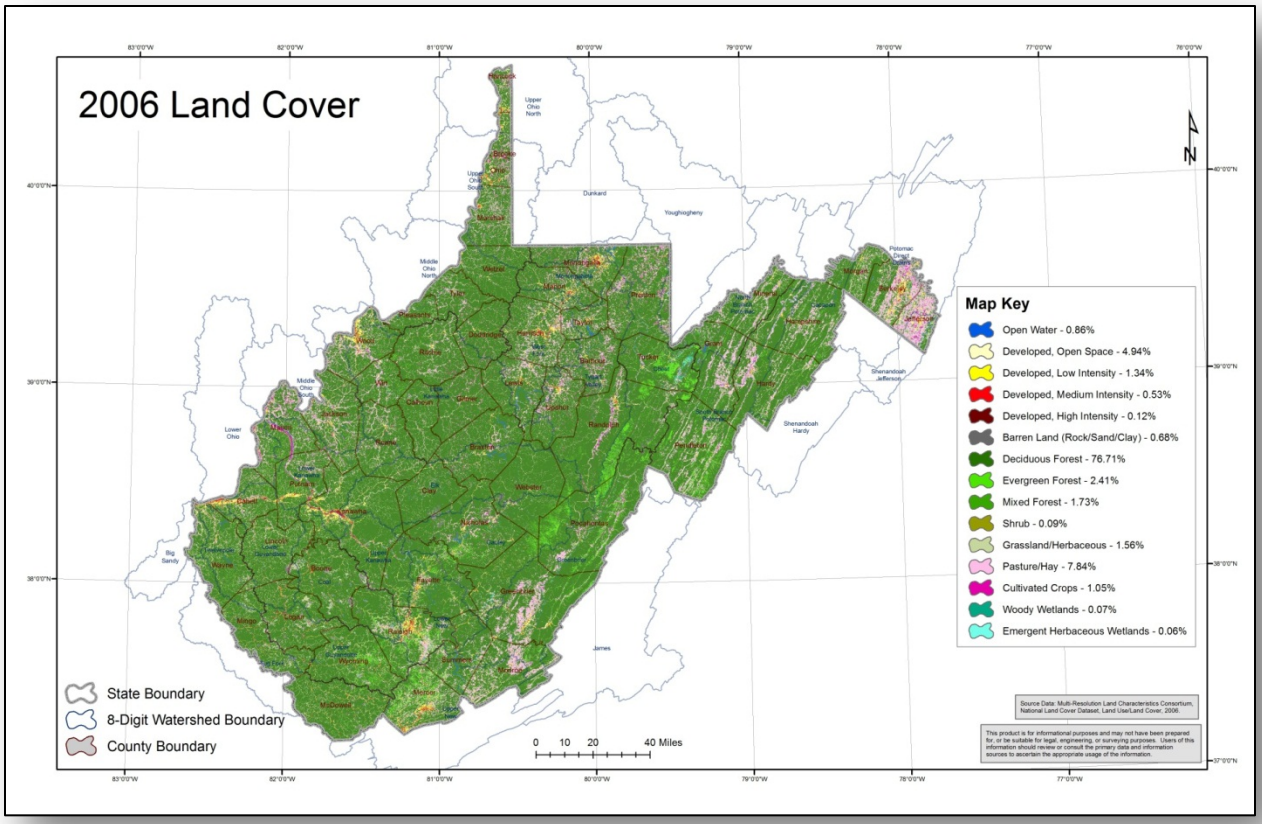
Table A-4 Average precipitation by watershed

HUC-8 Watershed	Average Precipitation
Big Sandy	41.86
Cacapon	37.84
Cheat	**51.00**
Coal	45.68
Dunkard	43.88
Elk	48.84
Gauley	50.62
Greenbrier	42.81
James	42.19
Little Kanawha	44.64
Lower Guyandotte	43.28
Lower Kanawha	41.62
Lower New	43.41
Lower Ohio	40.43
Middle Ohio North	44.91
Middle Ohio South	41.35
Monongahela	44.80
North Branch Potomac	39.54
Potomac Direct Drains	37.69
Shenandoah Hardy	38.71
Shenandoah Jefferson	38.10
South Branch Potomac	***37.65***
Tug Fork	43.07
Twelvepole	43.34
Tygart Valley	49.80
Upper Guyandotte	45.65
Upper Kanawha	44.16
Upper New	38.04
Upper Ohio North	38.34
Upper Ohio South	41.49
West Fork	45.60
Youghiogheny	50.99
Total	**44.21**

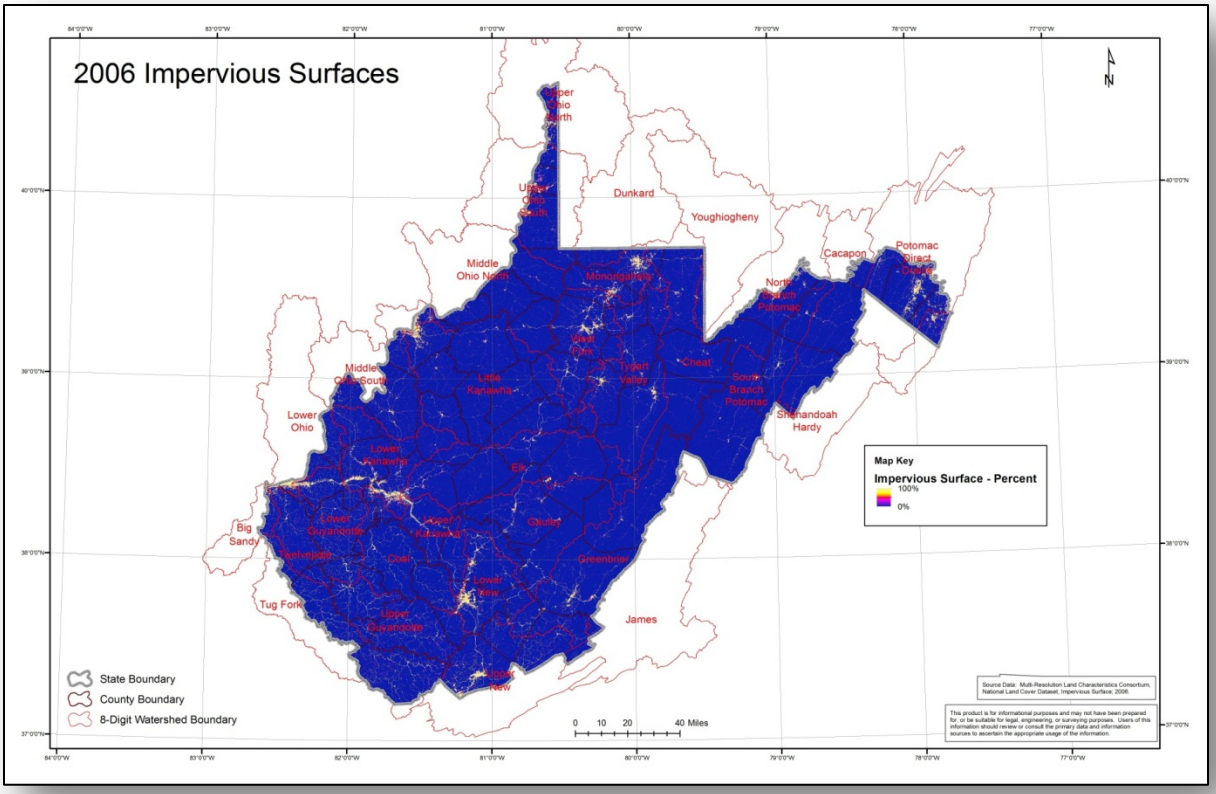
The HUC-8 watershed that has the highest average temperature is the Tug Fork at 57 degrees Fahrenheit. The HUC-8 watershed that has the lowest average temperature is the Cheat River at 41 degrees Fahrenheit.



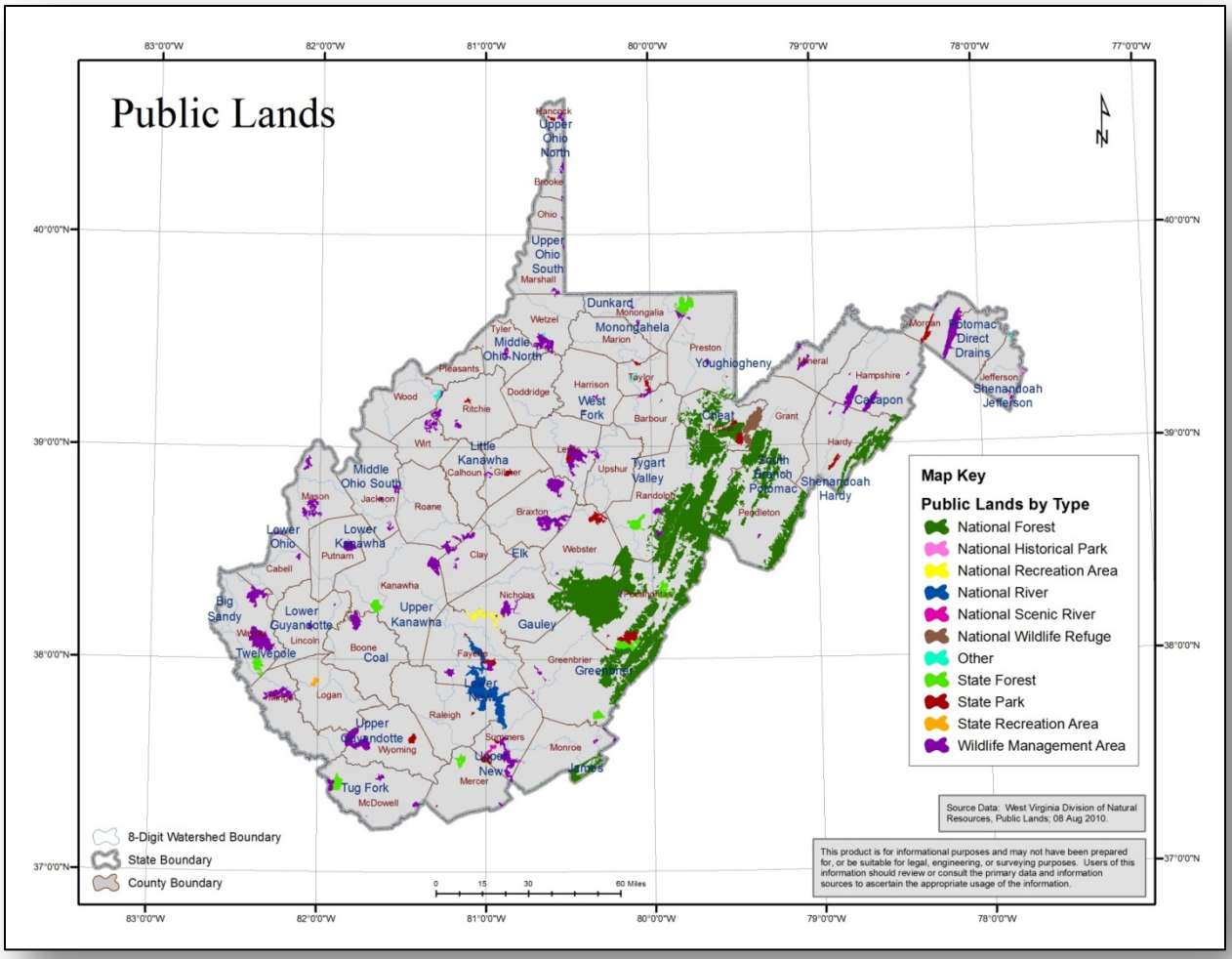
The majority of the state is covered by deciduous forest at 76.71% or over 18,671 sq mi. The smallest landuse classification within the state is Emergent Herbaceous Wetlands which covers 0.06% of the state or slightly over 145 sq mi.



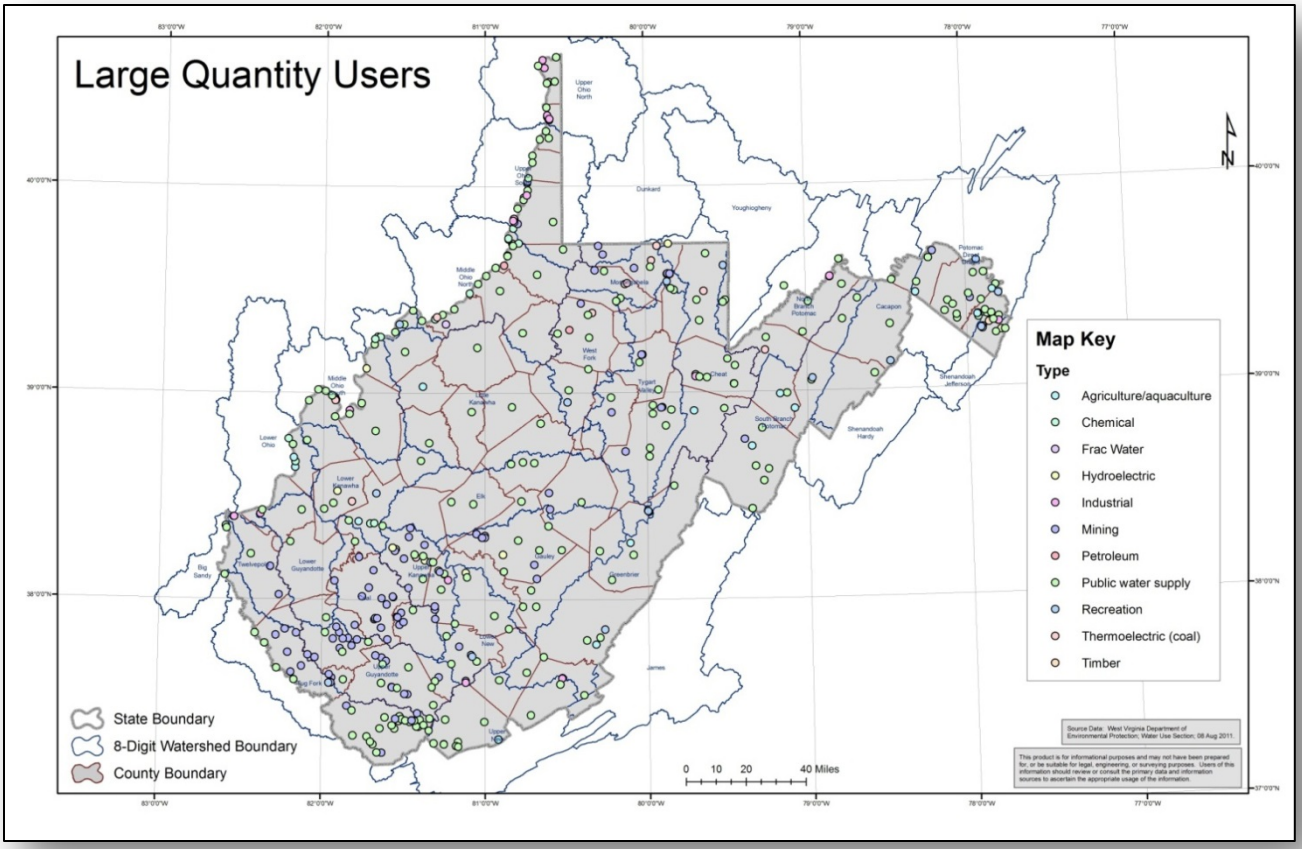
The HUC-8 watershed with the largest amount of impervious surface area is Upper Ohio North (9.6%). The HUC-8 Watershed with the least amount of impervious surface area is the Cacapon, with 0.63%.



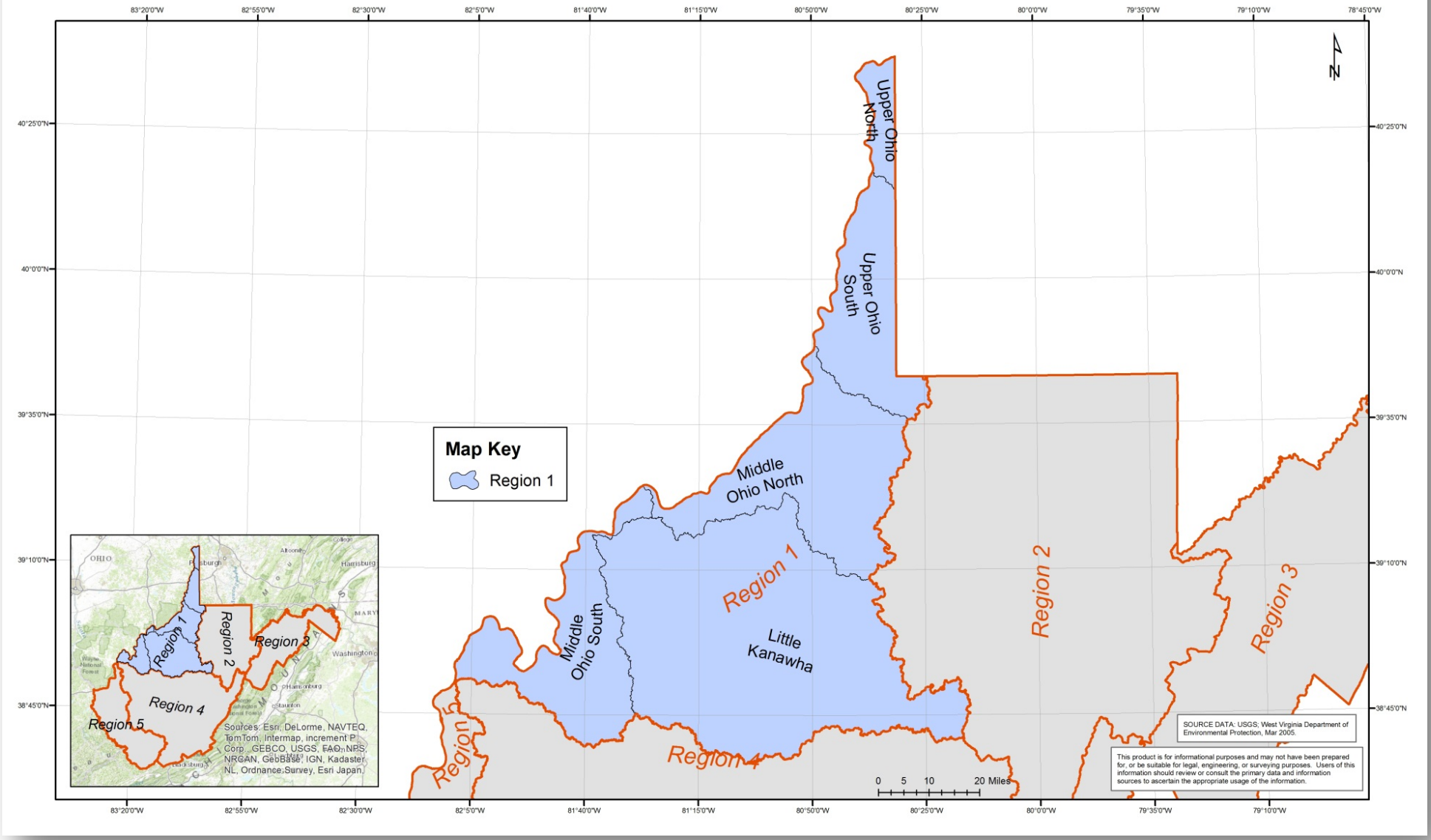
The largest area of public land in the state is the Monongahela National Forest which covers 1,439 sq mi. The least is Fairfax Stone Historical State Monument State Park, covering 0.006 sq mi. Public lands designated as National Forests cover over 1,600 sq mi, while National Historical Parks account for less than 2 sq mi.

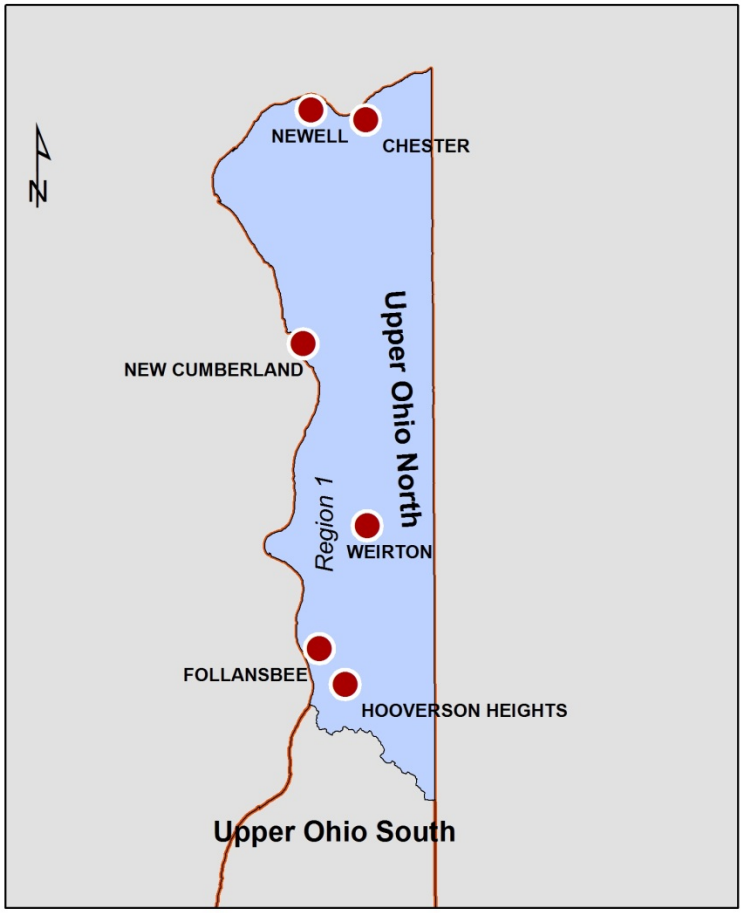


The HUC-8 watershed with the highest annual withdrawal is the North Branch Potomac, with over 404 billion gallons a year. The HUC-8 watershed(s) with the lowest annual withdrawal is the Shenandoah Hardy and the James, with less than 0.01 billion gallons a year.

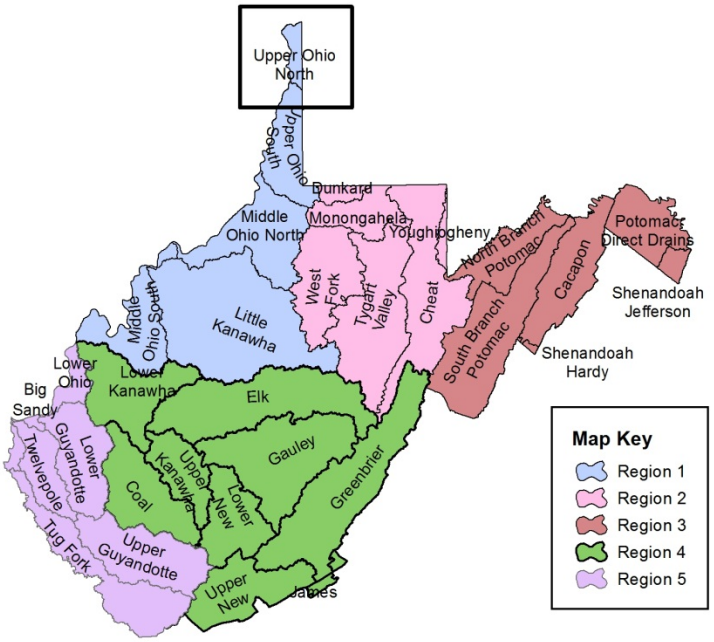


Region 1


Upper Ohio North
Upper Ohio South
Middle Ohio North
Middle Ohio South
Little Kanawha
Region 1
Region 2
Region 3
Region 4
Region 5
Map Key
Region 1
N
0 5 10 20 Miles
SOURCE DATA: USGS; West Virginia Department of Environmental Protection, Mar 2005.
This product is for informational purposes and may not have been prepared for, or be suitable for legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the appropriate usage of the information.
Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster, NL, Ordnance Survey, Esri Japan



Upper Ohio North Watershed



Watershed Summaries

Region 1

Upper Ohio North Watershed

Watershed Description

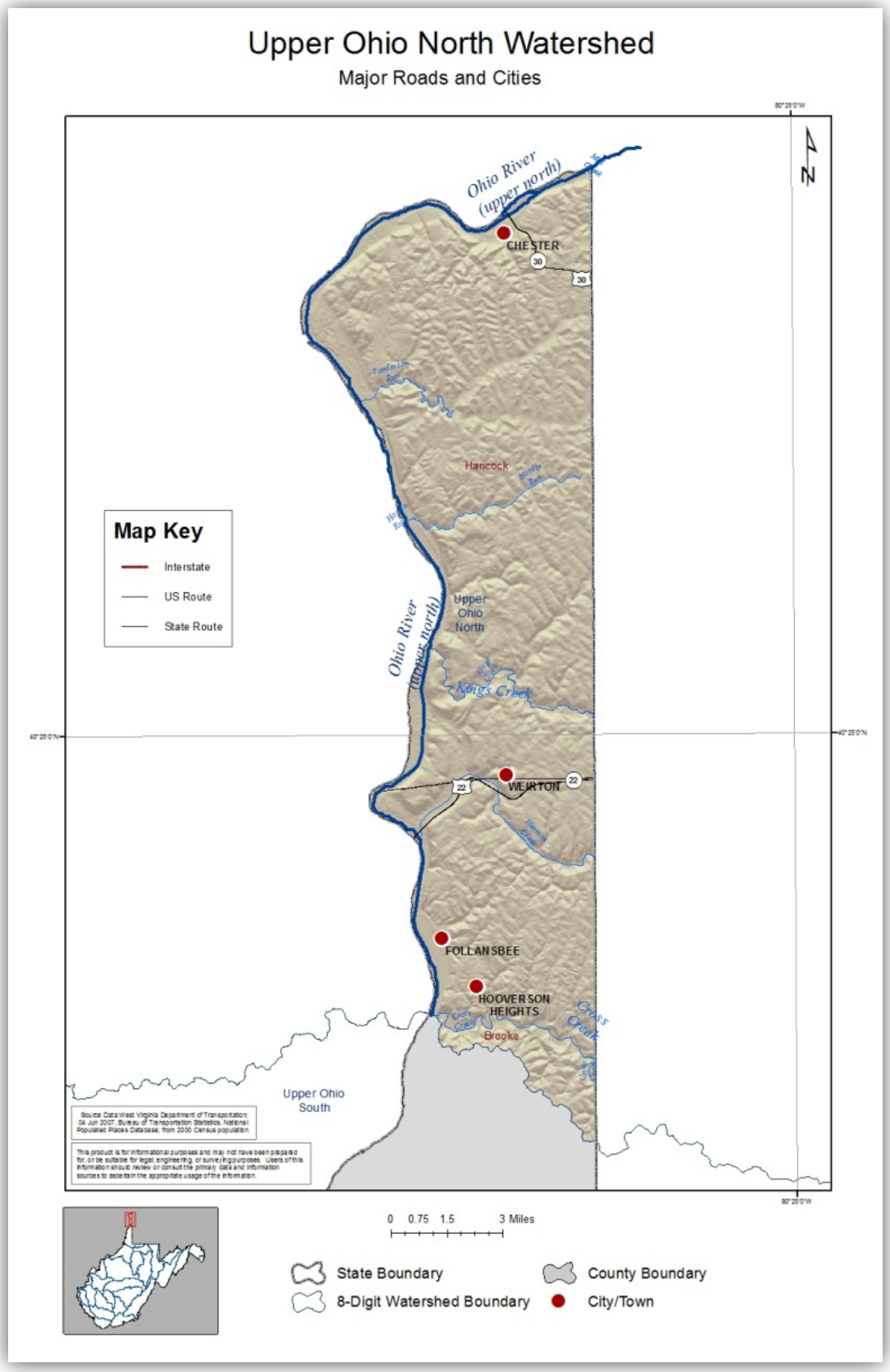
Located in the Northern Panhandle region of West Virginia, the Upper Ohio North Watershed covers 126 square miles in West Virginia and contains all, or portions, of two counties (Brooke and Hancock).

The Upper Ohio North Watershed has 246 miles of streams and rivers and contains the Ohio River mainstem. The Ohio River flows southerly along the West Virginia-Ohio border. The major tributaries include Kings Creek, Harmon Creek, Cross Creek and Tomlinson Run. The Upper Ohio North Watershed also encompasses Tomlinson Run Lake, which is a 30-acre lake located in Tomlinson Run State Park in Hancock County.

Additionally, the watershed encompasses all, or portions, of the following state and federal public lands: two wildlife management areas (Cross Creek and Hillcrest), one state park (Tomlinson Run) and several river islands included in the Ohio River Islands National Wildlife Refuge.

Demographics

The Upper Ohio North Watershed has a total population of approximately 45,130. The watershed has four cities and towns with a population exceeding 2,000. The largest city within the watershed is Weirton with a total population of 19,746, followed by Follansbee (2,986), Hooverson Heights (2,590) and Chester (2,585).


Upper Ohio North Watershed
Major Roads and Cities
Ohio River (upper north)
CHESTER
30
Hancock
Map Key
Interstate
US Route
State Route
Upper Ohio North
Kings Creek
WEIRTON
22
FOLLANSBEE
HOOVERSON HEIGHTS
Brooke
Upper Ohio South
0 0.75 1.5 3 Miles
State Boundary
County Boundary
8-Digit Watershed Boundary
City/Town

Geography and Geology

The Upper Ohio North Watershed lies completely within the Western Allegheny Plateau Ecoregion, which is comprised of rounded hills with wide fertile valleys, mixed oak forests and agricultural lands. The average elevation for the watershed is 1,096 feet above mean sea level, with the highest elevation of 1,621 feet located on Mt. Pleasant. The lowest elevation, 636 feet, is located on the Ohio River. The average annual temperature for the watershed is 53 degrees Fahrenheit and ranges from 51 to 53 degrees. The average annual precipitation for the Upper Ohio North Watershed is 38.34 inches per year.

The majority (61%) of the watershed is covered by forest area, while 9% is cultivated. Approximately 20% of the land cover is classified as developed and 9.6% is defined as impervious surface area. The surface geology in the Upper Ohio North Watershed is predominantly (63%) shale, while 26% of the geology is comprised of shale and 11% is alluvium.

The United States Geological Survey (USGS), in conjunction with federal, state and local agencies, including the DEP, cooperatively funds the USGS stream gaging network to monitor water availability. Currently, there are three surface water gaging stations located within the watershed. Data is collected from the stations located on Kings Creek (1) and two on the Ohio River at New Cumberland Locks and Dam. The recorded data can be accessed at http://waterdata.usgs.gov/nwis.

LQU data

Table 1-1 contains a list of all Large Quantity User (LQU) facilities in the Upper Ohio North Watershed that are currently operating, their Standard Industrial Category (SIC) of use, the average percent of source water withdrawn annually, percent withdrawn from the watershed and county, as well as others if intakes are located elsewhere, and the average amount of water withdrawn by the facility based on the most recent three years of monthly data. A detailed discussion about categories of use type and comparisons of use to statewide withdrawals and consumption is available in Chapter 2 of the Plan. Chapter 4 of the Plan includes data and discussion about future use projections. The following is a summary of data collected regarding the facilities:

- 6 Public Water Supply Facilities
    - Weirton Water is the largest user, averaging 1.2 billion gallons annually
    - Oakland PSD withdraws the least, averaging 37.7 million gallons annually

- 5 Industrial facilities
    - ISG Weirton closed in 2009
- 2 Petroleum facilities: Ergon West Virginia, Inc. and Koppers Inc.
- 1 Recreation facility: Mountaineer Race Track Casino

Table 1-1 All facilities withdrawing from Upper Ohio North Watershed organized by Use Category and Intake Source and Location (watershed and county). Blanks indicate that no additional withdrawals were occurring.

Facility ID	Facility Name	Use Category	Source and % of 3 Year Average		Watershed and % of 3 Year Average	County and % of 3 Year Average		3 Year Annual Average (gallons)
10078	ArcelorMittal Weirton	Industrial	Surface Water 100.00%		Upper Ohio North 100.00%	Hancock 100.00%		11,253,300,000
5152	Arroyo Air Separation Plant	Industrial		Groundwater 100.00%	Upper Ohio North 100.00%	Hancock 100.00%		136,235,520
10012	City of Chester	Public water supply	Surface Water 100.00%		Upper Ohio North 100.00%	Hancock 100.00%		123,690,000
7022	City of New Cumberland	Public water supply		Groundwater 100.00%	Upper Ohio North 100.00%	Hancock 100.00%		163,820,667
1112	Ergon West Virginia, Inc.	Petroleum	Surface Water 0.98%	Groundwater 99.02%	Upper Ohio North 100.00%	Hancock 38.67%	PA 61.33%	213,093,153
1582	Follansbee Hooverson Heights	Public water supply	Surface Water 100.00%		Upper Ohio North 100.00%	Brooke 100.00%		155,115,000
3137	Follansbee Municipal Water	Public water supply		Groundwater 100.00%	Upper Ohio North 100.00%	Brooke 100.00%		311,318,500
3558	Koppers Inc.	Petroleum	Surface Water 100.00%		Upper Ohio North 100.00%	Brooke 100.00%		112,478,235
1923	Mountain State Carbon - Follansbee Coke Plant	Industrial	Surface Water 100.00%		Upper Ohio North 100.00%	Brooke 100.00%		2,736,773,333
7767	Mountaineer Race Track Casino	Recreation		Groundwater 100.00%	Upper Ohio North 100.00%	Hancock 100.00%		87,153,876
10045	Oakland Public Service District	Public water supply		Groundwater 100.00%	Upper Ohio North 100.00%	Hancock 100.00%		37,702,533
1187	Weirton Water Treatment Plant	Public water supply	Surface Water 88.96%	Groundwater 11.04%	Upper Ohio North 100.00%	Brooke 100.00%		1,212,390,831
3554	Wheeling-Nisshin	Industrial		Groundwater 100.00%	Upper Ohio North 100.00%	Brooke 100.00%		146,016,000

Figures 1-1 through 1-4 summarize the breakdown of the share total withdrawals occurring among currently operating facilities, the trends in use over time for each industry group, and the amount and share of source water withdrawn by the currently operating LQUs in the watershed.

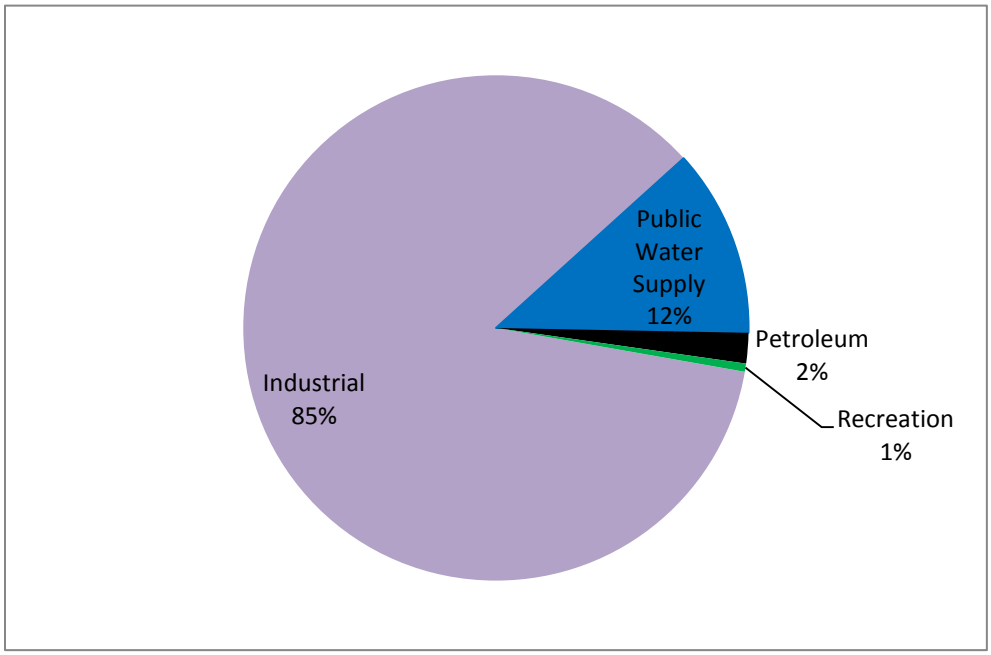
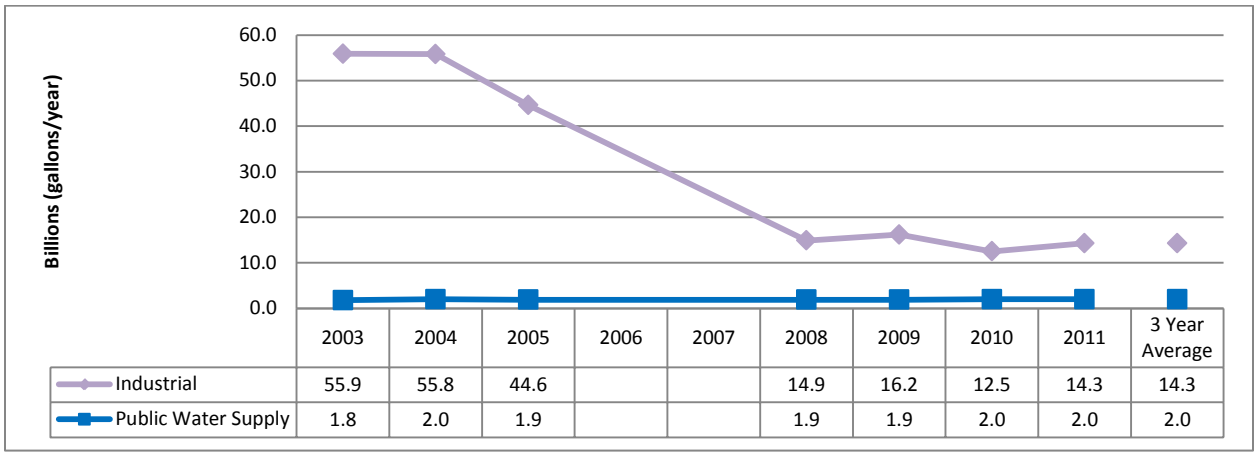
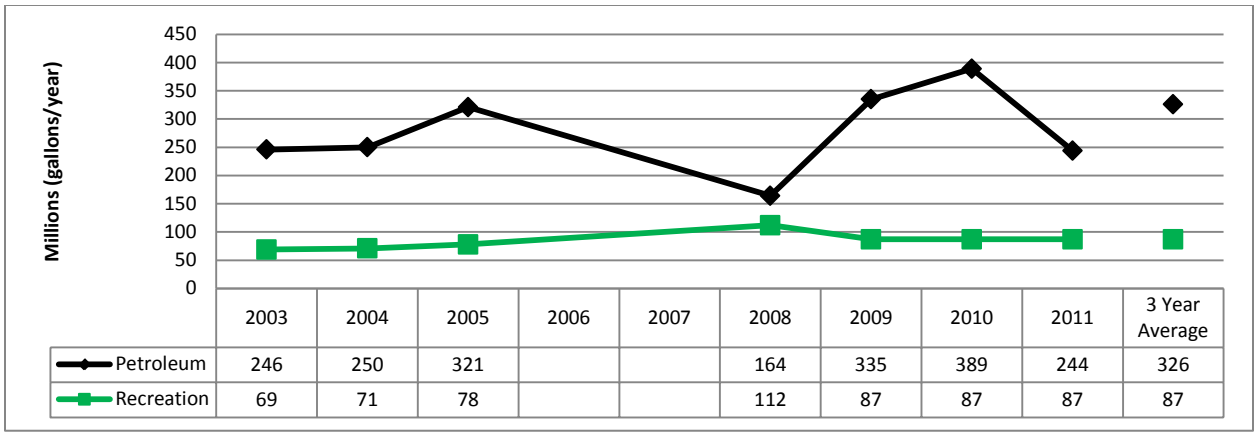


Figure 1-1 Upper Ohio North Watershed LQU percent of total average annual water withdrawals by sector.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Industrial	55.9	55.8	44.6			14.9	16.2	12.5	14.3	14.3
Public Water Supply	1.8	2.0	1.9			1.9	1.9	2.0	2.0	2.0

Figure 1-2 Upper Ohio North Watershed LQU water withdrawal trends for the Industrial and Public Water Supply SIC categories, measured in billions of gallons per year.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Petroleum	246	250	321			164	335	389	244	326
Recreation	69	71	78			112	87	87	87	87

Figure 1-3 Upper Ohio North Watershed LQU water withdrawal trends for the Petroleum and Recreation SIC categories, measured in millions of gallons per year.

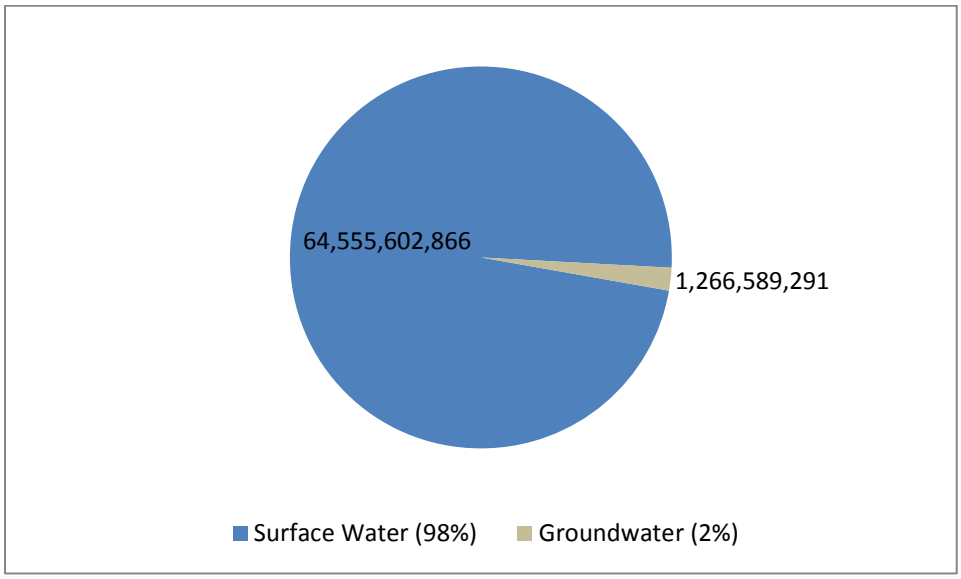
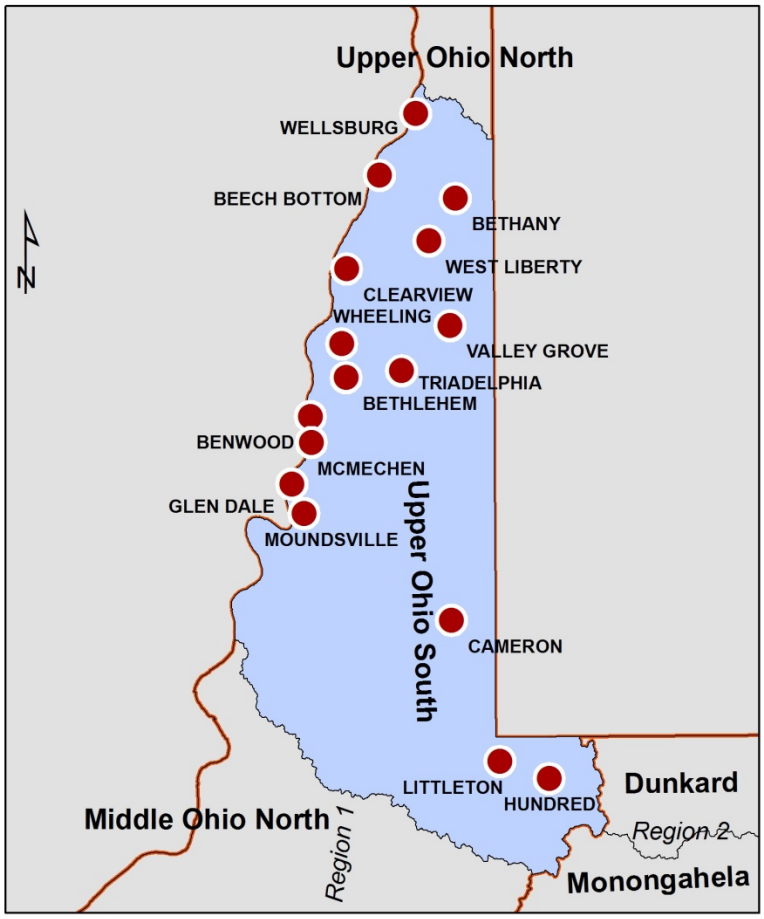


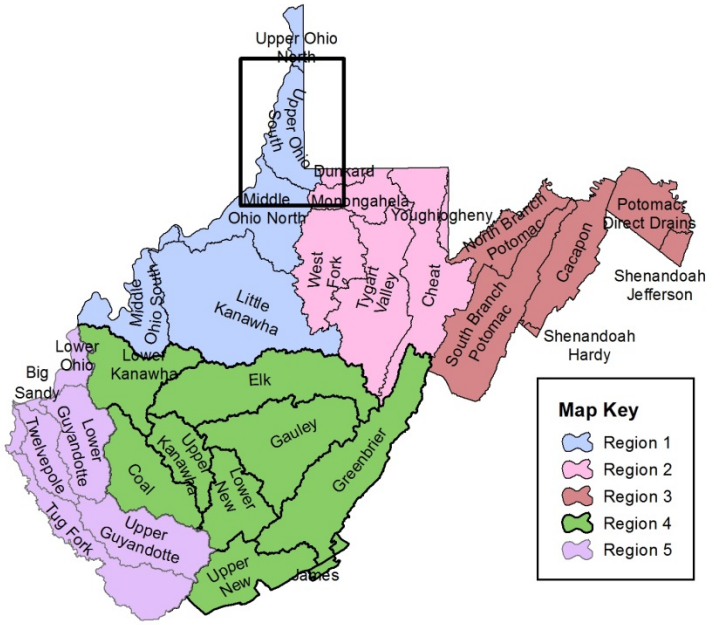
Figure 1-4 Average annual gallons of water withdrawn by LQUs from groundwater and surface water sources in the Upper Ohio North Watershed.

Interbasin transfers occur when water is permanently moved from one watershed to another. This can occur in a number of ways. However, only three possible routes of transfer are considered here; see Chapter 2 of the Plan for a discussion of possibilities and data limitations. The following is a detailed list of interbasin transfers occurring between the Upper Ohio North and other HUC-8 watersheds as a result of LQU operations in 2011:

- Withdrawals vs. Stream Discharges
    - Rain CII Carbon LLC withdraws a three year average of approximately 48.7 million gallons of water from the Upper Ohio South watershed for use as process water, potable water for employee use and consumption, cooling water, and fire suppression. A three year average equal to 14.3 million gallons of excess water is generally discharged into the Upper Ohio South watershed via NPDES outfalls on the Ohio River.
- Withdrawals vs. POTW discharges
    - Rain CII Carbon LLC withdraws a three-year average of approximately 48.7 million gallons of water from the Upper Ohio South Watershed for use as process water, potable water for employee use and consumption, cooling water, and fire suppression. A three year average equal to approximately 43,700 gallons is discharged annually to the Moundsville Sanitary Plant in the Upper Ohio South Watershed. However, a three-year average of 19,300 gallons of water is discharged annually into the Upper Ohio North Watershed via the Jefferson County Ohio WWTP.
- Purchased water vs. Stream/POTW Discharges
    - None reported



Upper Ohio South Watershed



Upper Ohio South Watershed

Watershed Description

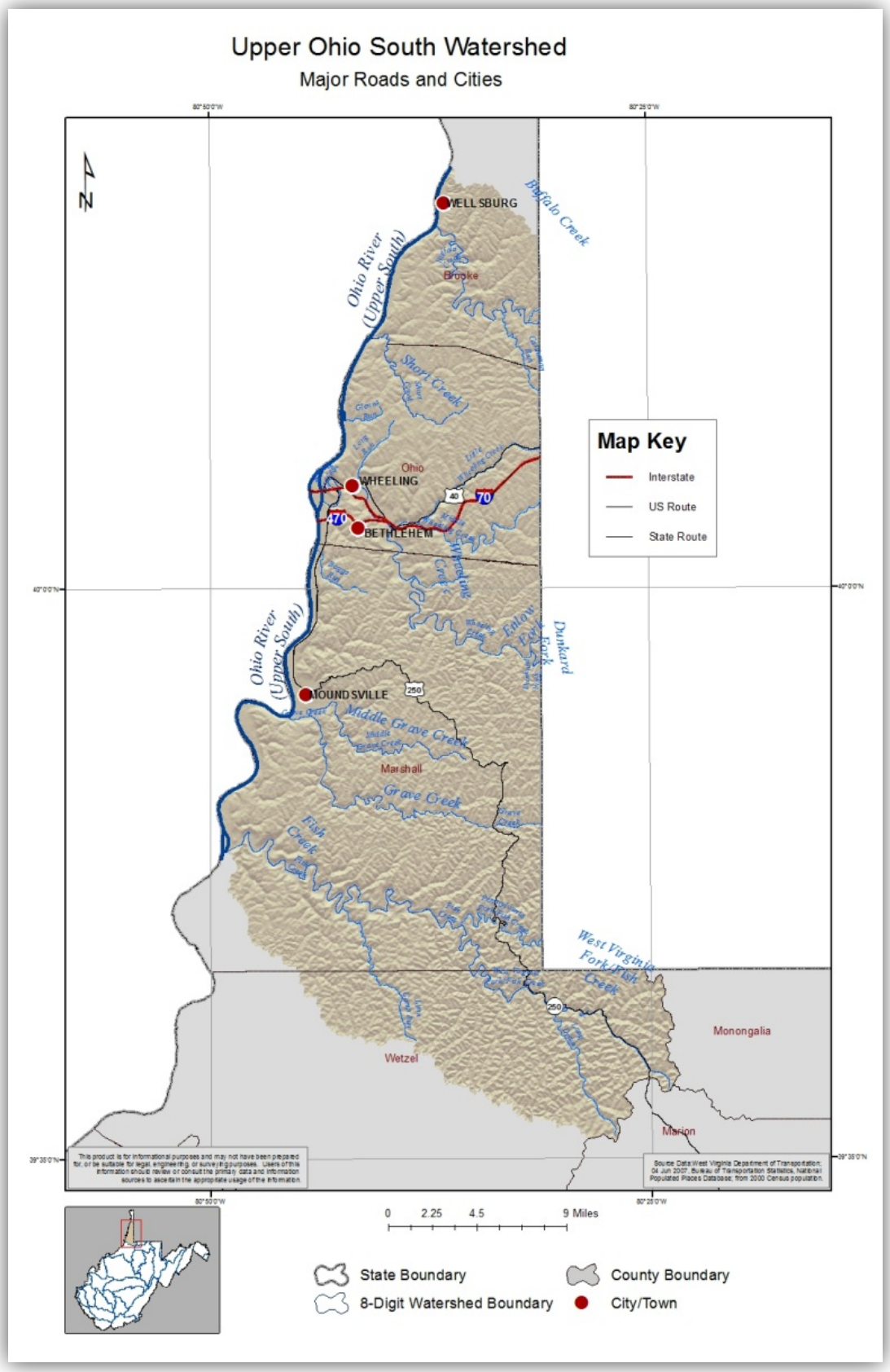
Located in the Northern Panhandle region of West Virginia, the Upper Ohio South Watershed covers 561 square miles in West Virginia and contains all, or portions, of four counties (Marshall, Ohio, Wetzel and Brooke).

The Upper Ohio South Watershed has 1,234 miles of streams and rivers and contains the Ohio River mainstem. The Ohio River flows southerly along the West Virginia-Ohio border. The major tributaries include Buffalo Creek, Wheeling Creek, Grave Creek and Fish Creek.

Additionally, the watershed encompasses all, or portions, of the following state and federal public lands: five wildlife management areas (Bear Rocks Lake, Burches Run, Castelmans Run, Cecil H. Underwood and Dunkard Fork) and several river islands included in the Ohio River Islands National Wildlife Refuge.

Demographics

The Upper Ohio South Watershed has a total population of approximately 89,255. The watershed has four cities and towns with a population exceeding 2,000. The largest city within the watershed is Wheeling with a total population of 28,486, followed by Moundsville (9,318), Wellsburg (2,805) and Bethlehem (2,499).


Upper Ohio South Watershed
Major Roads and Cities
WELLSBURG
Brooke
Ohio River (Upper South)
Buffalo Creek
Short Creek
Ohio
WHEELING
BETHLEHEM
Map Key
Interstate
US Route
State Route
Ohio River (Upper South)
MOUNDSVILLE
Middle Grave Creek
Marshall
Grave Creek
Fish Creek
Dunkard
West Virginia Fork Fish Creek
Monongalia
Wetzel
Marion
0 2.25 4.5 9 Miles
State Boundary
8-Digit Watershed Boundary
County Boundary
City/Town

Geography and Geology

The Upper Ohio South Watershed lies completely within the Western Allegheny Plateau Ecoregion, which is comprised of rounded hills with wide fertile valleys, mixed oak forests and agricultural lands. The average elevation for the watershed is 1,114 feet above mean sea level, with the highest elevation of 1,621 feet. The lowest elevation, 625 feet, is located at the confluence of Fish Creek and the Ohio River. The average annual temperature for the watershed is 52 degrees Fahrenheit and ranges from 49 to 53 degrees. The average annual precipitation for the Upper Ohio South Watershed is 41.49 inches per year. The majority (73%) of the watershed is covered by forest area, while 12% is cultivated. Approximately 11% of the land cover is classified as developed and 3.7% is defined as impervious surface area. The surface geology in the Upper Ohio South Watershed is predominantly (94%) sandstone while 3% of the geology is comprised of alluvium and 3% shale.

The United States Geological Survey (USGS), in conjunction with federal, state and local agencies, including the DEP, cooperatively funds the USGS stream gaging network to monitor water availability. Currently, there are six surface water gaging stations and one groundwater gaging site located within the watershed. Data is collected from the groundwater well site located in Brooke County, while the surface water gaging stations are located on Dunkard Fork (1), Wheeling Creek (1) and multiple locations along the Ohio River (4). The recorded data can be accessed at http://waterdata.usgs.gov/nwis.

LQU data

Table 1-2 contains a list of all Large Quantity User (LQU) facilities in the Upper Ohio South Watershed that are currently operating, their Standard Industrial Category (SIC) of use, the average percent of source water withdrawn annually, percent withdrawn from the watershed and county, as well as others if intakes are located elsewhere, and the average amount of water withdrawn by the facility based on the most recent three years of monthly data. A detailed discussion about categories of use type and comparisons of use to statewide withdrawals and consumption is available in Chapter 2 of the Plan. Chapter 4 of the Plan includes data and discussion about future use projections. The following is a summary of data collected regarding the facilities:

- 12 Public Water Supply facilities
    - Wheeling water plant is the largest withdrawer, averaging 2.5 billion gallons annually
    - Louis Niebergall Ice Co. is the smallest, averaging 9.5 million gallons annually

- 3 Mining facilities
    - Venture Coke Co., LLC closed in 2005
- 2 Thermoelectric (coal) facilities: Ohio Power Co. (Kammer and Mitchell Plants)
- 2 Industrial facilities: RG Steel Wheeling, LLC – Beech Bottom Plant and Reynolds Memorial Hospital
- 1 Agriculture/aquaculture facility: Coronet Foods Inc., which closed in 2007
- 1 Chemical facility: Bayer Material Science LLC.
    - Bayer Material Science LLC gets 3% of its total facility withdrawals from Upper Ohio South, the remainder comes from Middle Ohio North Watershed
- 1 Petroleum facility: Rain CII Carbon, LLC
- 1 Timber facility, Banner Fiberboard Company, which closed in 2006

Table 1-2 All facilities withdrawing from Upper Ohio South Watershed organized by Use Category and Intake Source and Location (watershed and county). Blanks indicate that no additional withdrawals were occurring.

Facility ID	Facility Name	Use Category	Source and % of 3 Year Average		Watershed and % of 3 Year Average		County and % of 3 Year Average		3 Year Annual Average (gallons)
2904	Bayer MaterialScience LLC	Chemical	Surface Water 83.68%	Groundwater 16.32%	Middle Ohio North 96.96%	Upper Ohio South 3.04%	Marshall 100.00%		735,624,151
10040	Beech Bottom Water Department	Public water supply		Groundwater 100.00%	Upper Ohio South 100.00%		Brooke 100.00%		14,688,443
10056	Benwood Municipal Utilities	Public water supply		Groundwater 100.00%	Upper Ohio South 100.00%		Marshall 100.00%		68,721,667
10020	Cameron Water	Public water supply	Surface Water 100.00%		Upper Ohio South 100.00%		Marshall 100.00%		41,178,792
1318	City of Wellsburg	Public water supply		Groundwater 100.00%	Upper Ohio South 100.00%		Brooke 100.00%		220,597,000
3360	Consol Energy - Shoemaker Mine & Preparation Plant	Mining	Surface Water 46.92%	Groundwater 53.08%	Upper Ohio South 100.00%		Marshall 100.00%		611,320,000
10053	Glen Dale Water Works	Public water supply		Groundwater 100.00%	Upper Ohio South 100.00%		Marshall 100.00%		88,872,335
1829	Hammond Public Service District	Public water supply	Surface Water 100.00%		Upper Ohio South 100.00%		Brooke 100.00%		61,694,163
2750	Hundred-Littleton Public Service District	Public water supply		Groundwater 100.00%	Upper Ohio South 100.00%		Wetzel 100.00%		19,889,135
7702	Louis Niebergall Ice Company	Public water supply		Groundwater 100.00%	Upper Ohio South 100.00%		Ohio 100.00%		9,476,400
10054	Marshall County PSD 2	Public water supply		Groundwater 100.00%	Upper Ohio South 100.00%		Marshall 100.00%		95,789,400
3362	McElroy Coal - McElroy Mine and Prep Plant	Mining	Surface Water 77.61%	Groundwater 22.39%	Upper Ohio South 100.00%		Marshall 100.00%		630,737,181
10055	McMechen Municipal Water	Public water supply		Groundwater 100.00%	Upper Ohio South 100.00%		Marshall 100.00%		231,098,667
1352	Moundsville Water Board	Public water supply		Groundwater 100.00%	Upper Ohio South 100.00%		Marshall 100.00%		557,674,333
3807	Ohio Power Co - Kammer Plant	Thermoelectric (coal)	Surface Water 99.99%	Groundwater 0.01%	Upper Ohio South 100.00%		Marshall 100.00%		132,394,974,000
3808	Ohio Power Co - Mitchell Plant	Thermoelectric (coal)	Surface Water 99.90%	Groundwater 0.10%	Upper Ohio South 100.00%		Marshall 100.00%		9,236,808,759
1499	Rain CII Carbon LLC	Petroleum		Groundwater 100.00%	Upper Ohio South 100.00%		Marshall 100.00%		48,722,299
2250	Reynolds Memorial Hospital	Industrial		Groundwater 100.00%	Upper Ohio South 100.00%		Marshall 100.00%		19,490,667
8056	RG Steel Wheeling, LLC - Beech Bottom Plant	Industrial		Groundwater 100.00%	Upper Ohio South 100.00%		Brooke 100.00%		142,360,667
1793	Wheeling Water Plant	Public water supply	Surface Water 97.54%	Groundwater 2.46%	Upper Ohio South 100.00%		Ohio 100.00%		2,464,776,833

Figures 1-5 through 1-9 summarize the breakdown of the share total withdrawals occurring among currently operating facilities, the trends in use over time for each industry group, and the amount and share of source water withdrawn by the currently operating LQUs in the watershed.

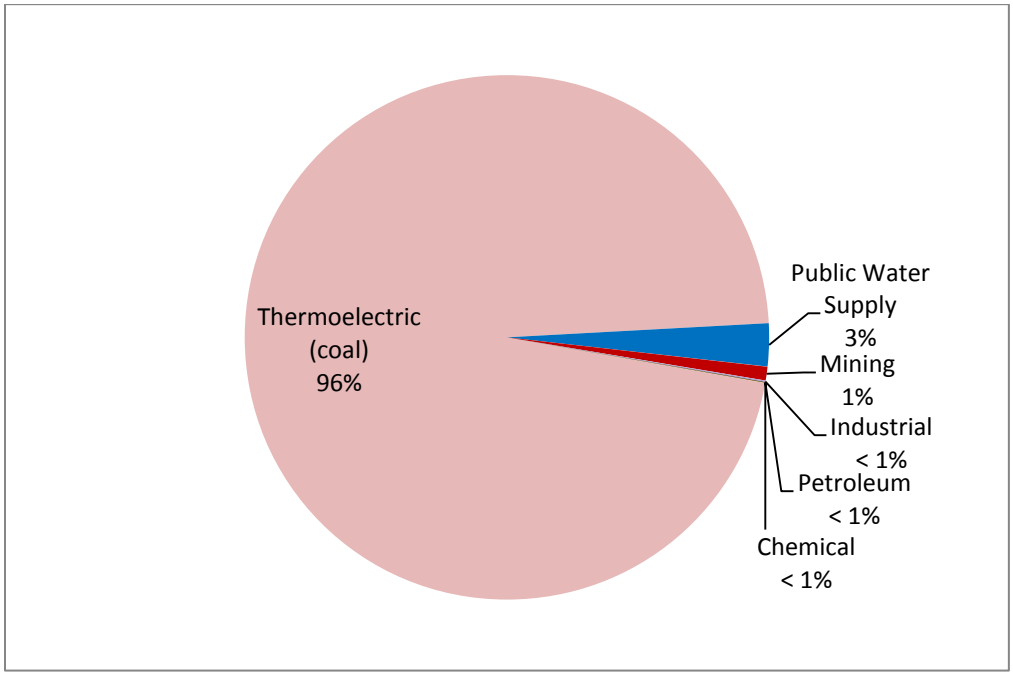
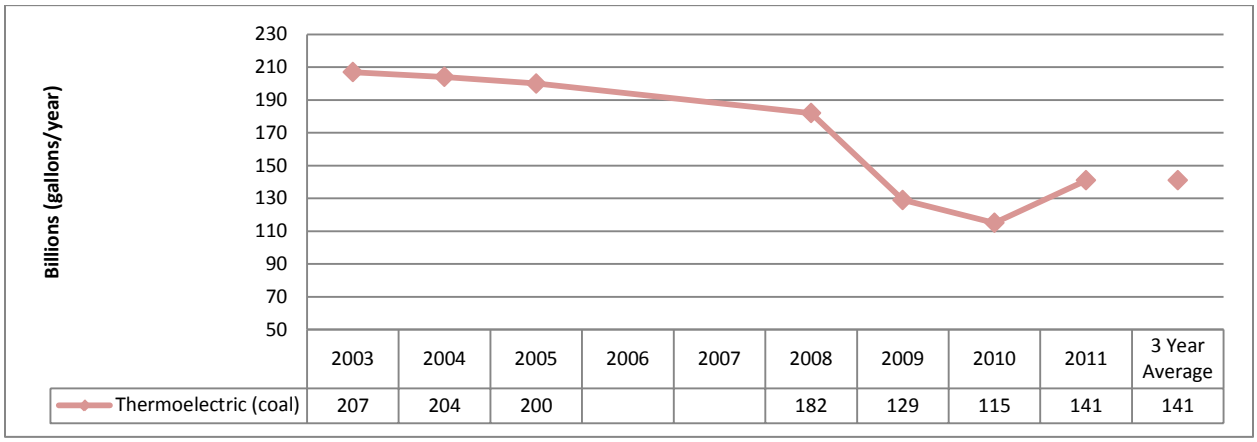
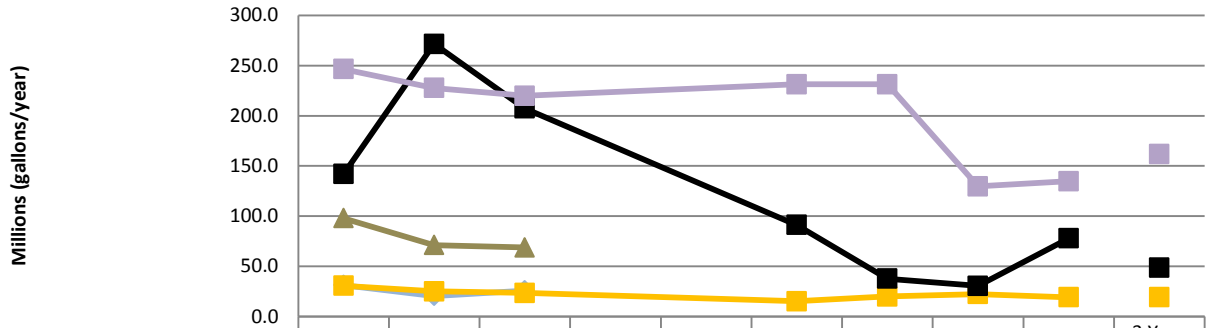


Figure 1-5 Upper Ohio South Watershed LQU percent of total average annual water withdrawals by sector (excluding Frac Water*).



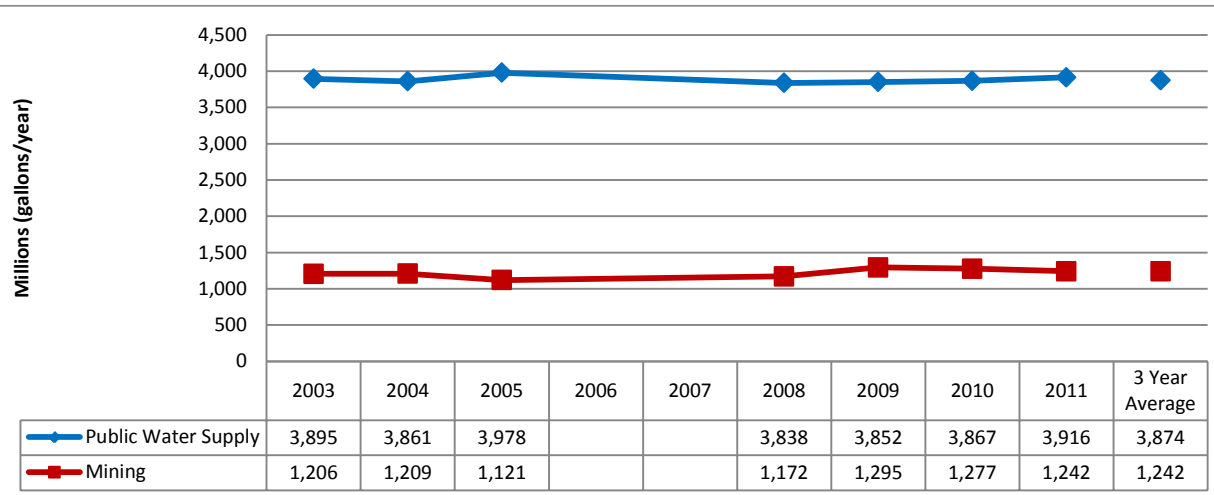
	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Thermoelectric (coal)	207	204	200			182	129	115	141	141

Figure 1-6 Upper Ohio South Watershed LQU water withdrawal trends for the Thermoelectric (coal) SIC category, measured in billions of gallons per year.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Agriculture/aquaculture	31.4	20.5	25.9							
Chemical	30.7	25.1	23.6			15.2	20.0	22.4	19.2	19.2
Timber	98.0	71.2	68.8							
Petroleum	141.9	271.4	207.2			91.3	37.8	30.5	77.9	48.7
Industrial	246.4	227.7	219.8			231.3	231.3	129.7	134.7	161.9

Figure 1-7 Upper Ohio South Watershed LQU water withdrawal trends for the Agriculture/aquaculture, Chemical, Timber, Petroleum, and Industrial SIC categories, measured in millions of gallons per year.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Public Water Supply	3,895	3,861	3,978			3,838	3,852	3,867	3,916	3,874
Mining	1,206	1,209	1,121			1,172	1,295	1,277	1,242	1,242

Figure 1-8 Upper Ohio South Watershed LQU water withdrawal trends for the Public Water Supply and Mining SIC categories, measured in millions of gallons per year.

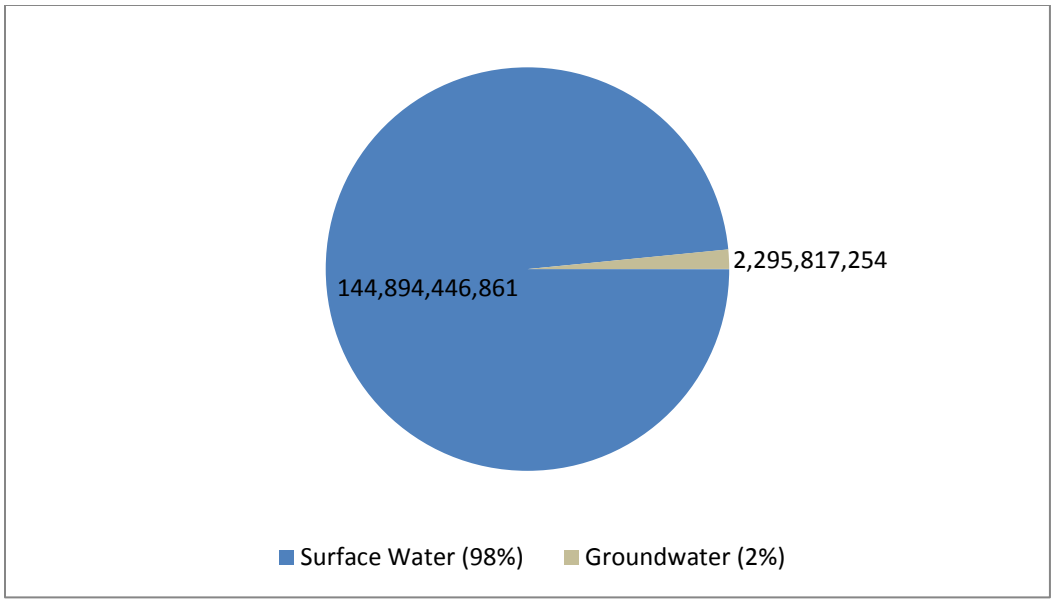


Figure 1-9 Average annual gallons of water withdrawn by LQUs from groundwater and surface water sources in the Upper Ohio South Watershed.

Interbasin transfers occur when water is permanently moved from one watershed to another. This can occur in a number of ways. However, only three possible routes of transfer are considered here; see Chapter 2 of the Plan for a discussion of possibilities and data limitations. The following is a detailed list of interbasin transfers occurring between the Upper Ohio South and other HUC-8 watersheds as a result of LQU operations in 2011:

- Withdrawals vs. Stream Discharges
    - Bayer Material Science LLC withdraws a three-year average of approximately 713 million gallons from surface and groundwater in the Middle Ohio North Watershed and 67 million gallons of groundwater a year from the Upper Ohio South Watershed. The water is used for industry-related purposes including steam generation, process cooling, and on-site potable water. The three-year average of all discharges equals approximately 728.4 million gallons which is all discharged back into the Middle Ohio North Watershed each year.
    - Rain CII Carbon LLC withdraws a three-year average of approximately 48.7 million gallons of water from the Upper Ohio South Watershed for use as process water, potable water for employee use and consumption, cooling water and fire suppression. A three-year average equal to 14.3 million gallons of excess water is generally discharged into the Upper Ohio South Watershed via NPDES outfalls on the Ohio River.

- Withdrawals vs. POTW discharges
    - Rain CII Carbon LLC withdraws a three-year average of approximately 48.7 million gallons of water from the Upper Ohio South Watershed for use as process water, potable water for employee use and consumption, cooling water and fire suppression. In 2009 approximately 43,700 gallons was discharged to the Moundsville Sanitary Plant in the Upper Ohio South Watershed. However, also in 2009, 19,300 gallons of water was discharged into the Upper Ohio North Watershed via the Jefferson County Ohio WWTP. There have been no other years with reported POTW discharges.
- Purchased water vs. Stream/POTW Discharges
    - None reported

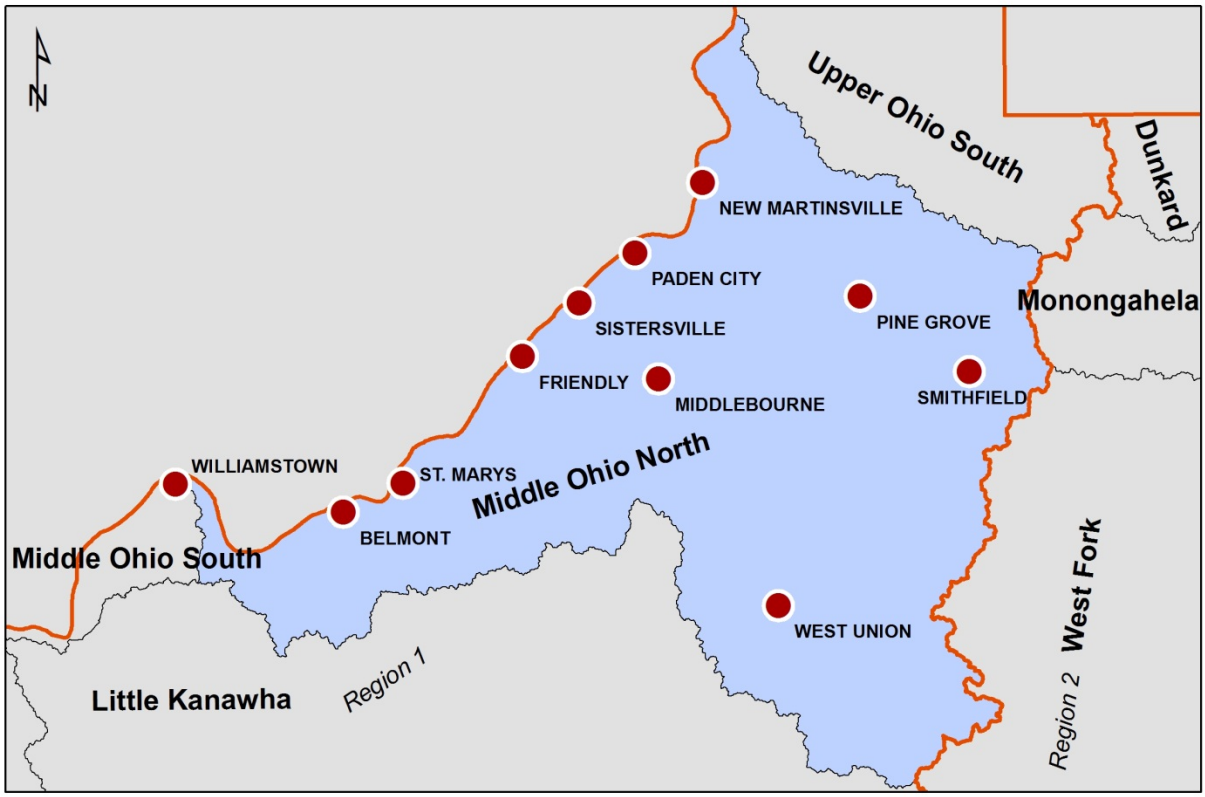
Marcellus Shale

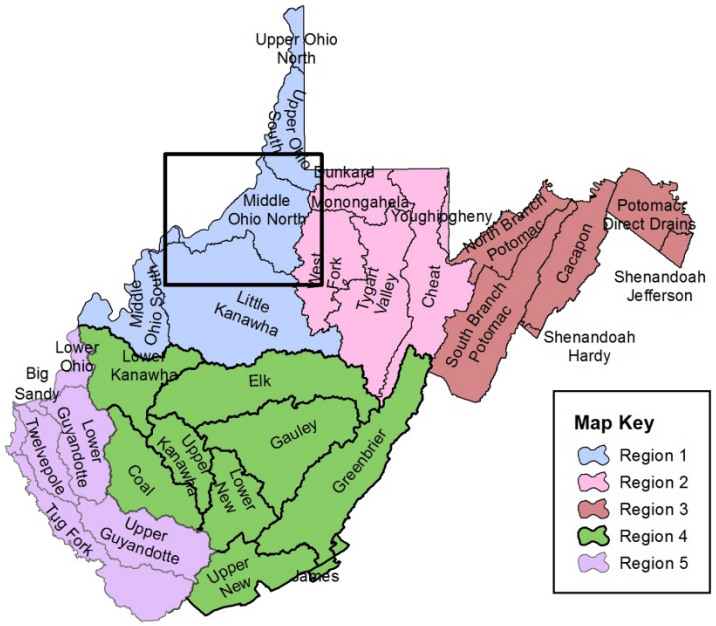
Since the DEP started tracking water use data associated with hydraulic fracturing operations in 2009, approximately 354 million gallons of water have been withdrawn from the Upper Ohio South Watershed. The vast majority of water withdrawn for these purposes from this watershed originated from streams or rivers. The most frequently cited stream and river sources from this region are the Ohio River, Fish Creek, and Wheeling Creek.

Water Source	2009	2010	2011	Grand Total
Commercial Broker	0	0	760,330	760,330
Lake/Reservoir/Pond	0	1,559,166	24,183,348	25,742,514
Stream/River	34,755,546	140,389,706	151,959,112	327,104,364
Grand Total	**34,755,546**	**141,948,872**	**176,902,790**	**353,607,208**

Table 1-3 Water use for hydraulic fracturing in the Upper Ohio South Watershed from 2009-2011 in gallons

Middle Ohio North Watershed





Middle Ohio North Watershed

Watershed Description

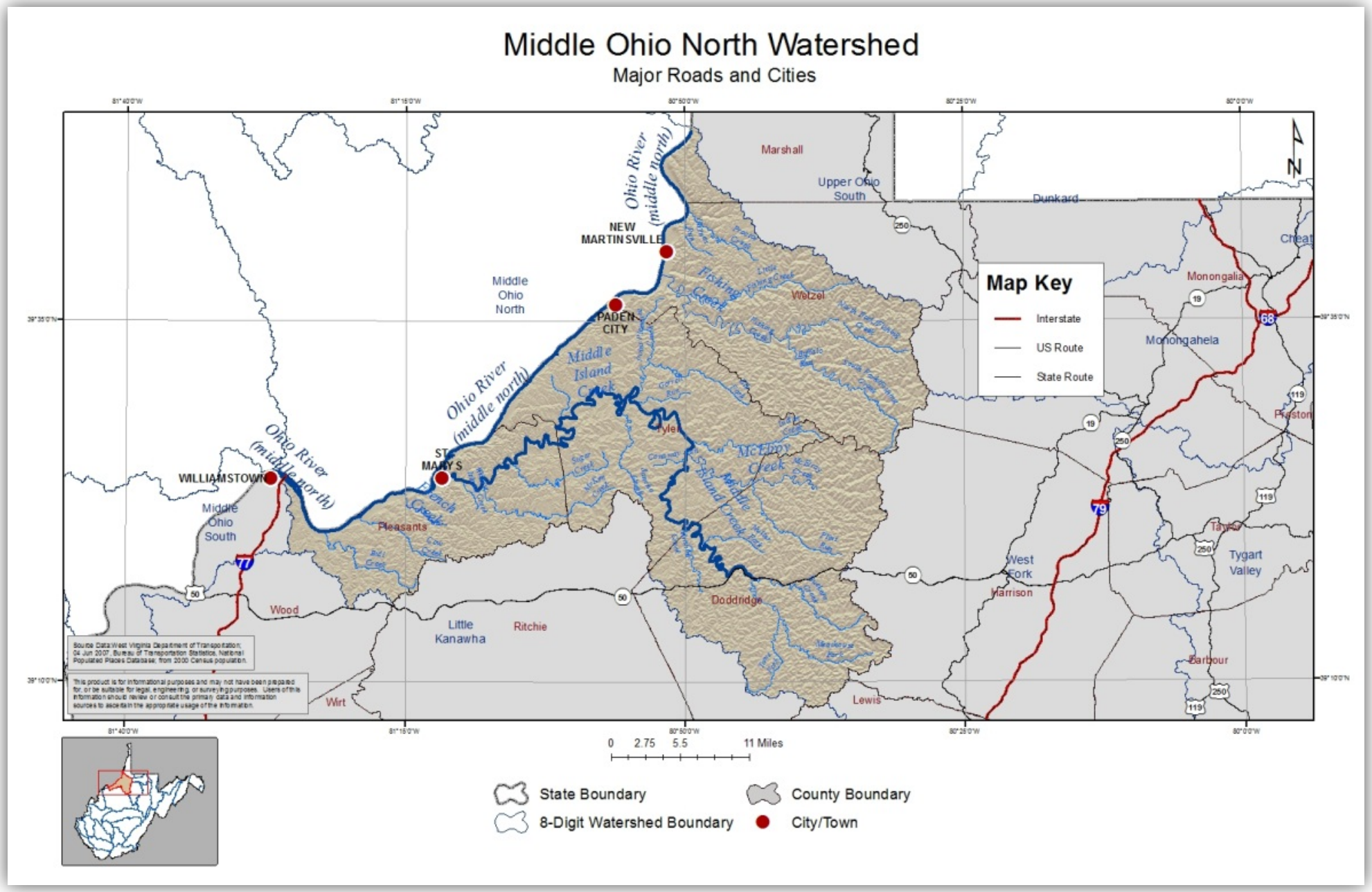
Located in northern West Virginia, the Middle Ohio North Watershed covers 953 square miles in West Virginia and contains all, or portions, of six counties (Tyler, Wetzel, Doddridge, Pleasants, Wood and Marshall).

The Middle Ohio North Watershed has 2,283 miles of streams and rivers and contains the Ohio River mainstem. The Ohio River flows southwesterly along the West Virginia-Ohio border. The major tributaries include Middle Island Creek and Fishing Creek.

Additionally, the watershed encompasses all, or portions, of the following state and federal public lands: seven wildlife management areas (Buffalo Run, Conaway Run, Lantz Farm and Nature Preserve, Lewis Wetzel, Sand Hill, Smoke Camp and The Jug) and several river islands included in the Ohio River Islands National Wildlife Refuge.

Demographics

The Middle Ohio North Watershed has a total population of approximately 41,637. The watershed has four cities and towns with a population exceeding 1,500. The largest city within the watershed is New Martinsville with a total population of 5,366, followed by Williamstown (2,908), Paden City (2,633) and St. Marys (1,860).


Middle Ohio North Watershed
Major Roads and Cities
Map Key
Interstate
US Route
State Route
Ohio River (middle north)
NEW MARTINSVILLE
PADEN CITY
ST. MARYS
WILLIAMSTOWN
Middle Ohio North
Middle Ohio South
Upper Ohio South
Marshall
Dunkard
Cheat
Monongalia
Monongahela
Preston
Taylor
Tygart Valley
West Fork
Harrison
Barbour
Lewis
Doddridge
Tyler
Wetzel
Pleasants
Wood
Ritchie
Little Kanawha
Wirt
Middle Island Creek
McElroy Creek
Fishing Creek
Buffalo Creek
Sugar Creek
Bull Creek
Cow Creek
Neuman Run
Flat Run
Middle Island Creek Trib
Pond Run
Newlonsburg Run
Big Run
Little Fishing Creek
North Fork Fishing Creek
Bigger Run
Brush Creek Trib
Gorrell Run
Sugar Creek
McCoy Creek
Conaway Run
Kinney Run
Pond Run
Source Data:West Virginia Department of Transportation, 04 Jun 2007. Bureau of Transportation Statistics, National Populated Places Database; from 2000 Census population.
This product is for informational purposes and may not have been prepared for, or be suitable for legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the appropriate usage of the information.
0 2.75 5.5 11 Miles
State Boundary
County Boundary
8-Digit Watershed Boundary
City/Town

Geography and Geology

The Middle Ohio North Watershed lies completely within the Western Allegheny Plateau Ecoregion which is comprised of rounded hills with wide fertile valleys, mixed oak forests and agricultural lands. The average elevation for the watershed is 1,010 feet above mean sea level, with the highest elevation of 1,669 feet. The lowest elevation, 582 feet, is located in at the confluence of Cow Creek and the Ohio River below the Willow Island Locks and Dam. The average annual temperature is 53 degrees Fahrenheit and ranges from 51 to 53 degrees. The average annual precipitation for the Middle Ohio North Watershed is 44.91 inches per year.

The majority (86%) of the watershed is covered by forest area, while 6% is cultivated. Approximately 6% of the land cover is classified as developed and 1.2% is defined as impervious surface area.

The surface geology in the Middle Ohio North Watershed is predominantly (96%) sandstone while 3% of the geology is comprised of alluvium and 1% shale.

The United States Geological Survey (USGS), in conjunction with federal, state and local agencies, including the DEP, cooperatively funds the USGS stream gaging network to monitor water availability. Currently, there are two surface water gaging stations located within the watershed. Data is collected from the gaging stations located on Middle Island Creek (1) and the Ohio River at the Hannibal Locks and Dam (1). The recorded data can be accessed at http://waterdata.usgs.gov/nwis.

LQU data

Table 1-4 contains a list of all Large Quantity User (LQU) facilities in the Middle Ohio North Watershed that are currently operating, their Standard Industrial Category (SIC) of use, the average percent of source water withdrawn annually, percent withdrawn from the watershed and county, as well as others if intakes are located elsewhere, and the average amount of water withdrawn by the facility based on the most recent three years of monthly data. A detailed discussion about categories of use type and comparisons of use to statewide withdrawals and consumption is available in Chapter 2 of the Plan. Chapter 4 of the Plan includes data and discussion about future use projections. The following is a summary of data collected regarding the facilities:

- 13 Public Water Supply facilities
    - New Martinsville has the highest three-year average, withdrawing 416 million gallons annually
    - Friendly PSD is the smallest averaging 17.5 million gallons/year
    - The City of Vienna only withdraws 8% of its total from the Middle Ohio North Watershed, the remainder comes from the Middle Ohio South Watershed.
- 6 Chemical facilities
    - Cabot Corporation closed in 2008
    - Bayer Material Science LLC gets 97% of its water from the Middle Ohio North Watershed, the rest comes from Upper Ohio South
- 2 Frac water brokering facilities registered as LQU in this watershed but are not considered here due to double counting.
- 2 Petroleum facilities
    - St. Marys Refining Company closed in 2009
    - New Martinsville Booster Plant is currently operating
- 2 Thermoelectric (coal) facilities: Allegheny Energy (Pleasants Power Station) and Monongahela Power Co. (Willow Island Power Station)
- 1 Hydroelectric facility: New Martinsville Hannibal Hydroelectric Plant

Table 1-4 All facilities withdrawing from Middle Ohio North Watershed organized by Use Category and Intake Source and Location (watershed and county). Blanks indicate that no additional withdrawals were occurring.

Facility ID	Facility Name	Use Category	Source and % of 3 Year Average		Watershed and % of 3 Year Average		County and % of 3 Year Average		3 Year Annual Average (gallons)
2549	Allegheny Energy - Pleasants Power Station	Thermoelectric (coal)	Surface Water 100.00%		Middle Ohio North 100.00%		Pleasants 100.00%		5,676,038,175
2904	Bayer MaterialScience LLC	Chemical	Surface Water 83.68%	Groundwater 16.32%	Middle Ohio North 96.96%	Upper Ohio South 3.04%	Marshall 100.00%		735,624,151
10062	City of Belmont	Public water supply		Groundwater 100.00%	Middle Ohio North 100.00%		Pleasants 100.00%		63,764,311
4891	City of Sistersville	Public water supply	Surface Water 100.00%		Middle Ohio North 100.00%		Tyler 100.00%		115,259,152
10063	City of St. Marys	Public water supply		Groundwater 100.00%	Middle Ohio North 100.00%		Pleasants 100.00%		168,407,333
10070	City of Vienna	Public water supply		Groundwater 100.00%	Middle Ohio North 8.64%	Middle Ohio South 91.36%	Pleasants 8.64%	Wood 91.36%	430,025,044
1696	City of Williamstown	Public water supply		Groundwater 100.00%	Middle Ohio North 100.00%		Wood 100.00%		97,947,333
3139	Consol Energy, Inc.	Chemical		Groundwater 100.00%	Middle Ohio North 100.00%		Marshall 100.00%		89,856,000
7568	Cytec Industries, Inc.	Chemical		Groundwater 100.00%	Middle Ohio North 100.00%		Pleasants 100.00%		1,286,996,426
10119	Eureka Hunter Pipeline, LLC - Carbide Service Cent	Frac Water	Surface Water 100.00%		Middle Ohio North 100.00%		Wetzel 100.00%		0
4700	Friendly PSD	Public water supply		Groundwater 100.00%	Middle Ohio North 100.00%		Tyler 100.00%		17,472,600
2751	Grandview-Doolin PSD	Public water supply		Groundwater 100.00%	Middle Ohio North 100.00%		Wetzel 100.00%		54,814,667
4080	Middlebourne Municipal Water Works	Public water supply	Surface Water 100.00%		Middle Ohio North 100.00%		Tyler 100.00%		40,773,333
2600	Monongahela Power Co - Willow Island Power Station	Thermoelectric (coal)	Surface Water 100.00%		Middle Ohio North 100.00%		Pleasants 100.00%		11,854,943,333
3788	MPM Silicones	Chemical		Groundwater 100.00%	Middle Ohio North 100.00%		Tyler 100.00%		2,050,754,923
1590	New Martinsville Booster Plant	Petroleum		Groundwater 100.00%	Middle Ohio North 100.00%		Wetzel 100.00%		78,556,680
10100	New Martinsville Hannibal Hydroelectric Plant	Hydroelectric	Surface Water 100.00%		Middle Ohio North 100.00%		Wetzel 100.00%		4,431,196,545,957
1176	New Martinsville Water Department	Public water supply		Groundwater 100.00%	Middle Ohio North 100.00%		Wetzel 100.00%		416,068,007
2124	Paden City Water Works	Public water supply		Groundwater 100.00%	Middle Ohio North 100.00%		Wetzel 100.00%		107,505,987
10036	Pine Grove Water	Public water supply	Surface Water 100.00%		Middle Ohio North 100.00%		Wetzel 100.00%		22,955,333
2781	PPG (Natrium)	Chemical	Surface Water 96.55%	Groundwater 3.45%	Middle Ohio North 100.00%		Marshall 100.00%		45,682,717,073
10116	Select Energy Service, LLC	Frac Water	Surface Water 100.00%		Middle Ohio North 100.00%		Pleasants 100.00%		21,092,799
3133	Union Williams Public Service District	Public water supply		Groundwater 100.00%	Middle Ohio North 100.00%		Wood 100.00%		221,090,054
10008	West Union Municipal Water Plant	Public water supply	Surface Water 100.00%		Middle Ohio North 100.00%		Doddridge 100.00%		56,309,000

Figures 1-10 through 1-14 summarize the breakdown of the share total withdrawals occurring among currently operating facilities, the trends in use over time for each industry group, and the amount and share of source water withdrawn by the currently operating LQUs in the watershed.

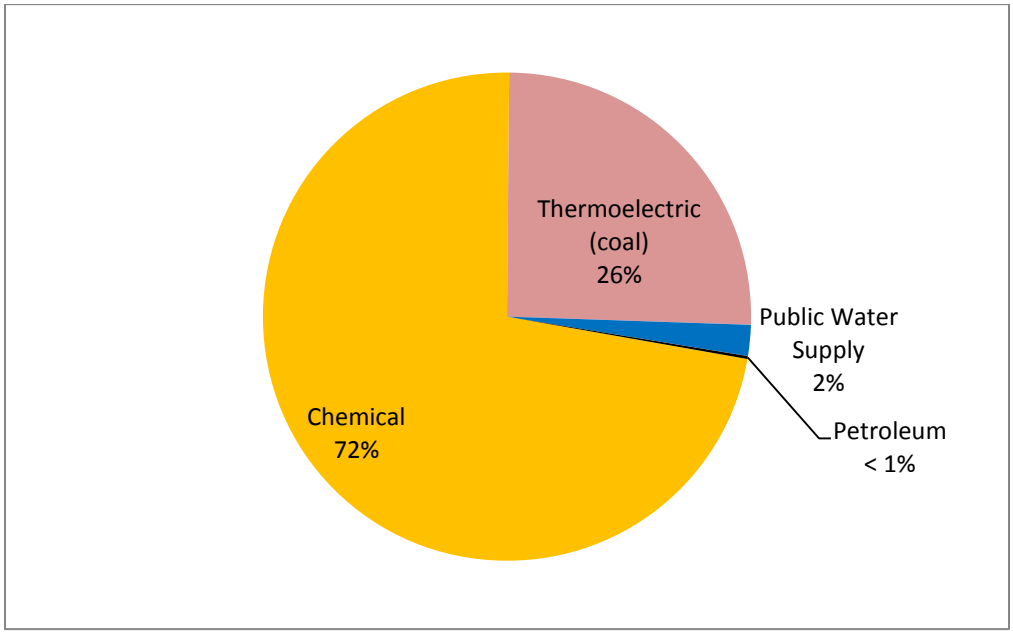


Figure 1-10 Middle Ohio North Watershed LQU percent of total average annual water withdrawals by sector (excluding Hydroelectric and Frac Water*).

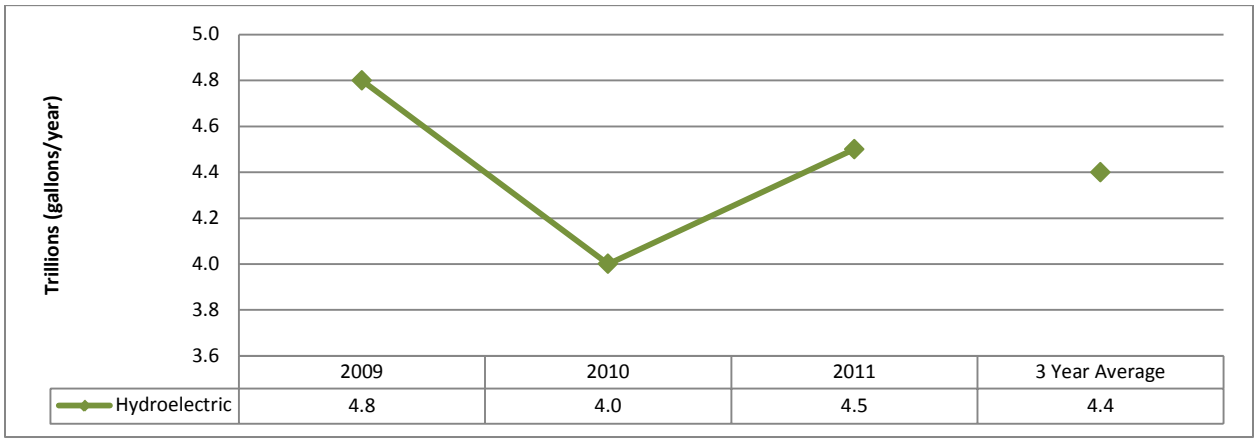
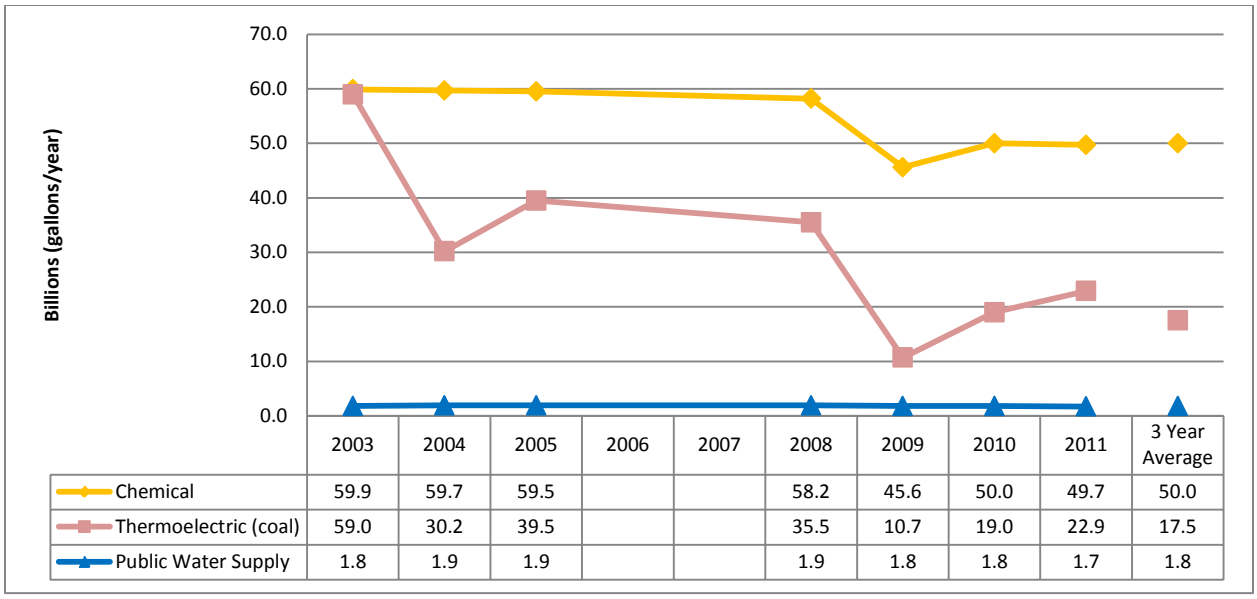
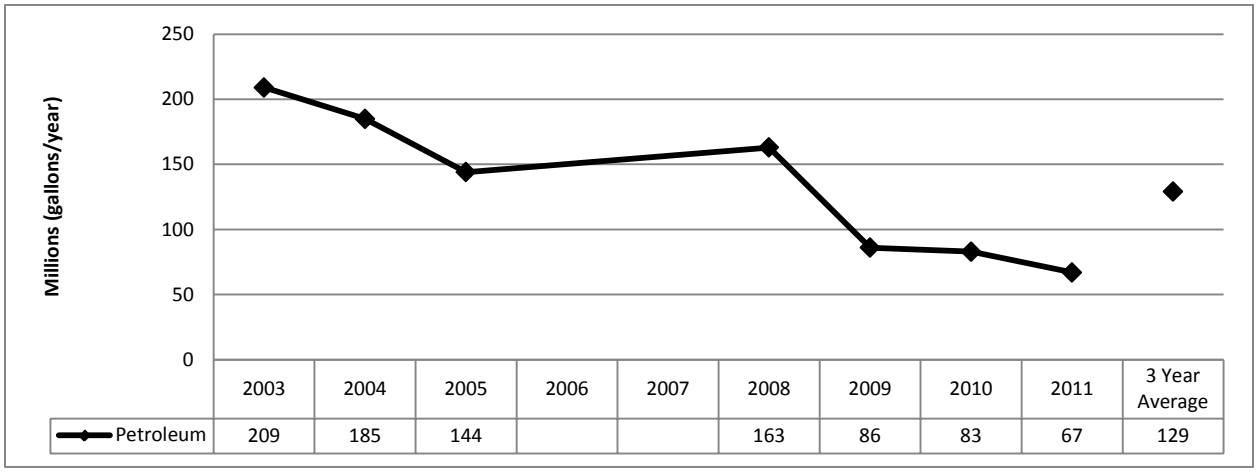


Figure 1-11 Middle Ohio North Watershed LQU water withdrawal trends for the Hydroelectric SIC category, measured in trillions of gallons per year.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Chemical	59.9	59.7	59.5			58.2	45.6	50.0	49.7	50.0
Thermoelectric (coal)	59.0	30.2	39.5			35.5	10.7	19.0	22.9	17.5
Public Water Supply	1.8	1.9	1.9			1.9	1.8	1.8	1.7	1.8

Figure 1-12 Middle Ohio North Watershed LQU water withdrawal trends for the Chemical, Thermoelectric (coal), and Public Water Supply SIC categories, measured in billions of gallons per year.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Petroleum	209	185	144			163	86	83	67	129

Figure 1-13 Middle Ohio North Watershed LQU water withdrawal trends for the Petroleum SIC category, measured in millions of gallons per year.

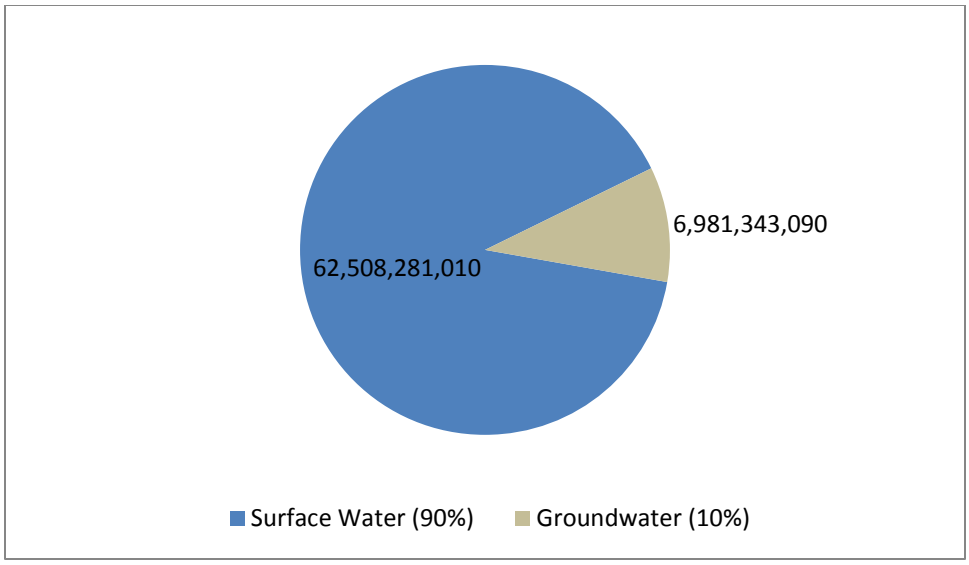


Figure 1-14 Average annual gallons of water withdrawn by LQUs from groundwater and surface water sources in the Middle Ohio North Watershed (excluding Hydroelectric).

Interbasin transfers occur when water is permanently moved from one watershed to another. This can occur in a number of ways. However, only three possible routes of transfer are considered here; see Chapter 2 of the Plan for a discussion of possibilities and data limitations. The following is a detailed list of interbasin transfers occurring between the Middle Ohio North and other HUC-8 watersheds as a result of LQU operations in 2011:

- Withdrawals vs. Stream Discharges
    - Bayer Material Science LLC withdraws a three-year average of approximately 713 million gallons from surface and groundwater in the Middle Ohio North Watershed and 67 million gallons of groundwater a year from the Upper Ohio South Watershed. The water is used for industry-related purposes including steam generation, process cooling, and on-site potable water. The three-year average of all discharges equals approximately 728.4 million gallons which is all discharged back into the Middle Ohio North Watershed each year.
- Withdrawals vs. POTW discharges
    - None reported
- Purchased water vs. Stream/POTW Discharges
    - None reported

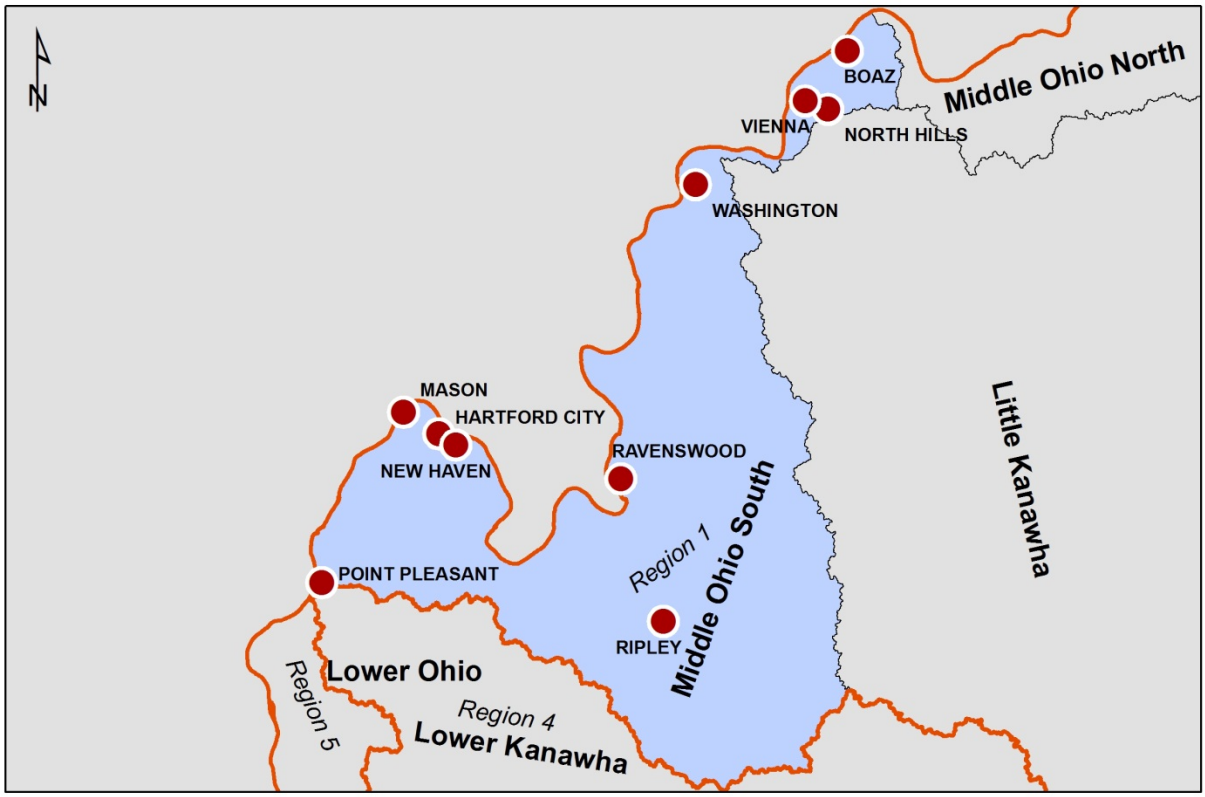
Marcellus Shale

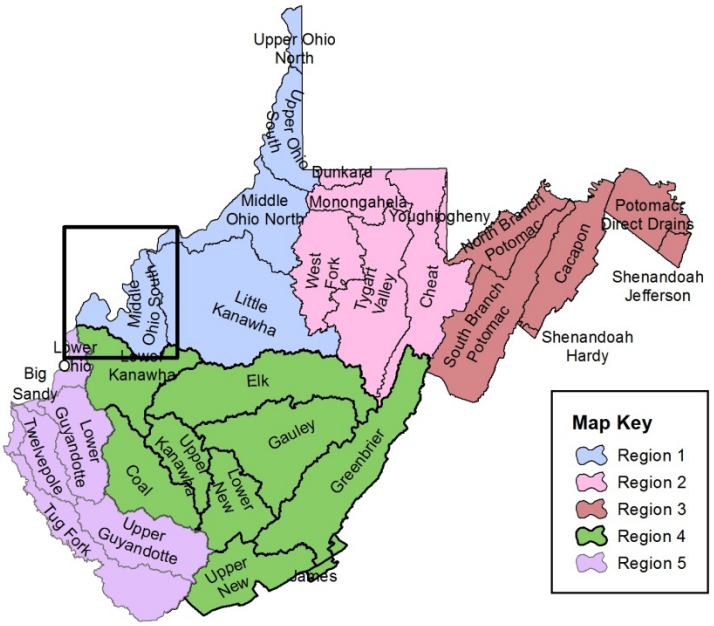
Since the DEP started tracking water use data associated with hydraulic fracturing operations in 2009, approximately 417 million gallons of water have been withdrawn from the Middle Ohio North Watershed. In this watershed, commercial sale of water makes up the majority of source water for the oil and gas exploration industry. The most frequently cited stream and river sources from this region are the Ohio River, Middle Island Creek, and Fishing Creek.

Water Source	2009	2010	2011	Grand Total
Commercial Broker	0	71,613,108	184,131,723	255,744,831
Lake/Reservoir/Pond	0	693,000	1,581,888	2,274,888
Stream/River	0	81,406,277	77,835,632	159,241,909
Grand Total	**0**	**153,712,385**	**263,549,243**	**417,261,628**

Table 1-5 Water use for hydraulic fracturing in the Middle Ohio North Watershed from 2009-2011 in gallons

Middle Ohio South Watershed





Middle Ohio South Watershed

Watershed Description

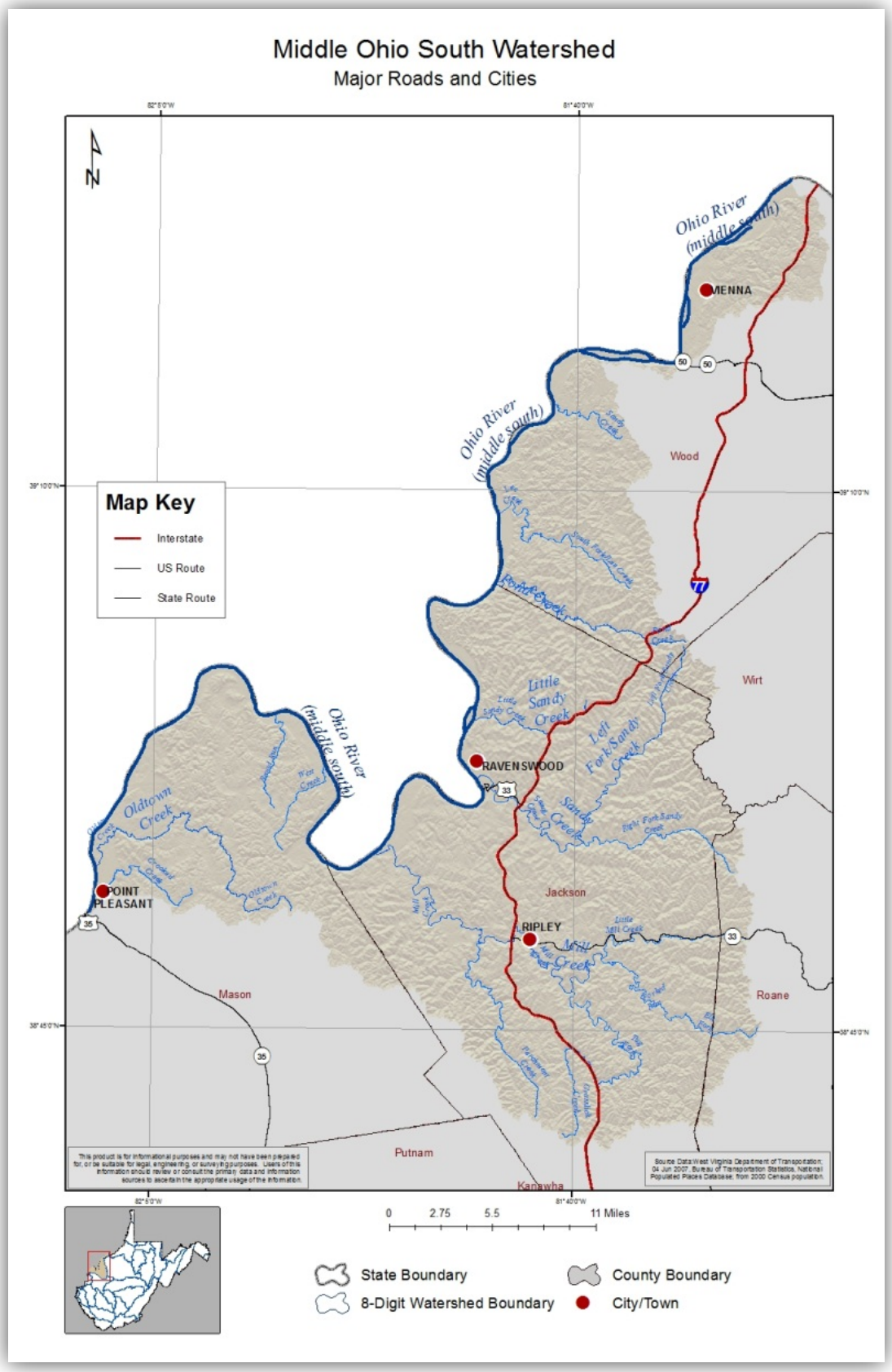
Located in western West Virginia, the Middle Ohio South Watershed extends northeasterly along the Ohio River from Point Pleasant in Mason County to Vienna in Wood County. Covering 705 square miles in West Virginia, the watershed contains portions of five counties (Jackson, Wood, Mason, Roane, and Wirt) while Jackson and Wood comprise 77% of the total area of the watershed.

The Middle Ohio South Watershed has 1,803 miles of streams and rivers and contains the Ohio River mainstem. The Ohio River mainstem flows southwesterly through the watershed along the West Virginia–Ohio border. The major tributaries include Pond Creek, Little Sandy Creek, Sandy Creek, Mill Creek and Oldtown Creek.

Additionally, the watershed encompasses all, or portions, of the following state and federal public lands: six wildlife management areas (Elk Fork Lake, Frozen Camp, McClintic, O'Brien Lake, Rollins Lake and Turkey Run Lake), two state parks (Blennerhassett Island and Tu-Endie-Wie) and one national wildlife refuge (Ohio River Islands).

Demographics

The Middle Ohio South Watershed has a total population of approximately 77,532. The watershed has four cities with a population exceeding 3,000. The largest city within the watershed is Vienna with a total population of 10,749, followed by Point Pleasant (4,350), Ravenswood (3,876) and Ripley (3,252).


Middle Ohio South Watershed
Major Roads and Cities
N
Map Key
Interstate
US Route
State Route
Ohio River (middle south)
MENNA
Wood
Wirt
Little Sandy Creek
Left Fork Sandy Creek
RAVENSWOOD
Oldtown Creek
POINT PLEASANT
Jackson
RIPLEY
Mason
Roane
Putnam
Kanawha
0 2.75 5.5 11 Miles
State Boundary
8-Digit Watershed Boundary
County Boundary
City/Town

Geography and Geology

The Middle Ohio South Watershed lies entirely within the Western Allegheny Plateau Ecoregion, which is comprised of rounded hills with wide fertile valleys, mixed oak forests and agricultural lands. The average elevation for the watershed is 748 feet above mean sea level. The highest elevation of 1,221 feet is located on Garnes Knob southwest of Kenna, West Virginia. The lowest elevation, 538 feet, is located in the southwest at the confluence of Crooked Creek and the Ohio River in Point Pleasant, West Virginia. The average annual temperature is 55 degrees Fahrenheit and ranges from 53 to 55 degrees. The average annual precipitation for the Middle Ohio South Watershed is 41.35 inches per year.

The majority (68%) of the watershed is covered by forest area, while 19% is cultivated. Approximately 10% of the land cover is classified as developed and 3.6% is defined as impervious surface area.

The surface geology in the Middle Ohio South Watershed is predominantly (86%) sandstone while 14% of the geology is comprised of alluvium.

The United States Geological Survey (USGS), in conjunction with federal, state and local agencies, including the DEP, cooperatively funds the USGS stream gaging network to monitor water availability. Currently, there are three surface water gaging stations located within the watershed. Data is collected from the stream gages located on Tug Fork at the Town of Statts Mills (1) and at multiple sites along the Ohio River (2). The recorded data can be accessed at http://waterdata.usgs.gov/nwis.

LQU data

Table 1-6 contains a list of all Large Quantity User (LQU) facilities in the Middle Ohio South Watershed that are currently operating, their Standard Industrial Category (SIC) of use, the average percent of source water withdrawn annually, percent withdrawn from the watershed and county, as well as others if intakes are located elsewhere, and the average amount of water withdrawn by the facility based on the most recent three years of monthly data. A detailed discussion about categories of use type and comparisons of use to statewide withdrawals and consumption is available in Chapter 2 of the Plan. Chapter 4 of the Plan includes data and discussion about future use projections. The following is a summary of data collected regarding the facilities:

- 12 Public water supply facilities
    - Parkersburg Water Treatment Plant has the greatest annual average withdrawal at approximately 3 billion gallons
    - Town of Hartford has the smallest annual average at only 20 million gallons
    - Point Pleasant water works only averages approximately 67% of its total withdrawals from the Middle Ohio South Watershed, the remainder is withdrawn from the Lower Ohio Watershed.
    - The City of Vienna withdraws 92% of its total water from the Middle Ohio South Watershed while the remainder comes from Middle Ohio North Watershed
- 3 Industrial facilities: 2 Closed, 1 in 2007 (Pechiney Rolled products, LLC.) and 1 in 2009 (Century Aluminum). Only Alcan Rolled Products currently contributes to the annual average water withdrawn for this category
- 2 Thermoelectric plants: Appalachian Power (Mountaineer Plant and Philip Sporn Plant)
- 2 Chemical facilities: Dupont Washington Works and SABIC Innovative Plastics
- 1 Hydroelectric facility: Belleville Hydroelectric Facility, which has reported the exact same numbers every year of report.
- 1 Recreation facility: Parkersburg Country Club

Table 1-6 All facilities withdrawing from Middle Ohio South Watershed organized by Use Category and Intake Source and Location (watershed and county). Blanks indicate that no additional withdrawals were occurring.

Facility ID	Facility Name	Use Category	Source and % of 3 Year Average		Watershed and % of 3 Year Average		County and % of 3 Year Average		3 Year Annual Average (gallons)
10079	Alcan Rolled Products	Industrial		Groundwater 100.00%	Middle Ohio South 100.00%		Jackson 100.00%		144,992,733
3805	Appalachian Power - Mountaineer Plant	Thermoelectric (coal)	Surface Water 93.92%	Groundwater 6.08%	Middle Ohio South 100.00%		Mason 100.00%		5,853,907,572
3806	Appalachian Power - Philip Sporn Plant	Thermoelectric (coal)	Surface Water >99.99%	Groundwater <0.01%	Middle Ohio South 100.00%		Mason 100.00%		199,232,260,160
8176	Belleville Hydroelectric Facility	Hydroelectric	Surface Water 100.00%		Middle Ohio South 100.00%		Wood 100.00%		4,718,113,048,800
2102	City of Ravenswood	Public water supply		Groundwater 100.00%	Middle Ohio South 100.00%		Jackson 100.00%		234,927,602
10070	City of Vienna	Public water supply		Groundwater 100.00%	Middle Ohio North 8.64%	Middle Ohio South 91.36%	Pleasants 8.64%	Wood 91.36%	430,025,044
1903	Cottageville Public Service District	Public water supply		Groundwater 100.00%	Middle Ohio South 100.00%		Jackson 100.00%		84,242,933
3127	Dupont Washington Works	Chemical	Surface Water 75.17%	Groundwater 24.83%	Middle Ohio South 100.00%		Wood 100.00%		16,994,376,000
2282	Lubeck Public Service District	Public water supply		Groundwater 100.00%	Middle Ohio South 100.00%		Wood 100.00%		304,292,937
1870	Mason County PSD - Lakin Well Field	Public water supply		Groundwater 100.00%	Middle Ohio South 100.00%		Mason 100.00%		114,415,000
3054	Mason County PSD - Letart Well Field	Public water supply		Groundwater 100.00%	Middle Ohio South 100.00%		Mason 100.00%		81,340,890
10058	Mason Water Department	Public water supply		Groundwater 100.00%	Middle Ohio South 100.00%		Mason 100.00%		64,038,047
10059	New Haven Water Department	Public water supply		Groundwater 100.00%	Middle Ohio South 100.00%		Mason 100.00%		57,188,333
5114	Parkersburg Country Club	Recreation		Groundwater 100.00%	Middle Ohio South 100.00%		Wood 100.00%		6,999,000
1495	Parkersburg Water Treatment Plant	Public water supply		Groundwater 100.00%	Middle Ohio South 100.00%		Wood 100.00%		2,958,506,333
1945	Point Pleasant Water Works	Public water supply		Groundwater 100.00%	Lower Ohio 35.30%	Middle Ohio South 64.70%	Mason 42.65%	OH 57.35%	454,604,867
2335	Ripley Water Works	Public water supply	Surface Water 100.00%		Middle Ohio South 100.00%		Jackson 100.00%		332,909,602
3165	SABIC Innovative Plastics	Chemical		Groundwater 100.00%	Middle Ohio South 100.00%		Wood 100.00%		704,329,980
10057	Town of Hartford	Public water supply		Groundwater 100.00%	Middle Ohio South 100.00%		Mason 100.00%		19,894,987

Figures 1-15 through 1-21 summarize the breakdown of the share total withdrawals occurring among currently operating facilities, the trends in use over time for each industry group, and the amount and share of source water withdrawn by the currently operating LQUs in the watershed.

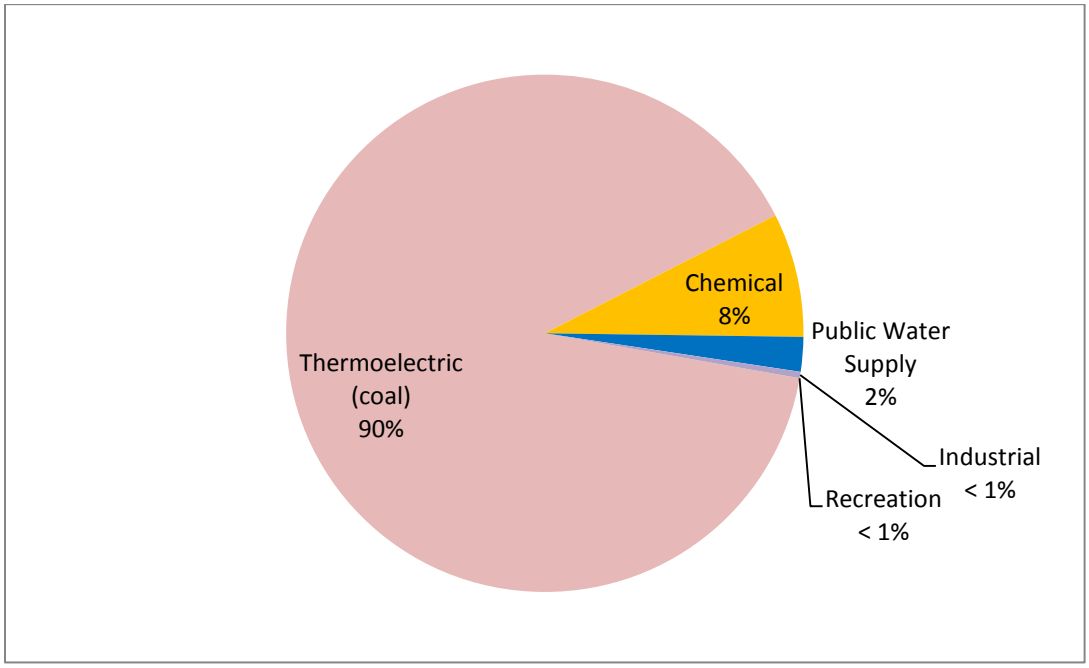
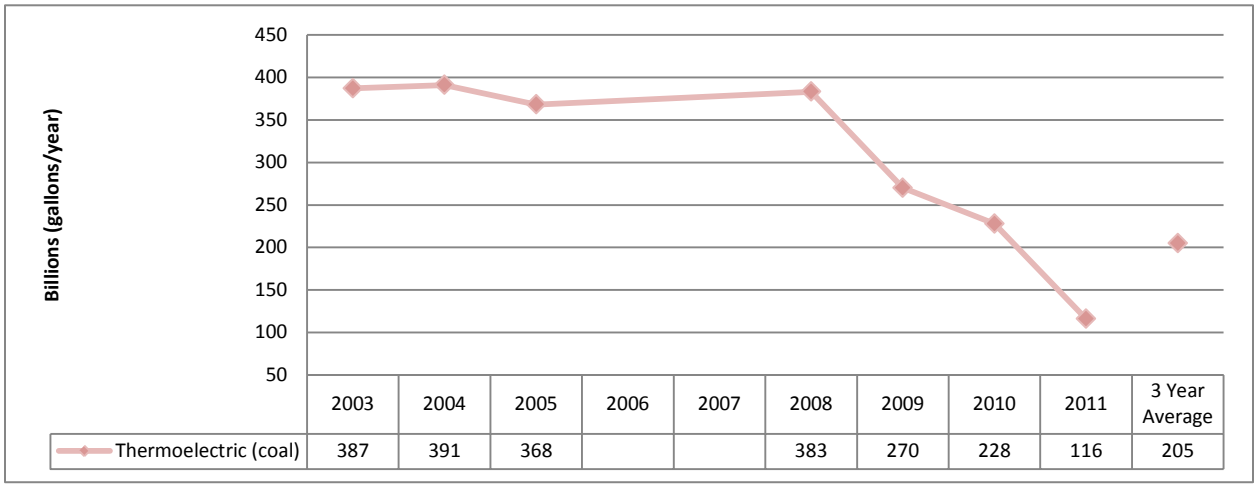


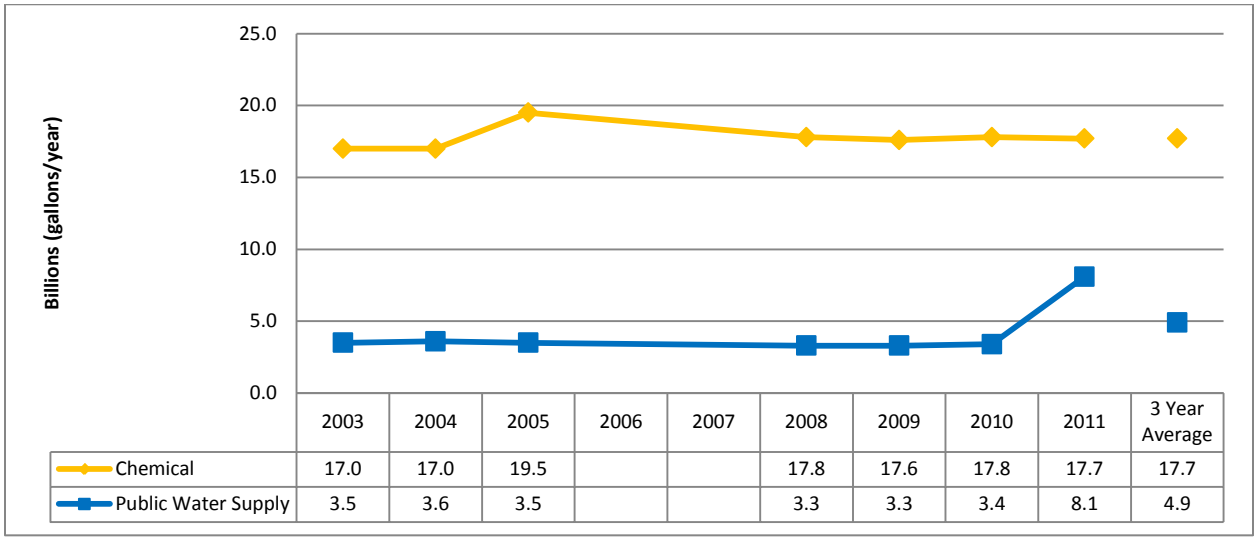
Figure 1-15 Middle Ohio South Watershed LQU percent of total average annual water withdrawals by sector (excluding Hydroelectric).

Figure 1-16 Middle Ohio South Watershed LQU water withdrawal trends for the Hydroelectric SIC category, measured in trillions of gallons per year



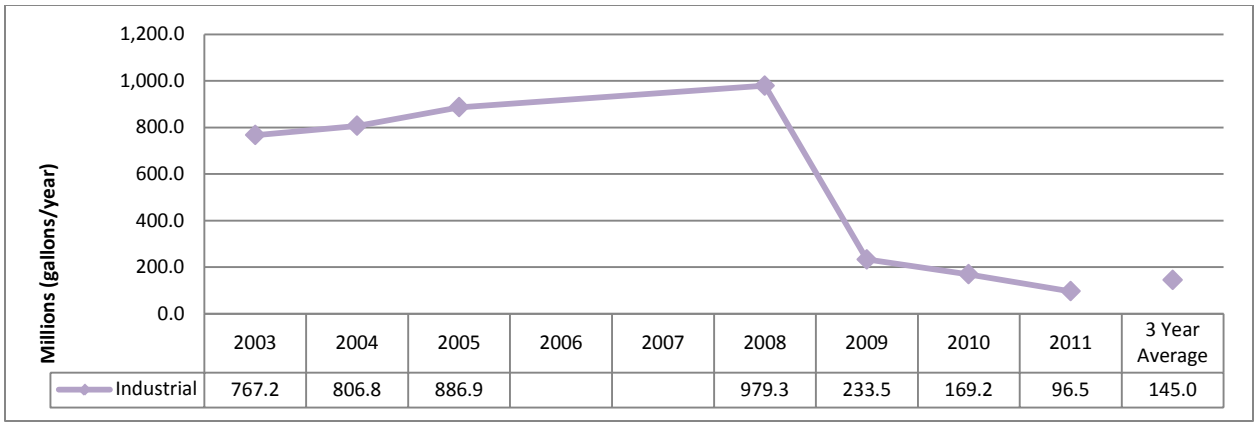
	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Thermoelectric (coal)	387	391	368			383	270	228	116	205

Figure 1-17 Middle Ohio South Watershed LQU water withdrawal trends for the Thermoelectric (coal) SIC category, measured in billions of gallons per year.



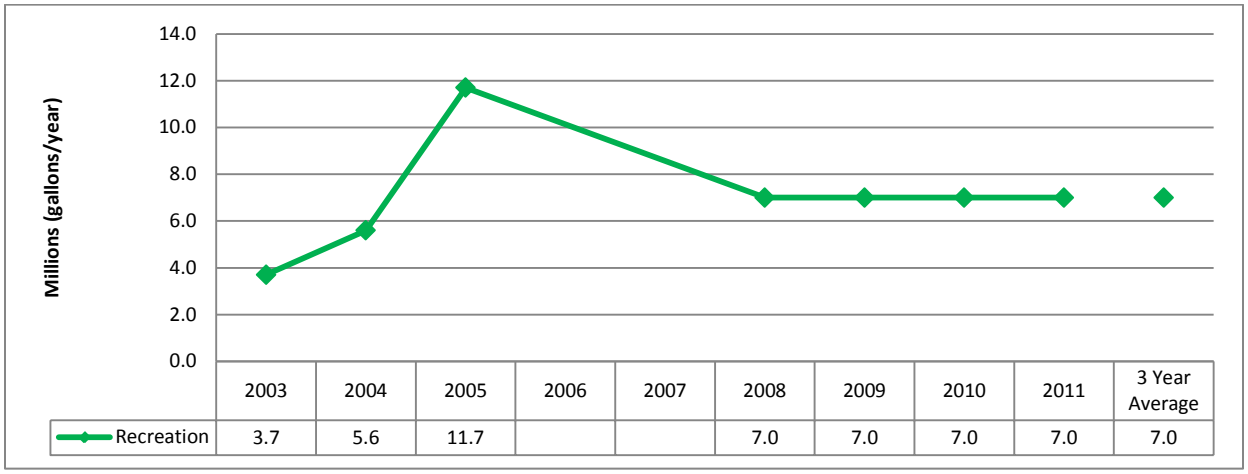
	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Chemical	17.0	17.0	19.5			17.8	17.6	17.8	17.7	17.7
Public Water Supply	3.5	3.6	3.5			3.3	3.3	3.4	8.1	4.9

Figure 1-18 Middle Ohio South Watershed LQU water withdrawal trends for the Chemical and Public Water Supply SIC categories, measured in billions of gallons per year.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Industrial	767.2	806.8	886.9			979.3	233.5	169.2	96.5	145.0

Figure 1-19 Middle Ohio South Watershed LQU water withdrawal trends for the Industrial SIC category, measured in millions of gallons per year.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Recreation	3.7	5.6	11.7			7.0	7.0	7.0	7.0	7.0

Figure 1-20 Middle Ohio South Watershed LQU water withdrawal trends for the Recreation SIC category, measured in millions of gallons per year.

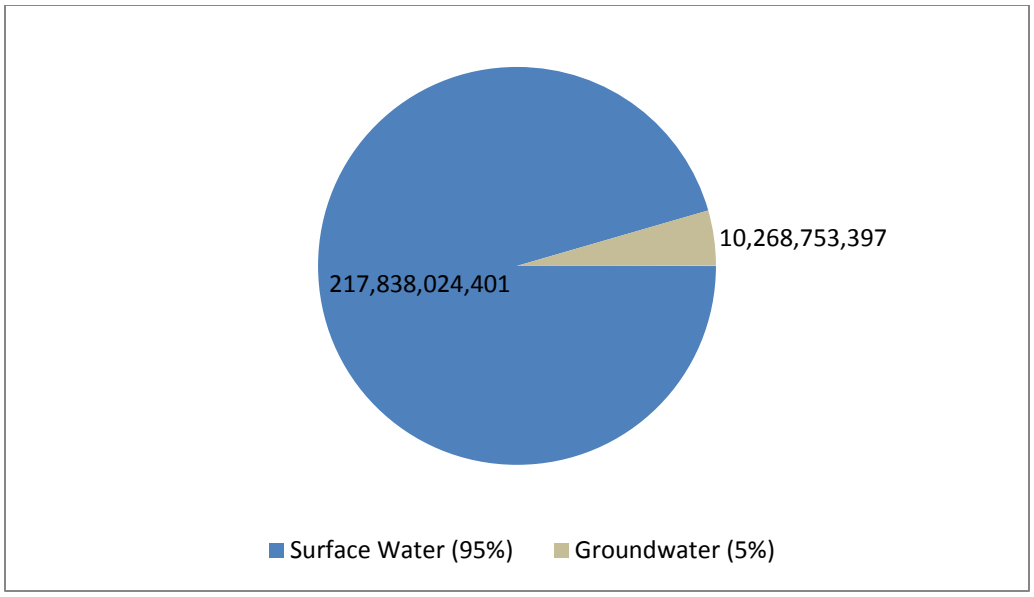
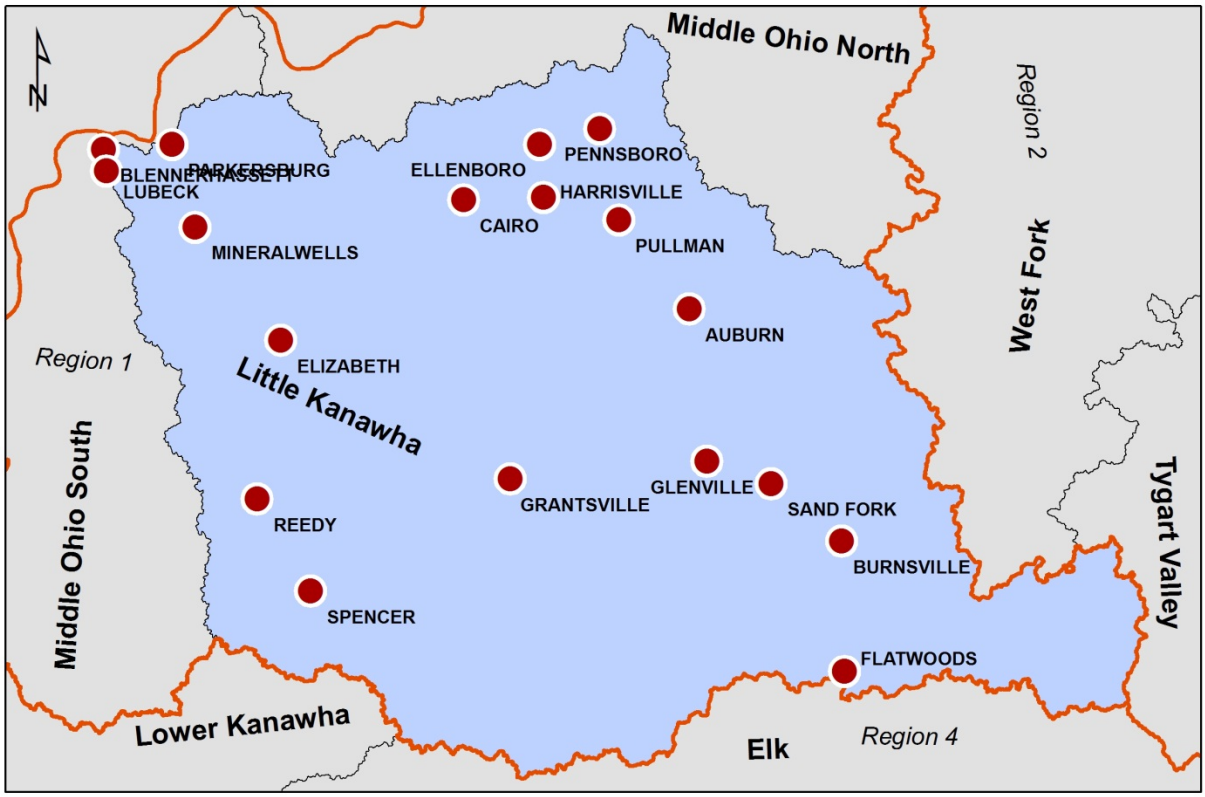
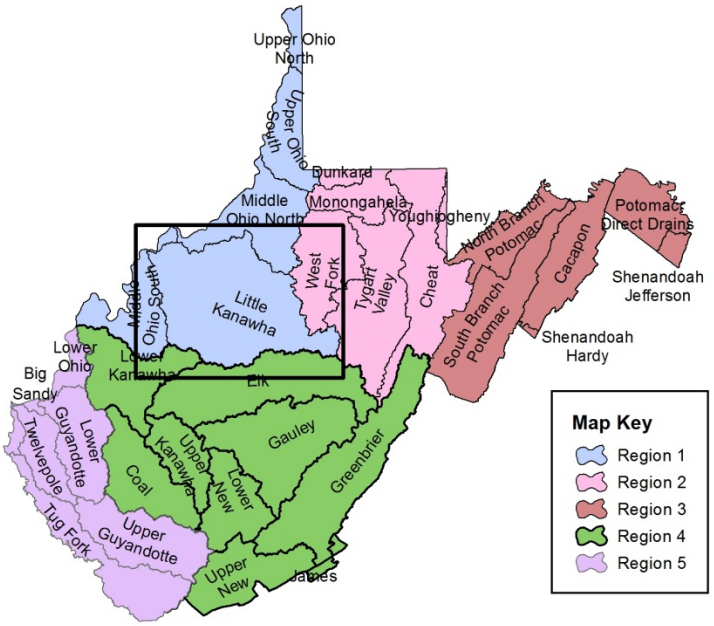


Figure 1-21 Average annual gallons of water withdrawn by LQUs from groundwater and surface water sources in the Middle Ohio South Watershed (excluding Hydroelectric).

Interbasin transfers occur when water is permanently moved from one watershed to another. This can occur in a number of ways. However, only three possible routes of transfer are considered here; see Chapter 2 of the Plan for a discussion of possibilities and data limitations. There are two public water supply facilities that reportedly withdraw water from multiple watersheds. However, because discharges for public water supply facilities are not recorded in the LQU database with the respective facilities, there are no reported interbasin transfers occurring between the Middle Ohio South and other HUC-8 watersheds as a result of LQU operations in 2011.

Little Kanawha River Watershed





Little Kanawha River Watershed

Watershed Description

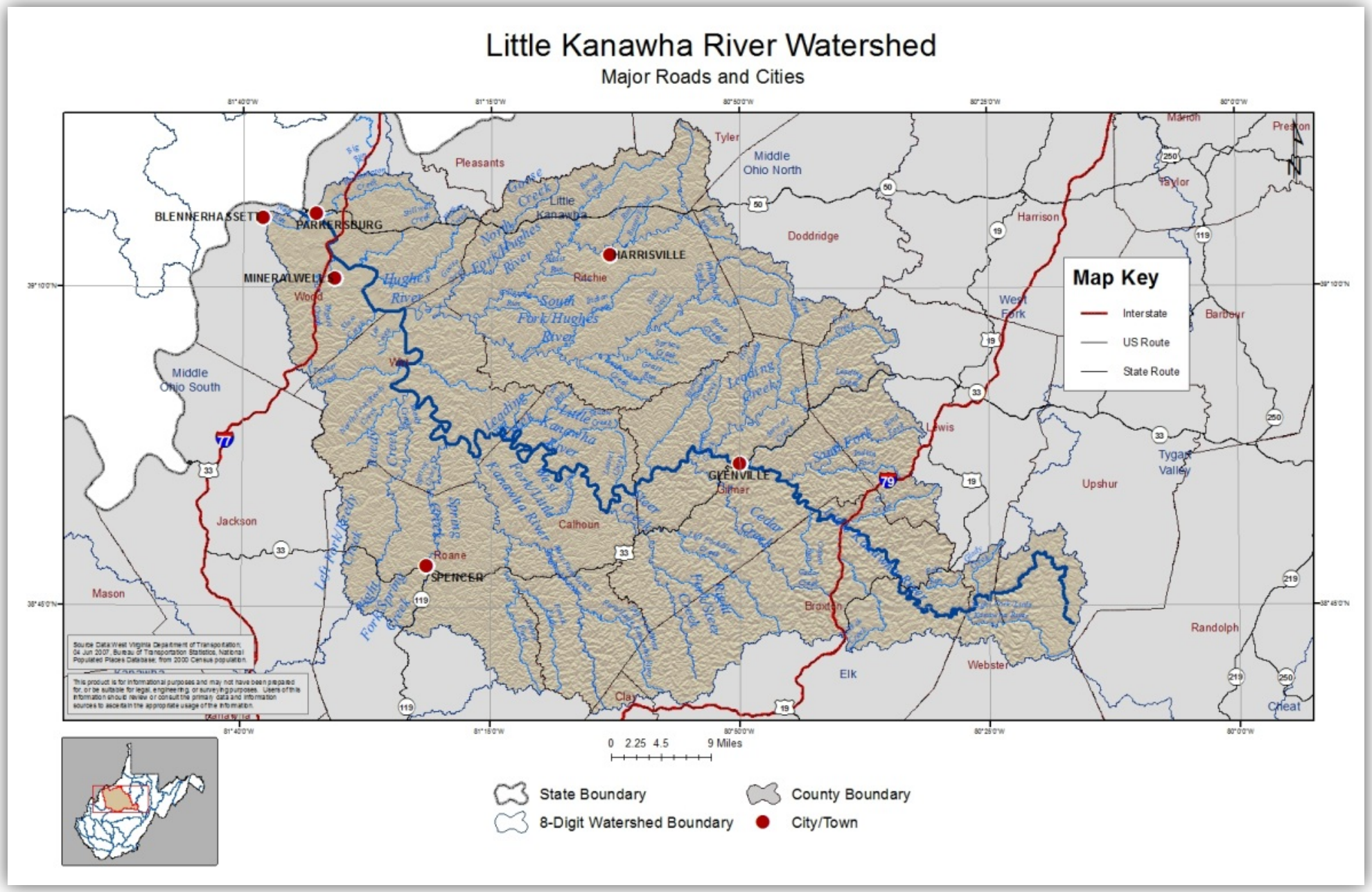
Located in central West Virginia, the Little Kanawha River Watershed covers 2,309 square miles and contains all, or portions, of 12 West Virginia counties (Ritchie, Gilmer, Braxton, Calhoun, Wirt, Roane, Wood, Lewis, Doddridge, Upshur, Webster and Clay).

The Little Kanawha River Watershed has 5,425 miles of streams and rivers and contains the Little Kanawha River mainstem. The Little Kanawha River flows westerly through the watershed from its source in southern Upshur County to its confluence with the Ohio River in Parkersburg. The major tributaries include Sand Fork, Leading Creek, Cedar Creek, Steer Creek, West Fork Little Kanawha, Spring Creek, Reedy Creek and Hughes River.

Additionally, the watershed encompasses all, or portions, of the following state and federal public lands: six wildlife management areas (Burnsville Lake, Hughes River, Ritchie Mines, Sand Hill, Stonewall Jackson Lake and Stumptown) and three state parks (Cedar Creek, Holly River and North Bend). The Little Kanawha River Watershed also encompasses Burnsville Lake, which is located on the Little Kanawha River in southeast Braxton County. The lake has 968 acres of surface area during normal summer pool and the Burnsville Dam maintains a minimum flow release of 20 cubic feet per second.

Demographics

The Little Kanawha River Watershed has a total population of approximately 101,091. The watershed has six cities and towns with a population exceeding 1,500. The largest city within the watershed is Parkersburg with a total population of 31,492, followed by Blennerhassett (3,089), Spencer (2,322), Mineral Wells (1,950), Harrisville (1,876) and Glenville (1,537).


Little Kanawha River Watershed
Major Roads and Cities
Map Key
Interstate
US Route
State Route
BLENNERHASSETT
PARKERSBURG
MINERALWELLS
HARRISVILLE
GLENVILLE
SPENCER
Pleasants
Tyler
Middle Ohio North
Doddridge
Harrison
Marion
Preston
Taylor
Barbour
Wood
Ritchie
West Fork
Middle Ohio South
Lewis
Upshur
Tygart Valley
Jackson
Gilmer
Calhoun
Roane
Mason
Braxton
Randolph
Webster
Elk
Clay
Cheat
Little Kanawha
Hughes River
North Fork Hughes River
South Fork Hughes River
Leading Creek
Kanawha River
Cedar Creek
0 2.25 4.5 9 Miles
State Boundary
County Boundary
8-Digit Watershed Boundary
City/Town

Geography and Geology

The Little Kanawha River Watershed lies within two ecoregions. Approximately 95% of the watershed occupies the Western Allegheny Plateau Ecoregion and is comprised of rounded hills with wide fertile valleys, mixed oak forests and agricultural lands. The southeast portion (5%) of the watershed is contained within the Central Appalachians Ecoregion, which is characterized by its rugged and mountainous terrain, cooler climate and biologically diverse habitat. The average elevation for the watershed is 1,018 feet above mean sea level, with the highest elevation of 2,805 feet. The lowest elevation, 582 feet, is located in at the confluence of the Little Kanawha River and the Ohio River in Parkersburg, West Virginia. The average annual temperature is 52 degrees Fahrenheit and ranges from 49 to 55 degrees. The average annual precipitation for the Little Kanawha River Watershed is 44.64 inches per year.

The majority (86%) of the watershed is covered by forest area, while 7% is cultivated. Approximately 6% of the land cover is classified as developed and 1.2% is defined as impervious surface area.

The surface geology in the Little Kanawha River Watershed is predominantly (85%) sandstone and shale (13%) while 2% of the geology is comprised of alluvium.

The United States Geological Survey (USGS), in conjunction with federal, state and local agencies, including the DEP, cooperatively funds the USGS stream gaging network to monitor water availability. Currently, there are nine surface water gaging stations and one groundwater monitoring well located within the watershed. Data is collected from the groundwater station in Ritchie County, while stream data is collected from nine gaging stations located on Saltlick Creek (1), North Fork Hughes River (1), South Fork Hughes River (1), West Fork Little Kanawha River (1) and multiple sites along the Little Kanawha River (5). The recorded data can be accessed at http://waterdata.usgs.gov/nwis.

LQU data

Table 1-7 contains a list of all Large Quantity User (LQU) facilities in the Little Kanawha Watershed that are currently operating, their Standard Industrial Category (SIC) of use, the average percent of source water withdrawn annually, percent withdrawn from the watershed and county, as well as others if intakes are located elsewhere, and the average amount of water withdrawn by the facility based on the most recent three years of monthly data. A detailed discussion about categories of use type and comparisons of use to statewide withdrawals and consumption is available in Chapter 2 of the Plan.

Chapter 4 of the Plan includes data and discussion about future use projections. The following is a summary of data collected regarding the facilities:

- 6 Public Water Supply facilities
    - 1 closed in 2011: Hughes River Water Board
    - Claywood Park PSD withdraws the most water averaging 444 million gallons annually
    - Burnsville Public Utility withdraws the least averaging 30 million gallons annually.
- 1 Agriculture/aquaculture facility: WVDNR – Palestine State Fish Hatchery

Table 1-7 All facilities withdrawing from Little Kanawha Watershed organized by Use Category and Intake Source and Location (watershed and county). Blanks indicate that no additional withdrawals were occurring.

Facility ID	Facility Name	Use Category	Source and % of 3 Year Average	Watershed and % of 3 Year Average	County and % of 3 Year Average	3 Year Annual Average (gallons)
7764	Burnsville Public Utility	Public water supply	Surface Water 100.00%	Little Kanawha 100.00%	Braxton 100.00%	29,581,340
7461	City of Spencer Waterworks	Public water supply	Surface Water 100.00%	Little Kanawha 100.00%	Roane 100.00%	218,337,464
7850	Claywood Park PSD	Public water supply	Surface Water 100.00%	Little Kanawha 100.00%	Wood 100.00%	443,996,333
7069	Glenville Water Plant	Public water supply	Surface Water 100.00%	Little Kanawha 100.00%	Gilmer 100.00%	224,960,667
1681	Town of Grantsville	Public water supply	Surface Water 100.00%	Little Kanawha 100.00%	Calhoun 100.00%	117,677,133
8124	WVDNR - Palestine State Fish Hatchery	Agriculture/aquaculture	Surface Water 100.00%	Little Kanawha 100.00%	Wirt 100.00%	79,632,000

Figures 1-22 through 1-23 summarize the breakdown of the share total withdrawals occurring among currently operating facilities, the trends in use over time for each industry group for currently operating LQUs in the watershed. 100% of the water withdrawn by registered LQUs in the state from the Little Kanawha Watershed is from surface water sources.

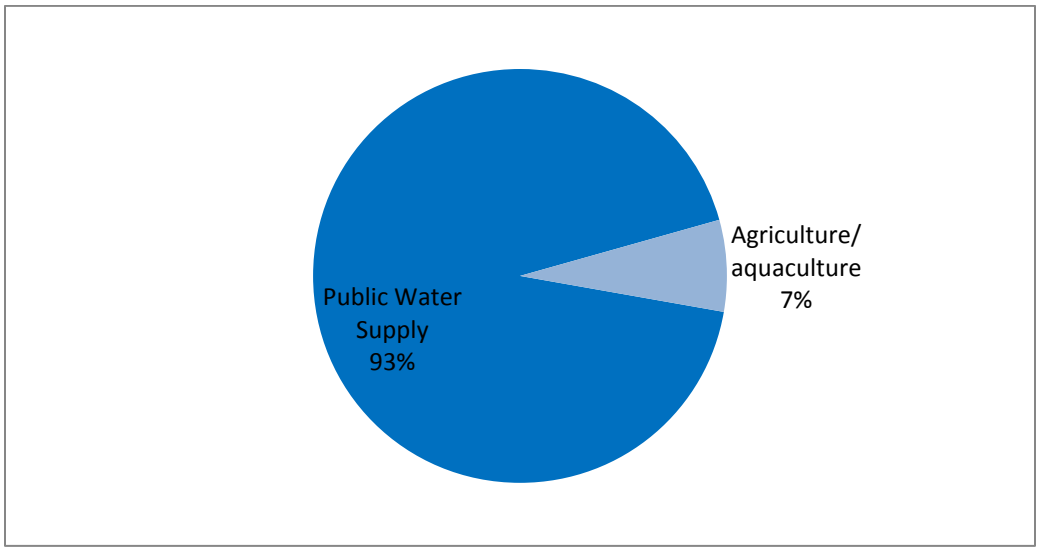
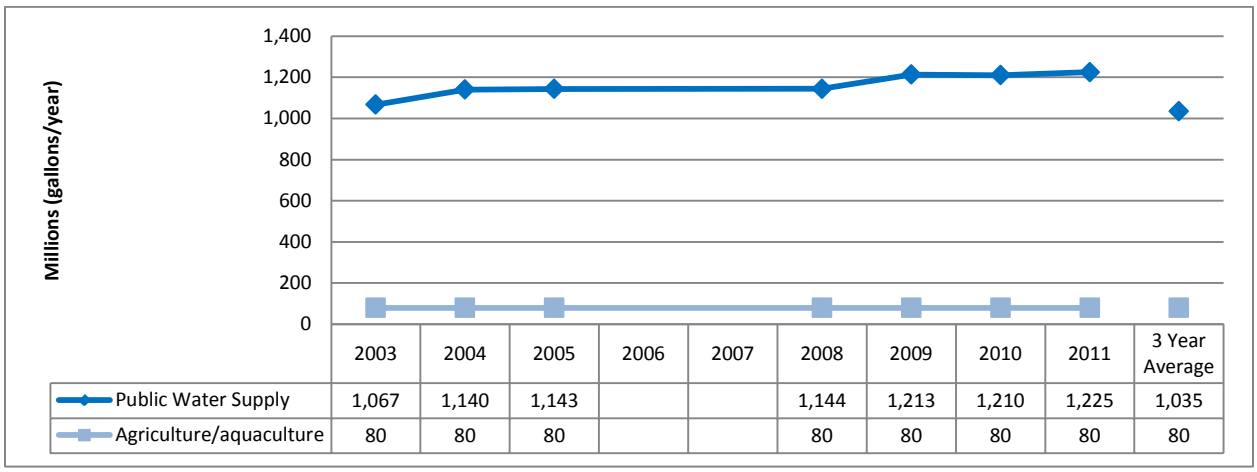


Figure 1-22 Little Kanawha Watershed LQU percent of total average annual water withdrawals by sector (excluding Frac Water*).



	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Public Water Supply	1,067	1,140	1,143			1,144	1,213	1,210	1,225	1,035
Agriculture/aquaculture	80	80	80			80	80	80	80	80

Figure 1-23 Little Kanawha Watershed LQU water withdrawal trends for the Public Water Supply and Agriculture/aquaculture SIC categories, measured in millions of gallons per year.

Interbasin transfers occur when water is permanently moved from one watershed to another. This can occur in a number of ways. However, only three possible routes of transfer are considered here; see Chapter 2 of the Plan for a discussion of possibilities and data limitations. However, there are no reported interbasin transfers occurring between the Little Kanawha and other HUC-8 watersheds as a result of LQU operations in 2011.

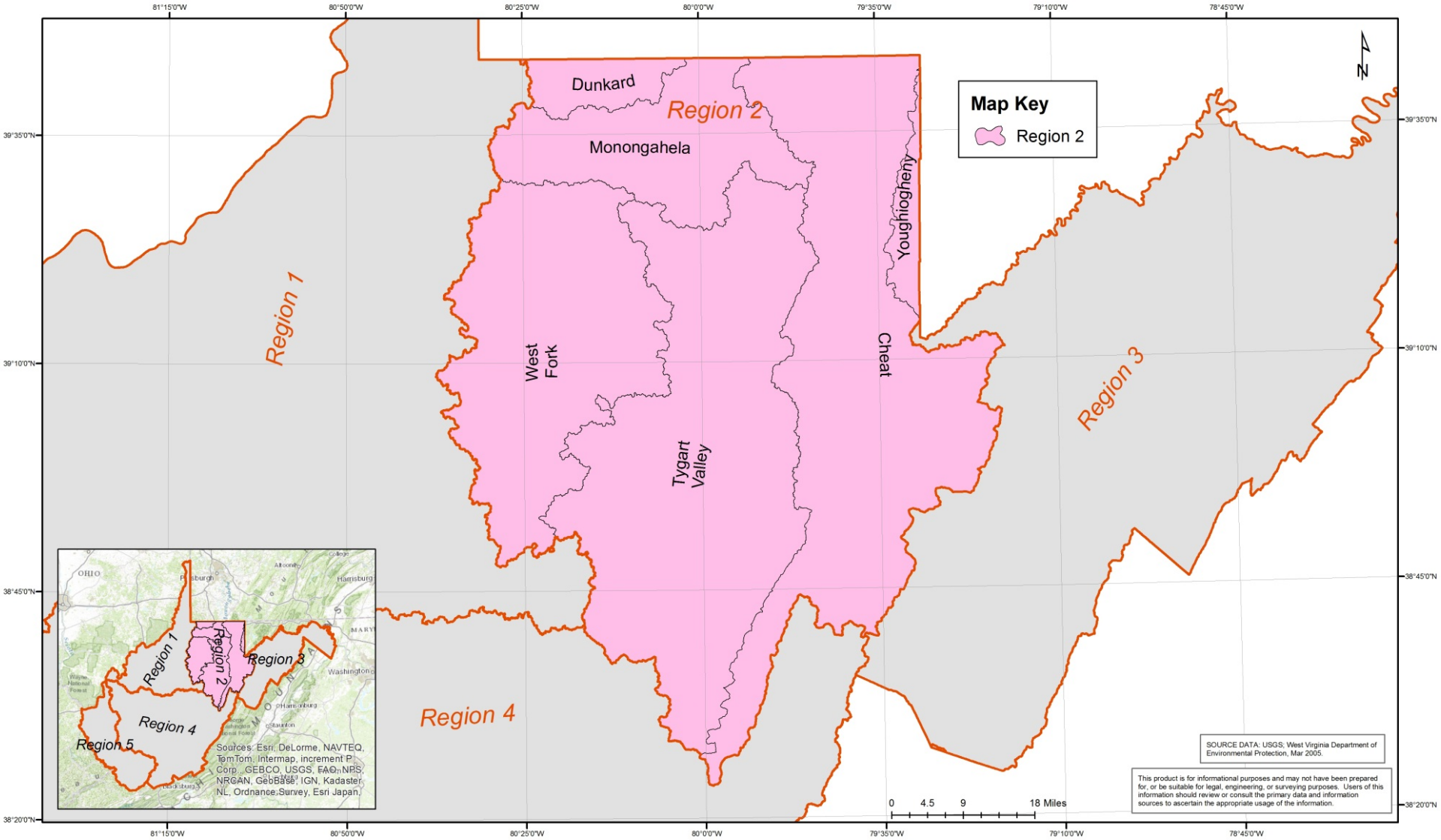
Marcellus Shale

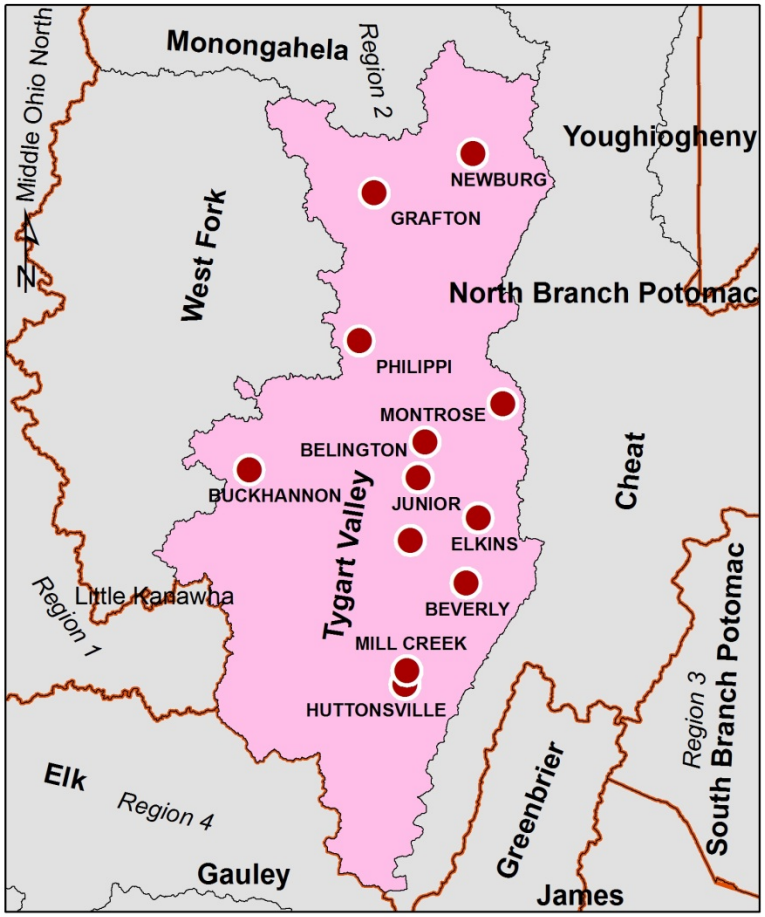
Since the DEP started tracking water use data associated with hydraulic fracturing operations in 2009, approximately 178 million gallons of water have been withdrawn from the Little Kanawha Watershed. In this watershed, stream/rivers comprise the majority of source water for the oil and gas exploration industry. The most frequently cited stream and river sources from this region are the Little Kanawha River and South Fork of Hughes River. North Bend Lake and the Pennsboro Reservoir represent nearly all withdrawals from lake sources/reservoir sources.

Water Source	2009	2010	2011	Grand Total
Commercial Broker	0	5,410,164	789,936	6,200,100
Lake/Reservoir/Pond	0	9,145,976	23,074,800	32,220,776
Stream/River	0	41,904,954	97,475,139	139,380,093
Grand Total	**0**	**56,461,094**	**121,339,875**	**177,800,969**

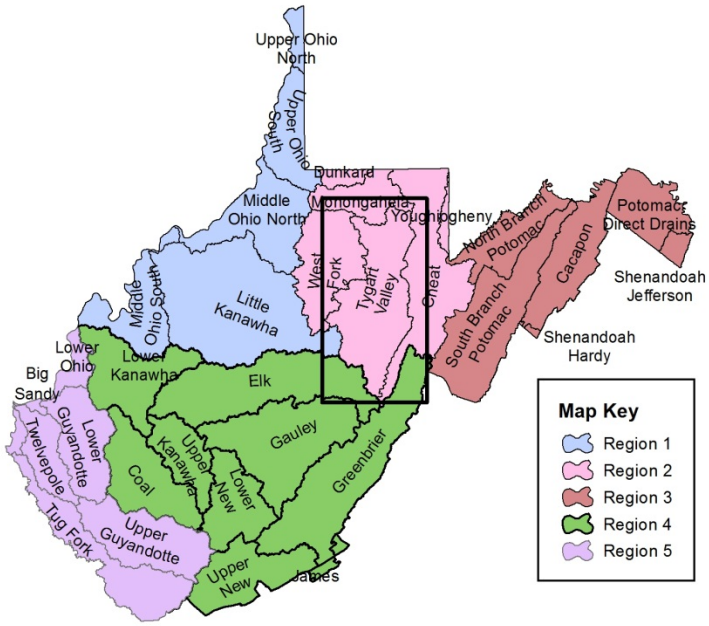
Table 1-8 Water use for hydraulic fracturing in the Little Kanawha Watershed from 2009-2011 in gallons

Region 2


Dunkard
Region 2
Monongahela
Youghiogheny
Region 1
West Fork
Cheat
Region 3
Tygart Valley
Region 4
Map Key
Region 2
N
81°15'0"W
80°50'0"W
80°25'0"W
80°0'0"W
79°35'0"W
79°10'0"W
78°45'0"W
39°35'0"N
39°10'0"N
38°45'0"N
38°20'0"N
0 4.5 9 18 Miles
SOURCE DATA: USGS; West Virginia Department of Environmental Protection, Mar 2005.
This product is for informational purposes and may not have been prepared for, or be suitable for legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the appropriate usage of the information.
Region 1
Region 2
Region 3
Region 4
Region 5
Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan.



Tygart Valley River Watershed



Region 2

Tygart Valley River Watershed

Watershed Description

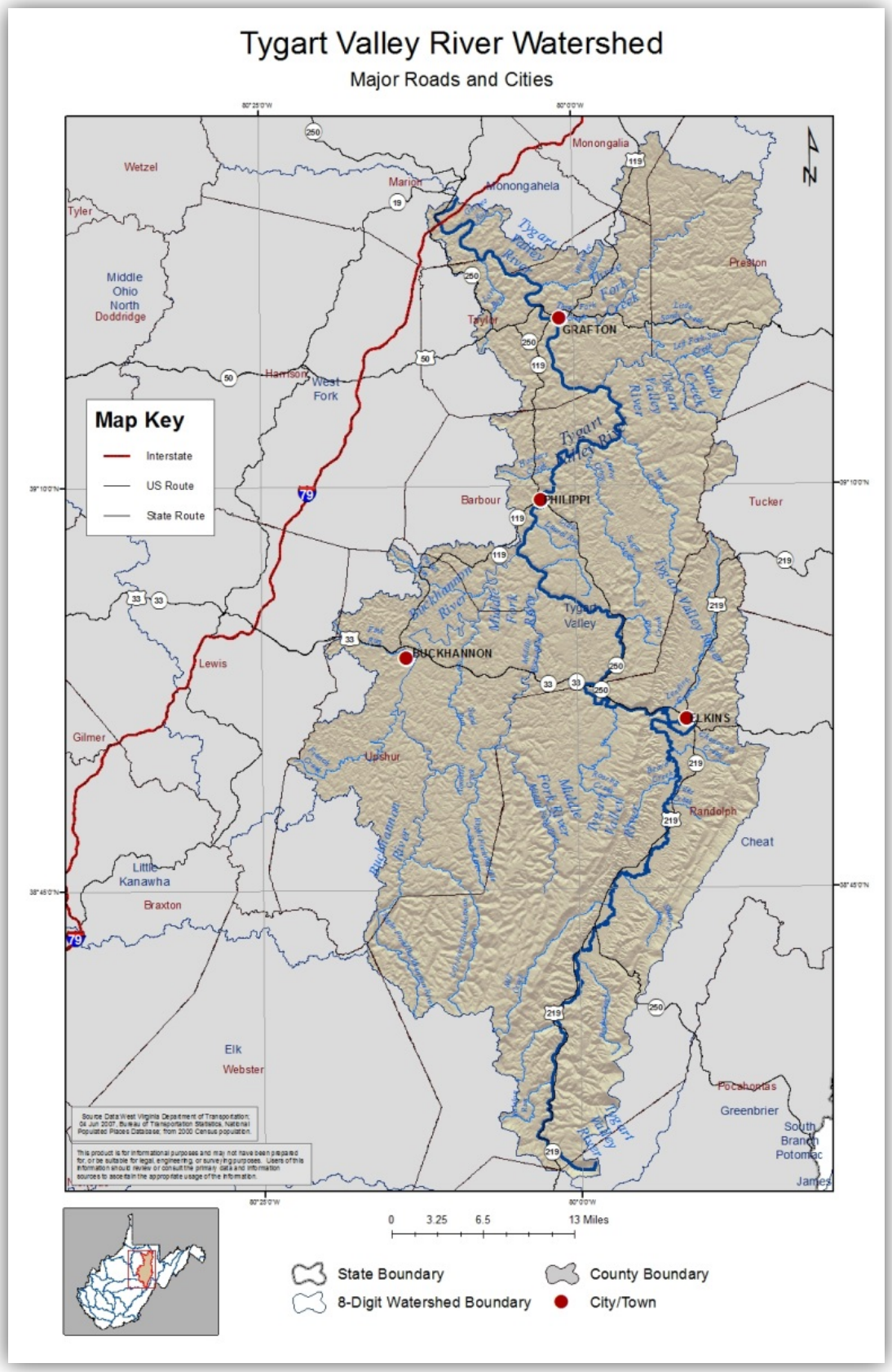
Located in north central West Virginia, the Tygart Valley River Watershed covers more than 3,226 square miles and contains all, or portions, of nine counties (Barbour, Lewis, Marion, Monongalia, Pocahontas, Preston, Randolph, Taylor, Tucker, Upshur and Webster). Randolph, Barbour and Upshur comprise 79% of the total area of the watershed.

The Tygart Valley River Watershed has 3,226 miles of streams and rivers. The source of the mainstem of the Tygart Valley River is on Cheat Mountain in Pocahontas County. The major tributaries include Middle Fork River and Buckhannon River.

Additionally, the watershed encompasses all, or portions, of the following state and federal public lands: 10 wildlife management areas (Becky's Creek, Blackwater, Cheat, Huttonsville State Farm, Little River, Otter Creek, Pleasant Creek, Pruntytown State Farm, Teter Creek Lake and Valley Bend Wetlands), four state parks (Audra, Holly River, Tygart Lake and Valley Falls), one state forest (Kumbrabow) and one national forest (Monongahela). The Tygart Valley River Watershed also encompasses Tygart Lake, which is located south of Grafton in Taylor County. The lake has 1,750 acres of surface area and the Tygart Valley Dam maintains a minimum flow release of 100 cubic feet per second.

Demographics

The Tygart Valley River Watershed has a total population of approximately 89,478. The watershed has four cities and towns with a population exceeding 2,500. The largest city within the watershed is Elkins with a total population of 7,094, followed by Buckhannon (5,639), Grafton (5,164) and Philippi (2,966).


Tygart Valley River Watershed
Major Roads and Cities
Map Key
Interstate
US Route
State Route
Wetzel
Tyler
Marion
Monongalia
Monongahela
Preston
Middle Ohio North Doddridge
Taylor
GRAFTON
Harrison
West Fork
Barbour
PHILIPPI
Tucker
Tygart Valley River
Buckhannon River
Middle Fork River
Tygart Valley
BUCKHANNON
Lewis
ELKINS
Gilmer
Upshur
Randolph
Cheat
Little Kanawha
Braxton
Elk
Webster
Pocahontas
Greenbrier
South Branch Potomac
James
0 3.25 6.5 13 Miles
State Boundary
County Boundary
8-Digit Watershed Boundary
City/Town

Geography and Geology

The Tygart Valley River Watershed lies within three ecoregions. The majority of the watershed (58%) occupies the Central Appalachians Ecoregion, which is known for its rugged and mountainous terrain, cooler climate, and biologically diverse habitat. Nearly 22% of the watershed is contained within the Ridge and Valley Ecoregion, which is characterized by its parallel mountain ridgelines and lowland valleys. Approximately 20% of the watershed lies within the Western Allegheny Plateau Ecoregion, which is comprised of rounded hills with wide fertile valleys, mixed oak forests and agricultural lands. The average elevation for the watershed is approximately 2,093 feet above mean sea level, with the highest elevation of 4,760 feet and the lowest elevation at approximately 837 feet. The average annual temperature is 49 degrees Fahrenheit and ranges from 43 to 53 degrees. The average annual precipitation for the Tygart Valley River Watershed is 49.80 inches per year.

The majority (81%) of the watershed is covered by forest area, while 11% is planted/cultivated area. Approximately 7% of the land cover is classified as developed and 1.6% is defined as impervious surface area. The surface geology in the Tygart Valley River Watershed is predominantly (95%) shale and sandstone while there is a small percentage of alluvium and limestone.

The United States Geological Survey (USGS), in conjunction with federal, state and local agencies, including the DEP, cooperatively funds the USGS stream gaging network to monitor water availability. Currently, there are 17 surface water gaging stations and one groundwater monitoring well located within the watershed. The groundwater gaging station is a well site located in Barbour County, while surface water data is collected from the 17 stream gages located on Elkwater Fork (1), Middle Fork River (1), Three Fork Creek (1), Tygart Valley Lake (1), Sand Run (1) and multiple locations along the Buckhannon River (3) and Tygart Valley River (9). The recorded data can be accessed at http://waterdata.usgs.gov/nwis.

LQU data

Table 2-1 contains a list of all Large Quantity User (LQU) facilities in the Tygart Valley Watershed that are currently operating, their Standard Industrial Category (SIC) of use, the average percent of source water withdrawn annually, percent withdrawn from the watershed and county, as well as others if intakes are located elsewhere, and the average amount of water withdrawn by the facility based on the most recent three years of monthly data. A detailed discussion about categories of use type and comparisons of use to statewide withdrawals and consumption is available in Chapter 2 of the Plan. Chapter 4 of the Plan

includes data and discussion about future use projections. The following is a summary of data collected regarding the facilities:

- 14 Public water supply facilities
    - Newburg Water Works closed in 2009
    - The largest withdrawer, the City of Fairmont withdraws an average of 2.4 billion gallons annually, which is about 3 times more per year than the next largest withdrawals (Elkins Water Works and City of Buckhannon).
    - The smallest annual withdrawer is Coalton Water System which averages only 8.4 million gallons
- 5 mining facilities
    - Kingwood Mining – Whitetail Kittanning mine only withdrew water in 2008, closing the following year
    - The largest withdrawals come from Wolf Run Mining – Sentinel Complex and average 81 million gallons annually, with a large increase in annual withdraws from groundwater beginning in 2011
    - The smallest annual mining withdrawal is executed by Aggregates Quarry, averaging only 9.1 million gallons annually

Table 2-1 All facilities withdrawing from Tygart Valley Watershed organized by Use Category and Intake Source and Location (watershed and county). Blanks indicate that no additional withdrawals were occurring.

Facility ID	Facility Name	Use Category	Source and % of 3 Year Average		Watershed and % of 3 Year Average		County and % of 3 Year Average		3 Year Annual Average (gallons)
3460	Aggregates Quarry	Mining	Surface Water 36.25%	Groundwater 63.75%	Tygart Valley 100.00%		Randolph 100.00%		9,052,333
1972	Belington Water Treatment Plant	Public water supply	Surface Water 100.00%		Tygart Valley 100.00%		Barbour 100.00%		80,445,667
1142	Beverly Water Plant	Public water supply	Surface Water 100.00%		Tygart Valley 100.00%		Randolph 100.00%		153,598,604
8309	Carter Roag Coal - Star Bridge Preparation Plant	Mining	Surface Water 100.00%		Tygart Valley 100.00%		Randolph 100.00%		14,990,300
1228	City of Buckhannon Water Plant	Public water supply	Surface Water 100.00%		Tygart Valley 100.00%		Upshur 100.00%		781,452,937
1247	City of Fairmont	Public water supply	Surface Water 100.00%		Tygart Valley 100.00%		Marion 100.00%		2,387,969,191
10069	Coalton Water System	Public water supply		Groundwater 100.00%	Tygart Valley 100.00%		Randolph 100.00%		8,380,200
1900	Elkins Water Works	Public water supply	Surface Water 100.00%		Tygart Valley 100.00%		Randolph 100.00%		789,237,288
10094	Hawthorne Coal Company - Sawmill Run Complex	Mining	Surface Water 81.66%	Groundwater 18.34%	Tygart Valley 100.00%		Upshur 100.00%		15,085,867
10032	Huttonsville Correctional Center	Public water supply	Surface Water 100.00%		Tygart Valley 100.00%		Randolph 100.00%		68,086,667
7573	Monongah Water Plant	Public water supply	Surface Water 100.00%		Tygart Valley 100.00%		Marion 100.00%		271,148,083
2223	Norton-Harding-Jimtown Public Service District	Public water supply		Groundwater 100.00%	Tygart Valley 100.00%		Randolph 100.00%		85,703,533
10001	Philippi Municipal Water	Public water supply	Surface Water 100.00%		Tygart Valley 100.00%		Barbour 100.00%		406,463,000
10014	Shinnston Water Board	Public water supply	Surface Water 100.00%		Tygart Valley 100.00%		Marion 100.00%		400,171,100
1856	Taylor County PSD	Public water supply	Surface Water 100.00%		Tygart Valley 100.00%		Barbour 100.00%		703,633,667
4339	Town of Mill Creek Municipal Water Plant	Public water supply	Surface Water 100.00%		Tygart Valley 100.00%		Randolph 100.00%		74,262,000
10103	Wolf Run Mining - Sentinel Complex	Mining	Surface Water 21.90%	Groundwater 78.10%	Tygart Valley 99.93%	West Fork 0.07%	Barbour 100.00%		81,209,500

Figures 2-1 through 2-5 summarize the breakdown of the share total withdrawals occurring among currently operating facilities, the trends in use over time for each industry group, and the amount and share of source water withdrawn by the currently operating LQUs in the watershed.

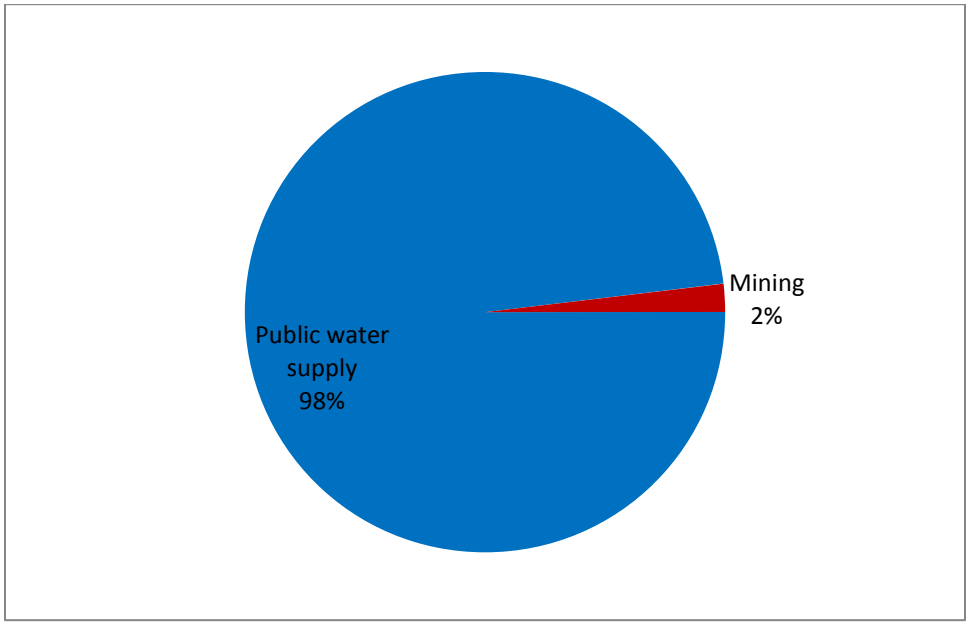
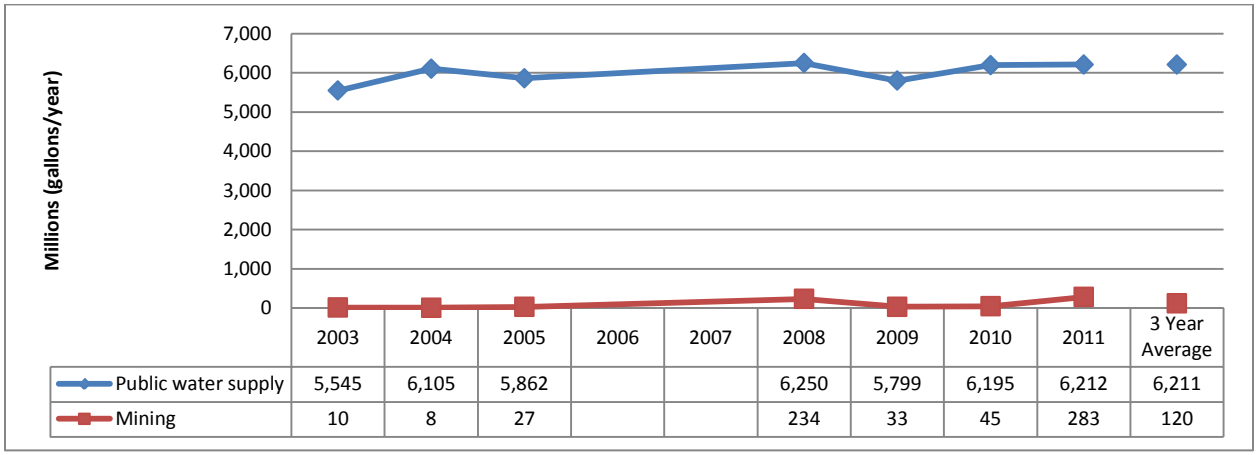
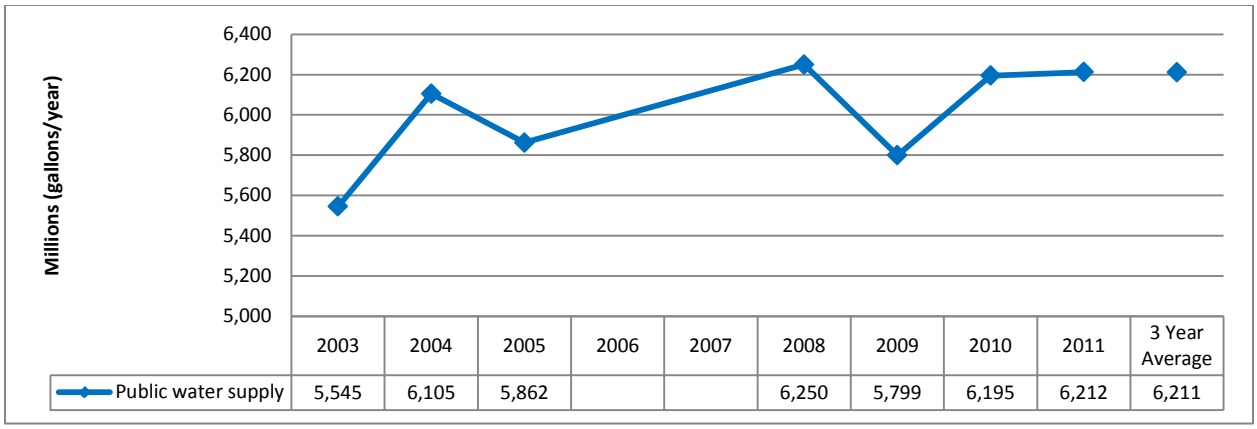


Figure 2-1 Tygart Valley Watershed LQU percent of total average annual water withdrawals by sector (excluding Frac Water*).



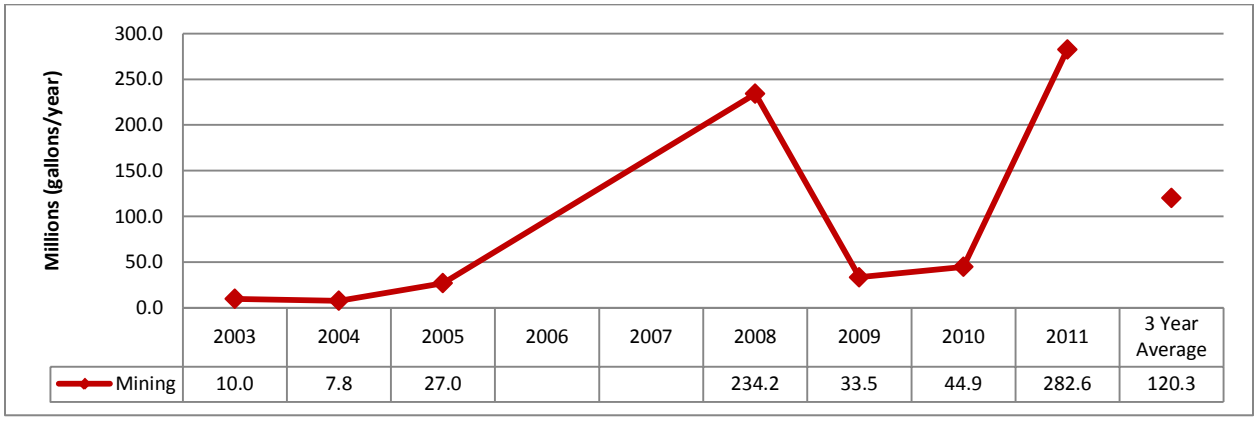
	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Public water supply	5,545	6,105	5,862			6,250	5,799	6,195	6,212	6,211
Mining	10	8	27			234	33	45	283	120

Figure 2-2 Tygart Valley Watershed LQU water withdrawal trends for the Public Water Supply and Mining SIC categories, measured in millions of gallons per year.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Public water supply	5,545	6,105	5,862			6,250	5,799	6,195	6,212	6,211

Figure 2-3 Tygart Valley Watershed LQU water withdrawal trends for the Public Water Supply SIC category, measured in millions of gallons per year.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Mining	10.0	7.8	27.0			234.2	33.5	44.9	282.6	120.3

Figure 2-4 Tygart Valley Watershed LQU water withdrawal trends for the Mining SIC category, measured in millions of gallons per year.

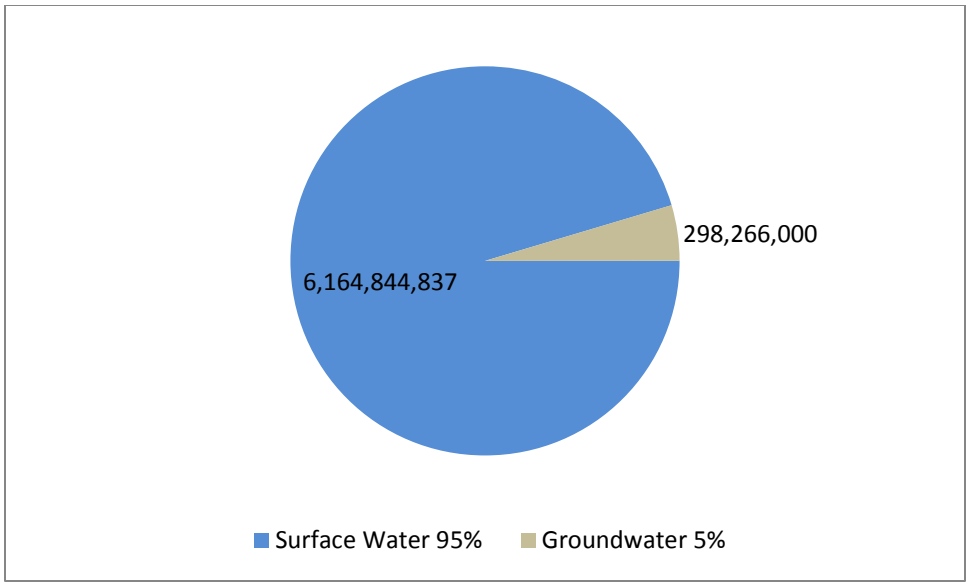


Figure 2-5 Average annual gallons of water withdrawn by LQUs from groundwater and surface water sources in the Tygart Valley Watershed.

Interbasin transfers occur when water is permanently moved from one watershed to another. This can occur in a number of ways. However, only three possible routes of transfer are considered here; see Chapter 2 of the Plan for a discussion of possibilities and data limitations. The following is a detailed list of interbasin transfers occurring between the Tygart Valley and other HUC-8 watersheds as a result of LQU operations in 2011:

- Withdrawals vs. Stream Discharges
    - Consol Energy – Robinson Run withdraws a three-year average of approximately 193 million from surface creeks and impoundments in the West Fork Watershed. The water is used for the industrial operation of a coal preparation plant, surface fire suppression, and dust control on haul roads. A three-year average of approximately 5.8 million gallons are discharged into a stream in West Fork, 1.8 million is discharged into a stream in the Monongahela Watershed, and 2.1 million is discharged on haul roads most highly concentrated in the West Fork Watershed.
    - Wolf Run Mining – Sentinel Complex withdraws a three-year average of approximately 81 million gallons of surface and ground water from Tygart Valley Watershed and approximately 161 thousand gallons annually from ground water sources in West Fork Watershed. The water is used as makeup water for the preparation plant and for safety and dust control underground. Water is released in unknown quantities into the surface waters of the Tygart Valley Watershed via 12 outlet locations that are under one NPDES permit number.

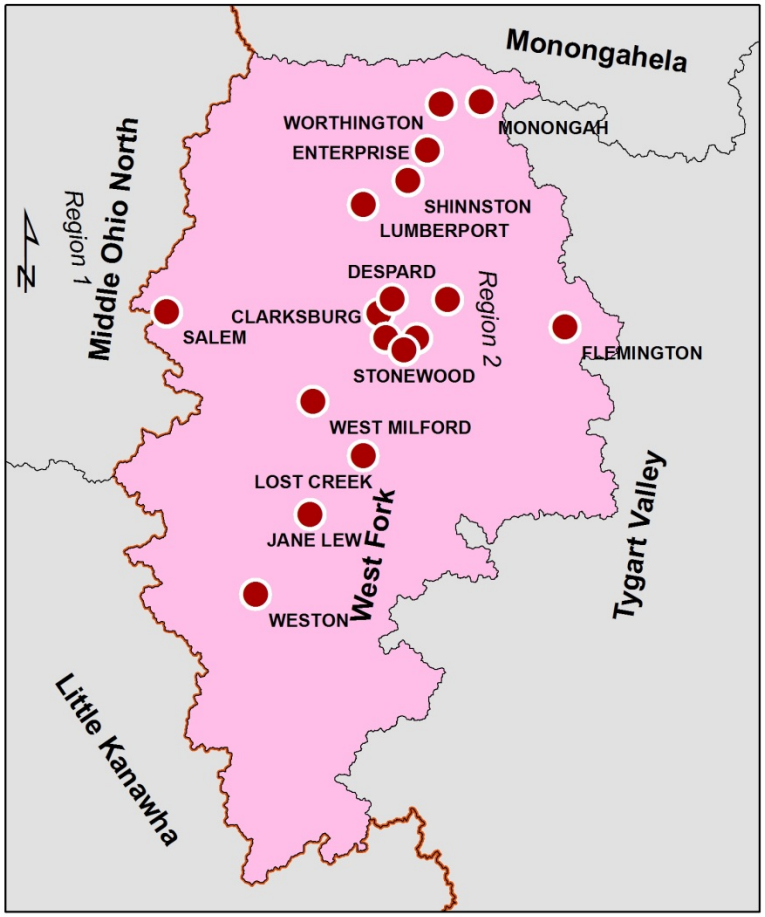
- Withdrawals vs. POTW discharges
    - None reported
- Purchased water vs. Stream/POTW Discharges
    - Consol Energy – Robinson Run purchases an approximate annual average of 8.9 million gallons of water from the Tygart Valley Watershed via Bingamon and Mannington PSDs. The water is used for the industrial operation of a coal preparation plant, surface fire suppression and dust control on haul roads. A three-year average of approximately 5.8 million gallons is discharged into a stream in the West Fork Watershed, 1.8 million is discharged into a stream in the Monongahela Watershed, and 2.1 million is discharged on haul roads most highly concentrated in the West Fork Watershed.
    - Allegheny Energy Supply – Harrison Power Station purchases a three-year average of water from the City of Shinnston approximately equal to 105 million gallons and from the Town of Lumberport at about 822 thousand gallons per year, which are located in the Tygart Valley and West Fork watersheds, respectively. The water is reportedly used by the facility for coal-fired steam electric generation and associated closed-loop cooling water processes. The only form of discharge reported is stream discharge at three locations that fall under a single NPDES permit number. All water discharged from the facility at these locations enters the West Fork Watershed at an average rate of 3.1 billion gallons per year.

Marcellus Shale

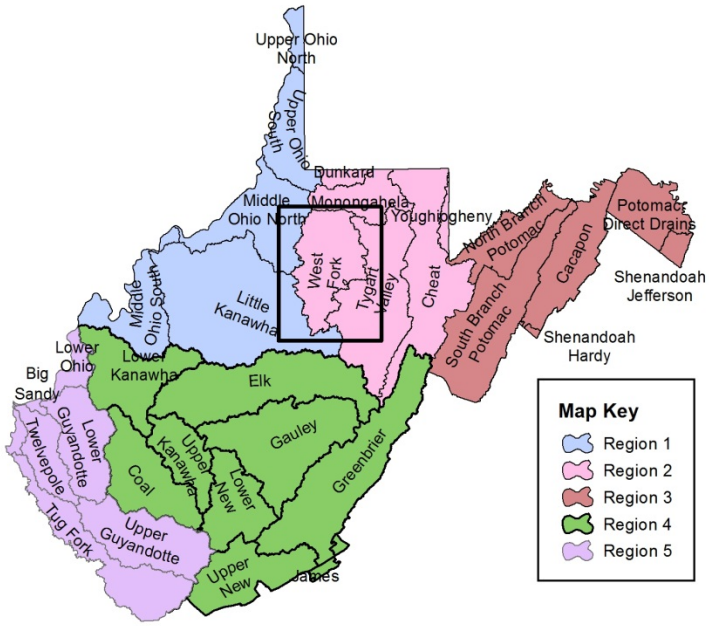
Since the DEP started tracking water use data associated with hydraulic fracturing operations in 2009, approximately 215 million gallons of water have been withdrawn from Tygart Valley River Watershed. In this watershed, stream/rivers comprise the majority of source water for the oil and gas exploration industry. The most frequently cited stream and river sources from this region are the Tygart Valley River and Buckhannon River.

Water Source	2009	2010	2011	Grand Total
Commercial Broker	0	20,708,292	19,992,788	40,701,080
Stream/River	3,273,606	88,112,696	82,662,972	174,049,274
Grand Total	**3,273,606**	**108,820,988**	**102,655,760**	**214,750,354**

Table 2-2 Water use for hydraulic fracturing in the Tygart Valley River Watershed from 2009-2011 in gallons



West Fork River Watershed



West Fork River Watershed

Watershed Description

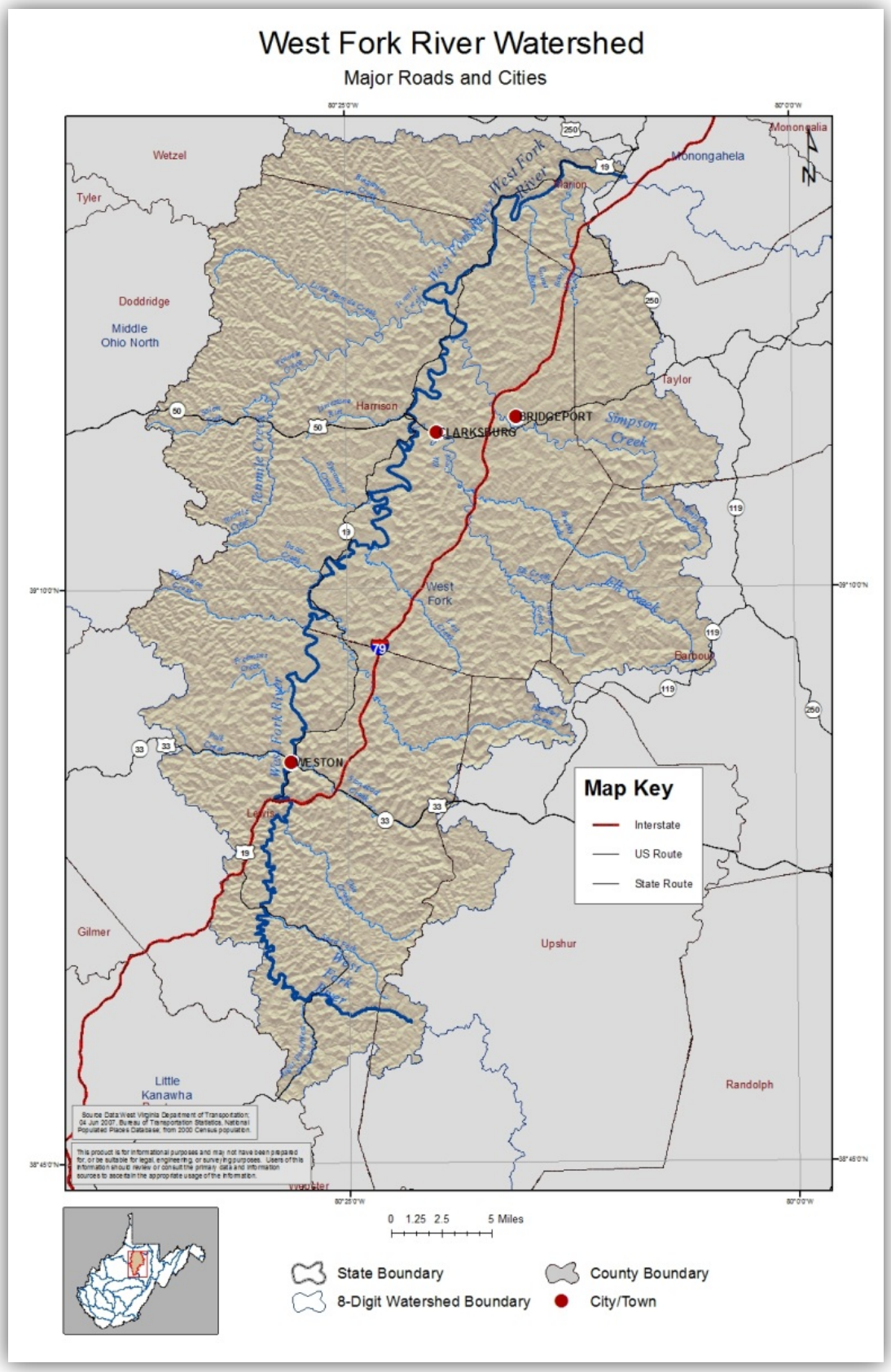
Located in north-central West Virginia, the West Fork River Watershed covers more than 880 square miles. The watershed contains all, or portions, of six counties (Barbour, Harrison, Lewis, Marion, Taylor and Upshur). Harrison and Lewis comprise 75% of the total area of the watershed.

The West Fork River Watershed has 1,888 miles of streams and rivers and contains the headwaters of the West Fork River. The West Fork River begins from its headwaters in Upshur County and flows north through the city of Clarksburg to its confluence with the Tygart River near the city of Fairmont. The major tributaries include Elk Creek, Simpson Creek and Tenmile Creek.

Additionally, the watershed encompasses all, or portions, of the following state and federal public lands: five wildlife management areas (Center Branch, Pruntytown State Farm, Smoke Camp, Stonecoal Lake and Stonewall Jackson Lake) and two state parks (Stonewall Jackson Lake and Watters Smith Memorial). The West Fork River Watershed also encompasses Stonewall Jackson Lake, which is located south of Weston in Lewis County. The lake has 1,736 acres of surface area and the Dam maintains a minimum flow release of 15 cubic feet per second.

Demographics

The West Fork River Watershed has a total population of approximately 104,004. The watershed has three cities and towns with a population exceeding 4,000. The largest city within the watershed is Clarksburg with a total population of 16,578, followed by Bridgeport (8,149) and Weston (4,110).


West Fork River Watershed
Major Roads and Cities
Wetzel
Tyler
Doddridge
Middle Ohio North
Monongalia
Marion
Harrison
Taylor
Barbour
Lewis
Gilmer
Upshur
Randolph
Little Kanawha
CLARKSBURG
BRIDGEPORT
WESTON
West Fork
West Fork River
Simpson Creek
Tenmile Creek
Elk Creek
Map Key
Interstate
US Route
State Route
0 1.25 2.5 5 Miles
State Boundary
8-Digit Watershed Boundary
County Boundary
City/Town

Geography and Geology

The West Fork River Watershed lies within two ecoregions. Nearly the entire watershed (99%) occupies the Western Allegheny Plateau Ecoregion, which is comprised of rounded hills with wide fertile valleys, mixed oak forests and agricultural lands. A small portion (1%) in the southern tip of the watershed is located in the Central Appalachians Ecoregion, which is known for its rugged and mountainous terrain, cooler climate and biologically diverse habitat. The average elevation for the watershed is 1,239 feet above mean sea level, with the highest elevation of 1,965 feet and the lowest elevation at approximately 837 feet. The average annual temperature is 52 degrees Fahrenheit and ranges from 51 to 53 degrees. The average annual precipitation for the West Fork River Watershed is 45.60 inches per year.

The majority (73%) of the watershed is covered by forest area, while 15% is planted/cultivated area. Approximately 15% of the land cover is classified as developed and 3.6% is defined as impervious surface area.

The surface geology in the West Fork River Watershed is predominantly (96%) shale and sandstone while there is a small percentage of alluvium.

The United States Geological Survey (USGS), in conjunction with federal, state and local agencies, including the DEP, cooperatively funds the USGS stream gaging network to monitor water availability. Currently, there are seven surface water gaging stations and one groundwater gaging station located within the watershed. The groundwater gaging station is a well site located in Harrison County. Surface water data is collected from seven stream gages located at Stonewall Jackson Lake (1) and multiple locations along the West Fork River (6). The recorded data can be accessed at http://waterdata.usgs.gov/nwis.

LQU data

Table 2-3 contains a list of all Large Quantity User (LQU) facilities in the West Fork Watershed that are currently operating, their Standard Industrial Category (SIC) of use, the average percent of source water withdrawn annually, percent withdrawn from the watershed and county, as well as others if intakes are located elsewhere, and the average amount of water withdrawn by the facility based on the most recent three years of monthly data. A detailed discussion about categories of use type and comparisons of use to statewide withdrawals and consumption is available in Chapter 2 of the Plan. Chapter 4 of the Plan

includes data and discussion about future use projections. The following is a summary of data collected regarding the facilities:

- 4 Public Water Supply facilities
    - Jane Lew Public Service District closed in 2010
    - Clarksburg Water Board withdraws the most, averaging 2.6 billion gallons annually
    - Lumberport Water is the smallest, withdrawing an average of 59.7 million gallons annually
- 2 Mining facilities: Consol Energy – Robinson Run and Wolf Run Mining –Sentinel Complex
- 1 Petroleum facility: Mars Water Supply Well
- 1 Recreation facility: WVDNR Stonewall Jackson Lake State Park
- 1 Thermoelectric (coal) facility: Allegheny Energy Supply Harrison Power Station
- 1 Frac Water facility
    - Salem Water Board registered as a LQU in this watershed but is not considered here due to double counting. They are reportedly only operating as a frac water broker. See Marcellus Shale section of this watershed for detailed information.

Table 2-3 All facilities withdrawing from West Fork Watershed organized by Use Category and Intake Source and Location (watershed and county). Blanks indicate that no additional withdrawals were occurring.

Facility ID	Facility Name	Use Category	Source and % of 3 Year Average		Watershed and % of 3 Year Average		County and % of 3 Year Average		3 Year Annual Average (gallons)
2521	Allegheny Energy Supply - Harrison Power Station	Thermoelectric (coal)	Surface Water 100.00%		West Fork 100.00%		Harrison 100.00%		13,560,292,200
4143	Clarksburg Water Board	Public water supply	Surface Water 100.00%		West Fork 100.00%		Harrison 100.00%		2,588,148,333
3411	Consol Energy - Robinson Run	Mining	Surface Water 100.00%		West Fork 100.00%		Harrison 90.20%	Marion 9.80%	192,785,167
2778	Lumberport Water	Public water supply	Surface Water 100.00%		West Fork 100.00%		Harrison 100.00%		59,705,333
2960	Mars Water Supply Well	Petroleum		Groundwater 100.00%	West Fork 100.00%		Harrison 100.00%		32,087,048
10013	Salem Water Board	Frac Water	Surface Water 100.00%		West Fork 100.00%		Harrison 100.00%		117,031,667
1469	West Virginia American Water - Weston WTP	Public water supply	Surface Water 100.00%		West Fork 100.00%		Lewis 100.00%		431,777,333
10103	Wolf Run Mining - Sentinel Complex	Mining	Surface Water 21.90%	Groundwater 78.10%	Tygart Valley 99.93%	West Fork 0.07%	Barbour 100.00%		81,209,500
2729	WVDNR - Stonewall Jackson Lake State Park	Recreation	Surface Water 100.00%		West Fork 100.00%		Lewis 100.00%		35,369,477

Figures 2-6 through 2-10 summarize the breakdown of the share total withdrawals occurring among currently operating facilities, the trends in use over time for each industry group, and the amount and share of source water withdrawn by the currently operating LQUs in the watershed.

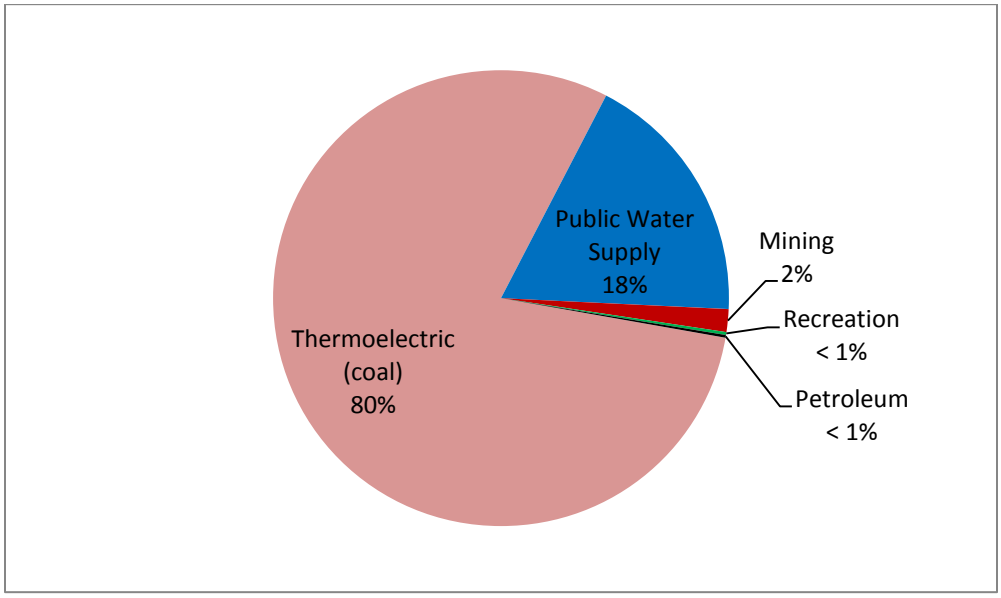
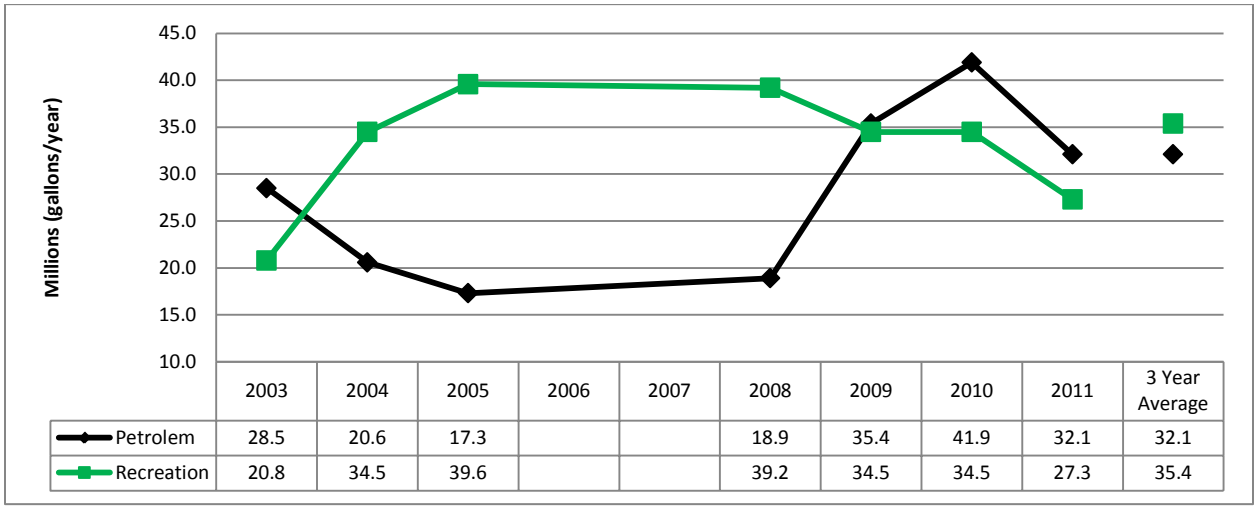
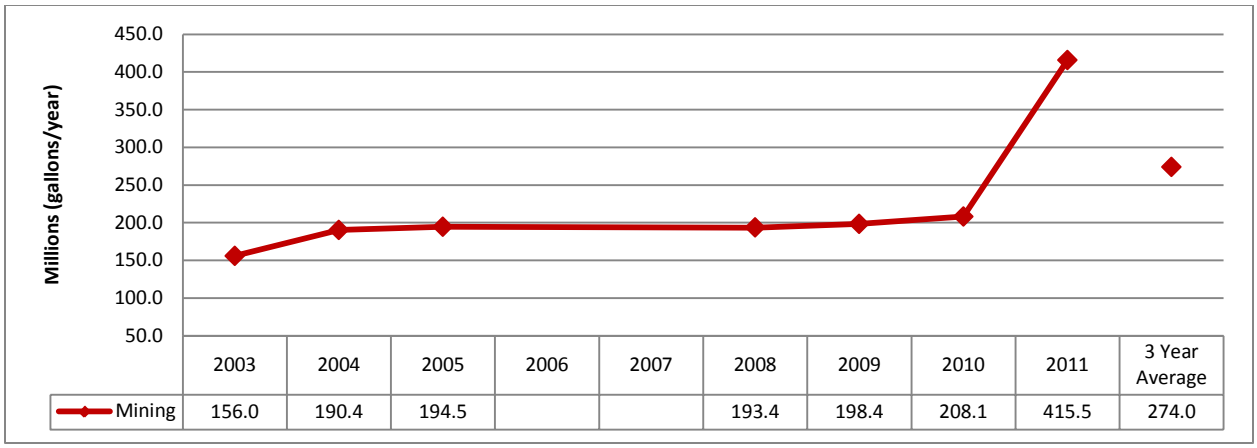


Figure 2-6 West Fork Watershed LQU percent of total average annual water withdrawals by sector (excluding Frac Water*).



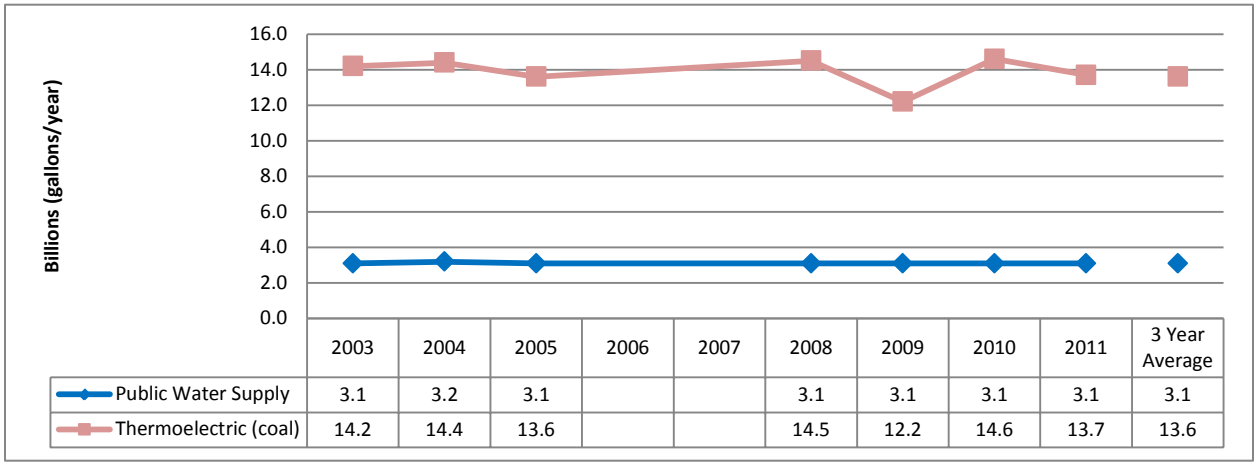
	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Petrolem	28.5	20.6	17.3			18.9	35.4	41.9	32.1	32.1
Recreation	20.8	34.5	39.6			39.2	34.5	34.5	27.3	35.4

Figure 2-7 West Fork Watershed LQU water withdrawal trends for the Petroleum and Recreation SIC categories, measured in millions of gallons per year.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Mining	156.0	190.4	194.5			193.4	198.4	208.1	415.5	274.0

Figure 2-8 West Fork Watershed LQU water withdrawal trends for the Mining SIC category, measured in millions of gallons per year.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Public Water Supply	3.1	3.2	3.1			3.1	3.1	3.1	3.1	3.1
Thermoelectric (coal)	14.2	14.4	13.6			14.5	12.2	14.6	13.7	13.6

Figure 2-9 West Fork Watershed LQU water withdrawal trends for the Public Water Supply and Thermoelectric (coal) SIC categories, measured in billions of gallons per year.

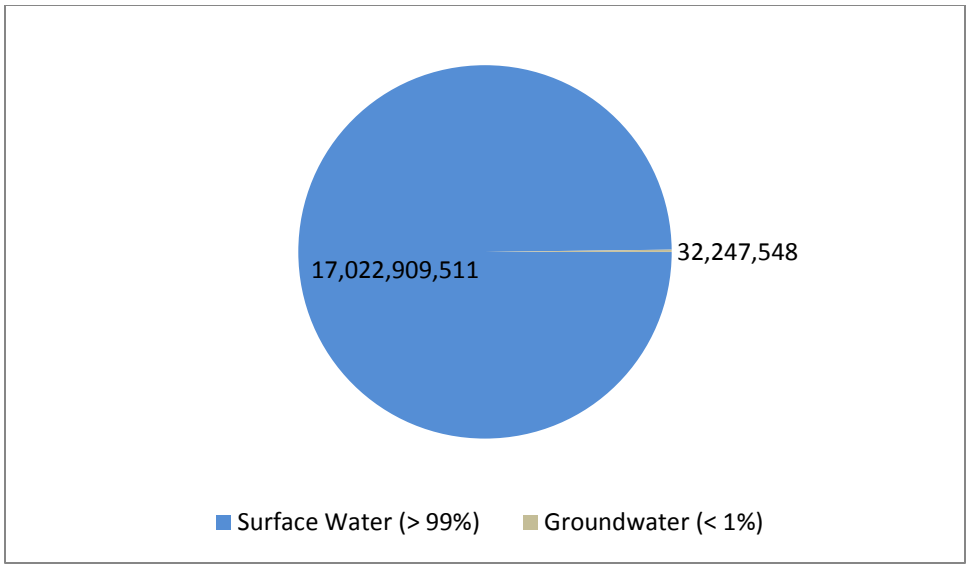


Figure 2-10 Average annual gallons of water withdrawn by LQUs from groundwater and surface water sources in the West Fork Watershed.

Interbasin transfers occur when water is permanently moved from one watershed to another. This can occur in a number of ways. However, only three possible routes of transfer are considered here; see Chapter 2 of the Plan for a discussion of possibilities and data limitations. The following is a detailed list of interbasin transfers occurring between the West Fork and other HUC-8 watersheds as a result of LQU operations in 2011:

- Withdrawals vs. Stream Discharges
    - Consol Energy – Robinson Run withdraws a three-year average of approximately 193 million gallons from surface creeks and impoundments in the West Fork Watershed. The water is used for the industrial operation of a coal preparation plant, surface fire suppression and dust control on haul roads. A three-year average of approximately 5.8 million gallons are discharged into a stream in West Fork, 1.8 million is discharged into a stream in the Monongahela Watershed, and 2.1 million is discharged on haul roads most highly concentrated in the West Fork watershed.
    - Wolf Run Mining – Sentinel Complex withdrawals a three-year average of approximately 81 million gallons of surface and ground water from Tygart Valley Watershed and approximately 161 thousand gallons annually from ground water sources in West Fork Watershed. The water is used as makeup water for the preparation plant and for safety and dust control underground. Water is released in unknown quantities into the surface waters of the Tygart Valley Watershed via 12 outlet locations that all fall under one NPDES permit number.

- Withdrawals vs. POTW discharges
    - None reported
- Purchased water vs. Stream/POTW Discharges
    - Allegheny Energy Supply – Harrison Power Station purchases a three-year average of water from the City of Shinnston approximately equal to 105 million gallons and from the Town of Lumberport at about 822 thousand gallons per year, which are located in the Tygart Valley and West Fork watersheds, respectively. The water is reportedly used by the facility for coal-fired steam electric generation and associated closed-loop cooling water processes. The only form of discharge reported is stream discharge at three locations that fall under a single NPDES permit number. All water discharged from the facility at these locations enters the West Fork Watershed at an average rate of 3.1 billion gallons per year.
    - Consol Energy – Robinson Run purchases an approximate annual average of 8.9 million gallons of water from the Tygart Valley Watershed via Bingamon and Mannington PSDs. The water is used for the industrial operation of a coal preparation plant, surface fire suppression and dust control on haul roads. A three-year average of approximately 5.8 million gallons is discharged into a stream in West Fork, 1.8 million is discharged into a stream in the Monongahela Watershed, and 2.1 million is discharged on haul roads most highly concentrated in the West Fork Watershed.

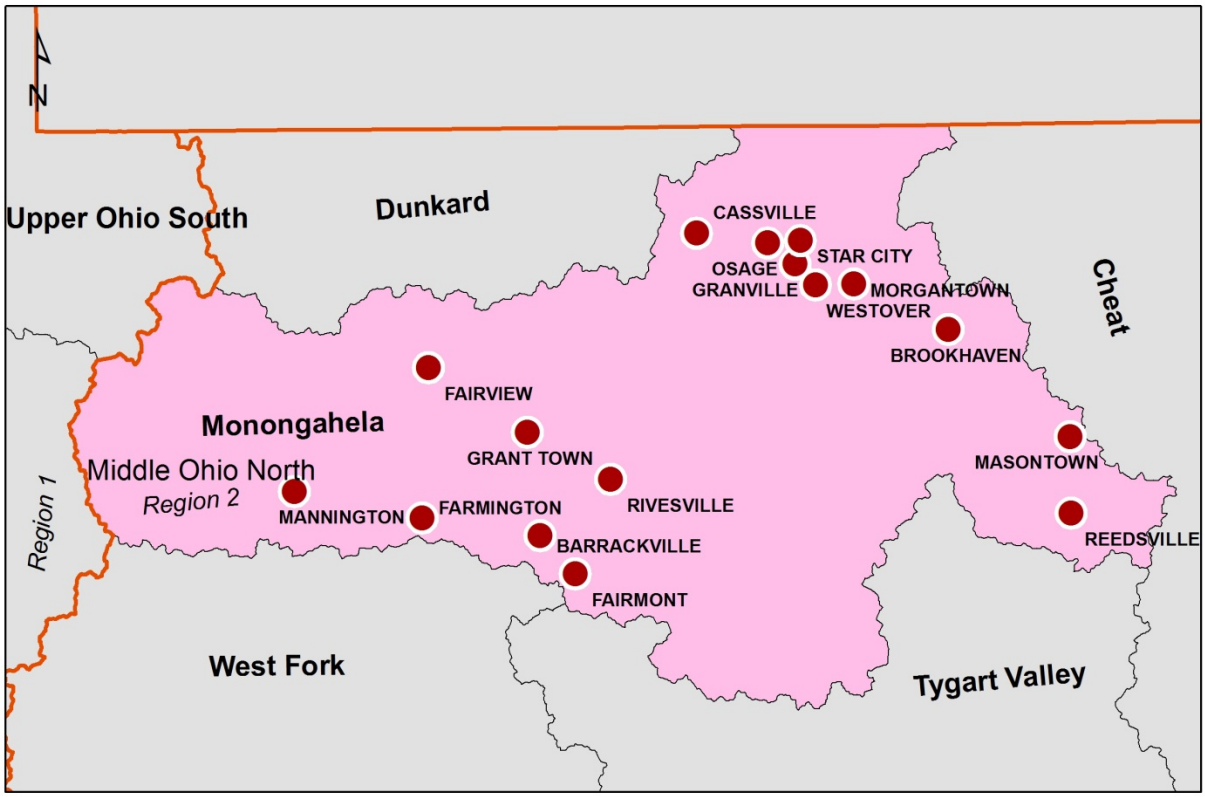
Marcellus Shale

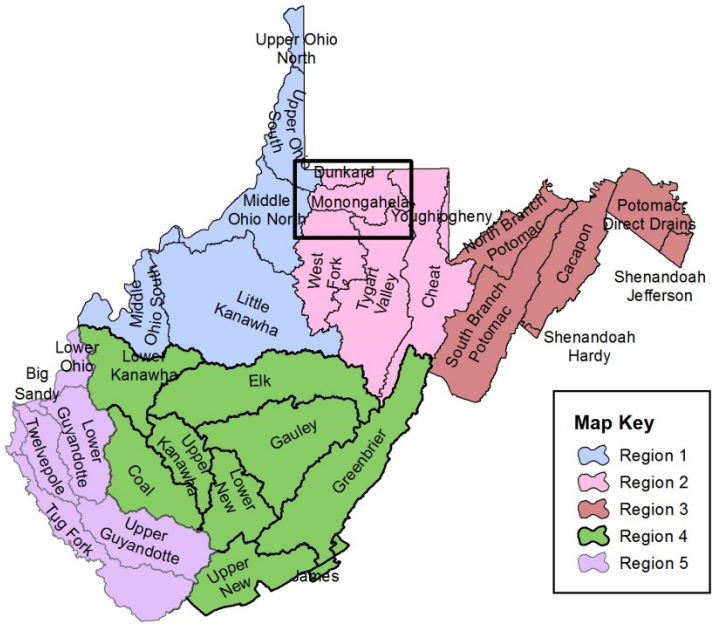
Since the DEP started tracking water use data associated with hydraulic fracturing operations in 2009, approximately 266 million gallons of water have been withdrawn from West Fork Watershed. In this watershed, stream/rivers comprise the majority of source water for the oil and gas exploration industry. The most frequently cited stream and river source from this region is the West Fork River. The City of Salem Reservoir represents a significant portion of water as well.

Water Source	2009	2010	2011	Grand Total
Commercial Broker	0	6,220,998	1,304,190	7,525,188
Lake/Reservoir/Pond	1,680,000	567,000	27,742,450	29,989,450
Stream/River	6,318,355	100,012,850	121,898,423	228,229,628
Grand Total	**7,998,355**	**106,800,848**	**150,945,063**	**265,744,266**

Table 2-4 Water use for hydraulic fracturing in the West Fork Watershed from 2009-2011 in gallons

Monongahela River Watershed





Monongahela River Watershed

Watershed Description

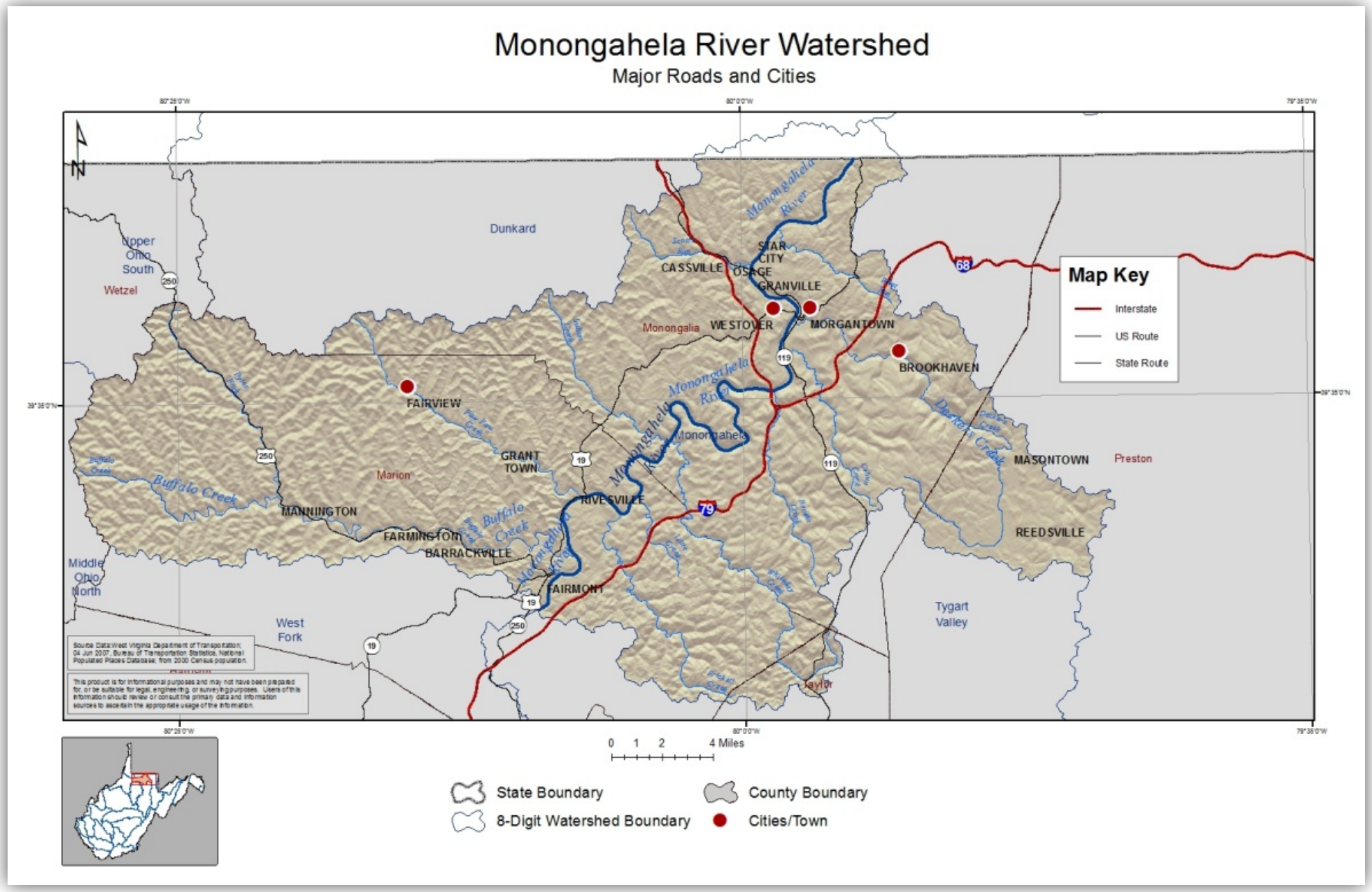
Located in north-central West Virginia, the Monongahela River Watershed extends from Taylor County in the south to the West Virginia-Pennsylvania border in the north. Covering approximately 456 square miles in West Virginia, the watershed contains all, or portions, of four counties (Marion, Monongalia, Preston and Taylor), while Marion and Monongalia comprise 92% of the total area of the watershed.

The Monongahela River Watershed has 867 miles of streams and rivers and contains the Monongahela River headwaters. The Monongahela River begins in the city of Fairmont where the West Fork River and Tygart Valley River converge. The major tributaries include Buffalo Creek and Deckers Creek.

Additionally, the watershed encompasses all, or portions, of the following state and federal public lands: four wildlife management areas (Dents Run, Little Indian Creek, Snake Hill and Upper Deckers Creek) and one state park (Prickett's Fort).

Demographics

The Monongahela River Watershed has a total population of approximately 121,256. The watershed has four cities and towns with a population exceeding 3,500. The largest city within the watershed is Morgantown with a total population of 29,660, followed by Fairmont (18,704), Brookhaven (5,171) and Westover (3,983).


Monongahela River Watershed
Major Roads and Cities
Dunkard
Upper Ohio South
Wetzel
Monongalia
Marion
Preston
Middle Ohio North
West Fork
Tygart Valley
Taylor
CASSVILLE
STAR CITY
OSAGE
GRANVILLE
WESTOVER
MORGANTOWN
BROOKHAVEN
FAIRVIEW
GRANT TOWN
MANNINGTON
FARMINGTON
BARRACKVILLE
RIVESVILLE
FAIRMONT
MASONTOWN
REEDSVILLE
Monongahela River
Buffalo Creek
Deckers Creek
Map Key
Interstate
US Route
State Route
0 1 2 4 Miles
State Boundary
8-Digit Watershed Boundary
County Boundary
Cities/Town

Geography and Geology

The Monongahela River Watershed lies within two ecoregions. The eastern portion (24%) of the watershed occupies the Central Appalachians Ecoregion, which is known for its rugged and mountainous terrain, cooler climate and biologically diverse habitat. The western portion (76%) lies within the Western Allegheny Plateau Ecoregion, which is comprised of rounded hills with wide fertile valleys, mixed oak forests and agricultural lands. The average elevation for the watershed is 1,313 feet above mean sea level, with the highest elevation of 2,408 feet and the lowest elevation at approximately 774 feet. The average annual temperature is 51 degrees Fahrenheit and ranges from 49 to 53 degrees. The average annual precipitation for the Monongahela River Watershed is 44.80 inches per year.

The majority (73%) of the watershed is covered by forest area, while 11% is planted/cultivated area. Approximately 13% of the land cover is classified as developed and 5.3% is defined as impervious surface area.

The surface geology in the Monongahela River Watershed is predominantly (97%) shale and sandstone while there is a small percentage of alluvium and limestone.

The United States Geological Survey (USGS), in conjunction with federal, state and local agencies, including the DEP, cooperatively funds the USGS stream gaging network to monitor water availability. Currently, there are nine surface water gaging stations located within the watershed. Surface water data is collected from the stream gages located on Buffalo Creek (1), Deckers Creek (1), Whetstone Run (1) and multiple locations along the Monongahela River (6). The recorded data can be accessed at http://waterdata.usgs.gov/nwis.

LQU Data

Table 2-5 contains a list of all Large Quantity User (LQU) facilities in the Monongahela Watershed that are currently operating, their Standard Industrial Category (SIC) of use, the average percent of source water withdrawn annually, percent withdrawn from the watershed and county, as well as others if intakes are located elsewhere, and the average amount of water withdrawn by the facility based on the most recent three years of monthly data. A detailed discussion about categories of use type and comparisons of use to statewide withdrawals and consumption is available in Chapter 2 of the Plan. Chapter 4 of the Plan includes data and discussion about future use projections. The following is a summary of data collected regarding the facilities:

- 7 Public Water Supply facilities
    - 3 have closed: Masontown waterworks in 2008 and in 2009 both Robert B. Creel Water Treatment Facility and Mannington Water Works closed
    - Current withdrawal averages range from 3.6 billion gallons by Morgantown Utility Board to 8 million gallons by Arthurdale Water Company.
- 4 Mining Facilities
    - Greer Limestone (Masontown location) closed in 2011
    - Average annual use ranges from 7 million gallons by Deckers Creek Limestone Company to 250 million gallons by Consol Energy – Loveridge.
- 3 Thermoelectric (coal) facilities ranging in use from 1 billion gallons annually to 27 billion gallons
- 1 Recreation facility: Pikewood National Golf Course
- 1 Timber facility: Fibrek Recycling U.S. Inc. – Fairmont Mill

Table 2-5 All facilities withdrawing from Monongahela Watershed organized by Use Category and Intake Source and Location (watershed and county). Blanks indicate that no additional withdrawals were occurring.

Facility ID	Facility Name	Use Category	Source and % of 3 Year Average		Watershed and % of 3 Year Average		County and % of 3 Year Average		3 Year Annual Average (gallons)
10065	Arthurdale Water Company	Public water supply		Groundwater 100.00%	Monongahela 100.00%		Preston 100.00%		8,060,800
3414	Consol Energy - Loveridge	Mining	Surface Water 100.00%		Dunkard 6.73%	Monongahela 93.27%	Monongalia 6.73%	Marion 93.27%	249,201,093
3184	Consolidation Coal Co - Flaggy Meadows AMD Plant	Mining	Surface Water 100.00%		Monongahela 100.00%		Monongalia 100.00%		54,493,335
10081	Deckers Creek Limestone Company	Mining	Surface Water 29.07%	Groundwater 70.93%	Monongahela 100.00%		Monongalia 100.00%		7,223,659
2310	Fibrek Recycling U.S. Inc. - Fairmont Mill	Timber	Surface Water 100.00%		Monongahela 100.00%		Marion 100.00%		1,169,002,867
2619	Monongahela Powe Co - Rivesville Power Station	Thermoelectric (coal)	Surface Water 100.00%		Monongahela 100.00%		Marion 100.00%		1,175,755,609
2493	Monongahela Power Co - Fort Martin Power Station	Thermoelectric (coal)	Surface Water 100.00%		Monongahela 100.00%		Monongalia 100.00%		3,671,588,650
3422	Morgantown Energy Facility	Thermoelectric (coal)	Surface Water 100.00%		Monongahela 100.00%		Monongalia 100.00%		26,827,340,000
10026	Morgantown Utility Board	Public water supply	Surface Water 100.00%		Monongahela 100.00%		Monongalia 100.00%		3,618,309,333
10092	Pikewood National Golf Course	Recreation	Surface Water 100.00%		Monongahela 100.00%		Monongalia 100.00%		14,717,658
7267	Preston County Public Service District #1 WIP	Public water supply	Surface Water 100.00%		Monongahela 100.00%		Preston 100.00%		82,995,531
2633	Town of Fairview Water Department	Public water supply		Groundwater 100.00%	Monongahela 100.00%		Marion 100.00%		22,162,860

Figures 2-11 through 2-14 summarize the breakdown of the share total withdrawals occurring among currently operating facilities, the trends in use over time for each industry group, and the amount and share of source water withdrawn by the currently operating LQUs in the watershed.

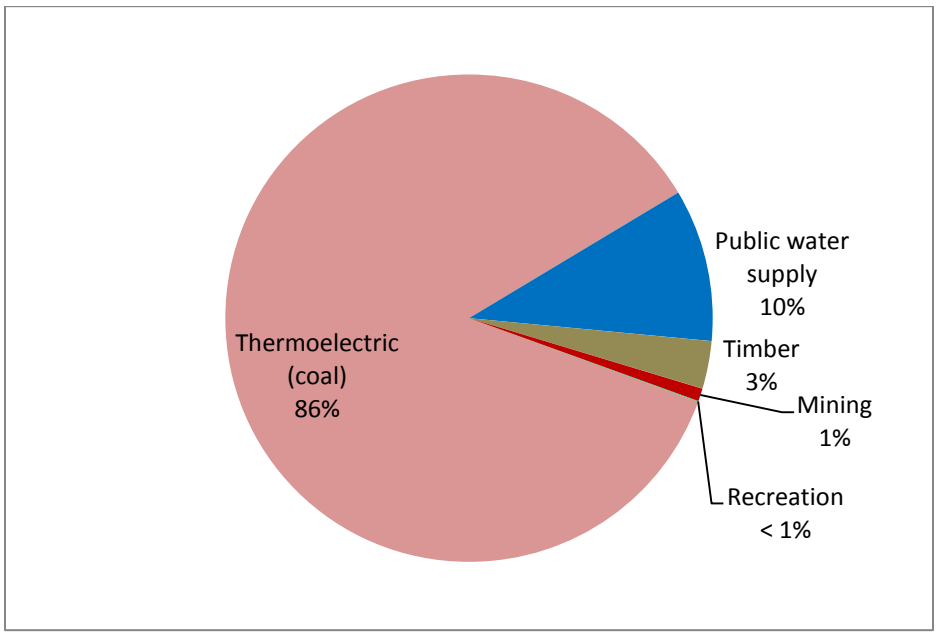
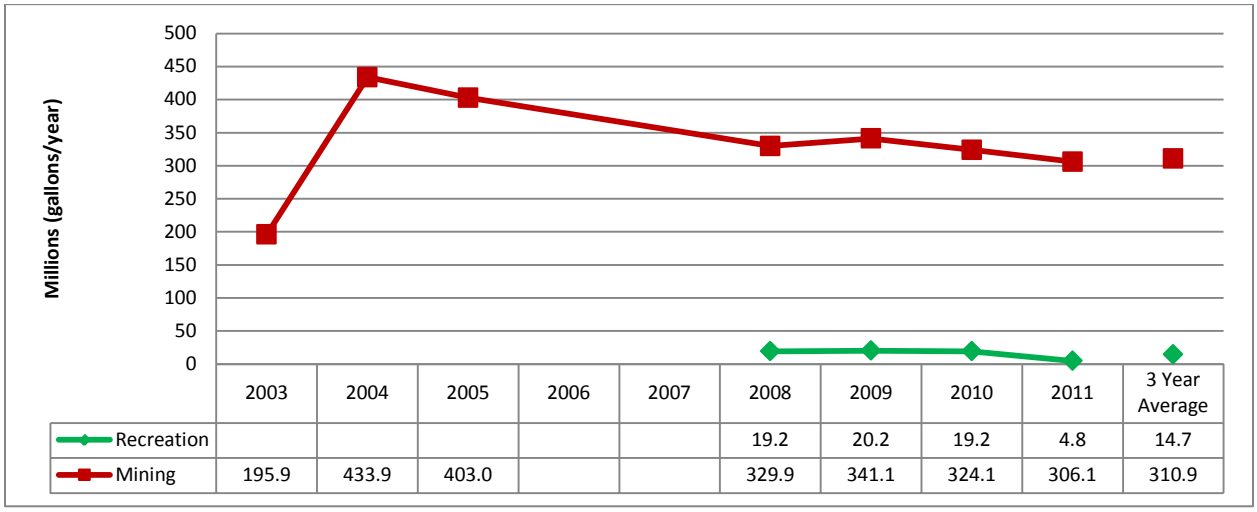
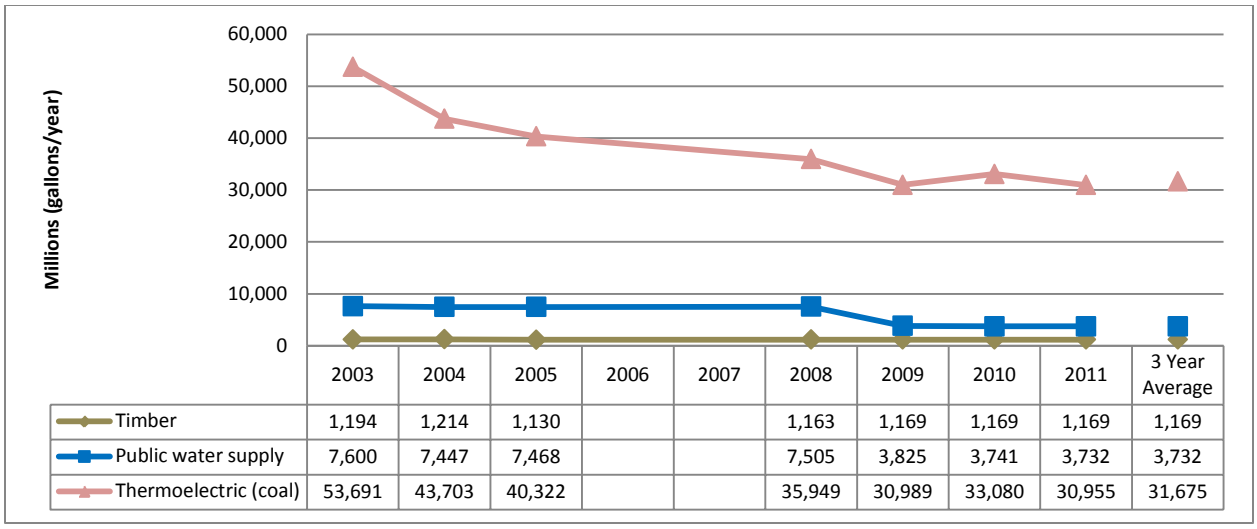


Figure 2-11 Monongahela Watershed LQU percent of total average annual water withdrawals by sector (excluding Frac Water*).



	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Recreation						19.2	20.2	19.2	4.8	14.7
Mining	195.9	433.9	403.0			329.9	341.1	324.1	306.1	310.9

Figure 2-12 Monongahela Watershed LQU water withdrawal trends for the Mining and Recreation SIC categories, measured in millions of gallons per year.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Timber	1,194	1,214	1,130			1,163	1,169	1,169	1,169	1,169
Public water supply	7,600	7,447	7,468			7,505	3,825	3,741	3,732	3,732
Thermoelectric (coal)	53,691	43,703	40,322			35,949	30,989	33,080	30,955	31,675

Figure 2-13 Monongahela Watershed LQU water withdrawal trends for the Timber, Public Water Supply, and Thermoelectric (coal) SIC categories, measured in millions of gallons per year.

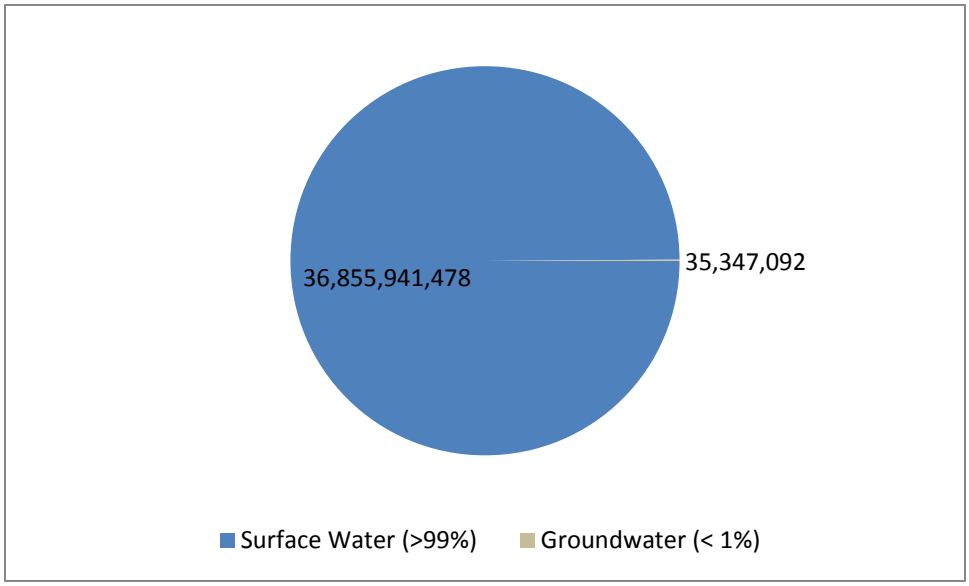


Figure 2-14 Average annual gallons of water withdrawn by LQUs from groundwater and surface water sources in the Monongahela Watershed.

Interbasin transfers occur when water is permanently moved from one watershed to another. This can occur in a number of ways. However, only three possible routes of transfer are considered here; see Chapter 2 of the Plan for a discussion of possibilities and data limitations. The following is a detailed list of interbasin transfers occurring between the Monongahela and other HUC-8 watersheds as a result of LQU operations in 2011:

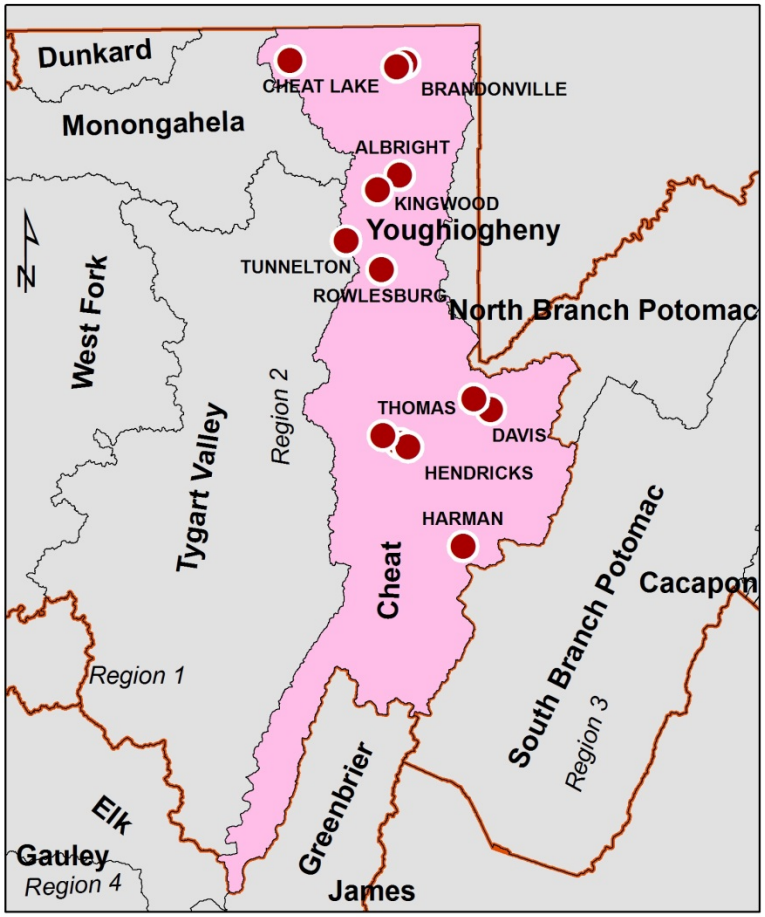
- Withdrawals vs. Stream Discharges
    - Consol Energy – Robinson Run withdraws a three-year average of approximately 193 million gallons from surface creeks and impoundments in the West Fork Watershed. The water is used for the industrial operation of a coal preparation plant, surface fire suppression and dust control on haul roads. A three-year average of approximately 5.8 million gallons is discharged into a stream in West Fork, 1.8 million is discharged into a stream in the Monongahela Watershed, and 2.1 million is discharged on haul roads most highly concentrated in the West Fork Watershed.
    - Consol Energy – Loveridge withdraws a three-year average of approximately 232 million gallons of surface water from the Monongahela Watershed and approximately 17 million gallons from the Dunkard Watershed each year for operation of a coal preparation plant, underground mine fire suppression, potable water and dust control. A three-year average of approximately 152 million gallons is reportedly discharged into surface waters of the Monongahela Watershed, while approximately 6 million gallons are discharged into the surface waters of the Dunkard Watershed. Another 54.5 million gallons are discharged into the Monongahela Watershed via ground spray and underground usage for dust control and fire suppression.
- Withdrawals vs. POTW discharges
    - None reported
- Purchased water vs. Stream/POTW Discharges
    - Consol Energy – Robinson Run purchases an approximate annual average of 8.9 million gallons of water from the Tygart Valley Watershed via Bingamon and Mannington PSDs. The water is used for the industrial operation of a coal preparation plant, surface fire suppression and dust control on haul roads. A three-year average of approximately 5.8 million gallons is discharged into a stream in West Fork, 1.8 million is discharged into a stream in the Monongahela Watershed and 2.1 million is discharged on haul roads most highly concentrated in the West Fork Watershed.

Marcellus Shale

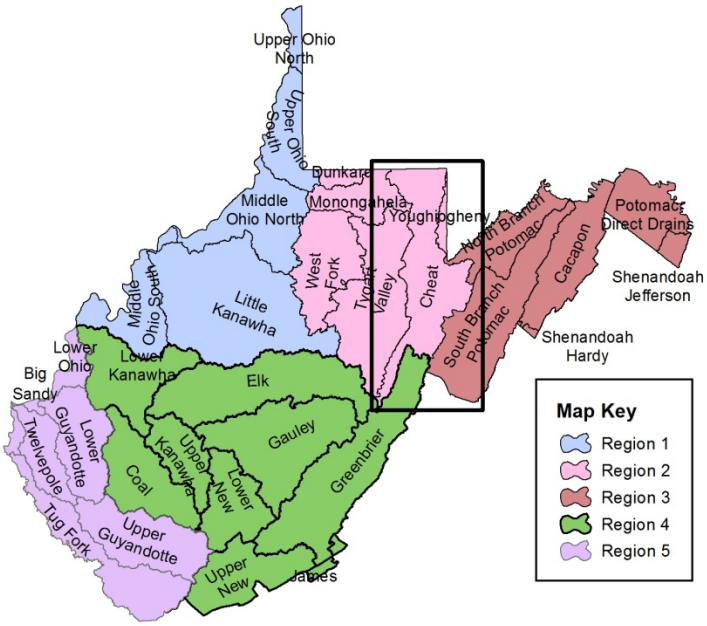
Since the DEP started tracking water use data associated with hydraulic fracturing operations in 2009, approximately 60 million gallons of water have been withdrawn from Monongahela Watershed. In this watershed, stream/rivers comprise the majority of source water for the oil and gas exploration industry. The most frequently cited stream and river source from this region is the Monongahela River.

Water Source	2009	2010	2011	Grand Total
Commercial Broker	0	0	4,112,700	4,112,700
Stream/River	0	0	56,298,410	56,298,410
Grand Total	**0**	**0**	**60,411,110**	**60,411,110**

Table 2-6 Water use for hydraulic fracturing in the Monongahela Watershed from 2009-2011 in gallons



Cheat River Watershed



Cheat River Watershed

Watershed Description

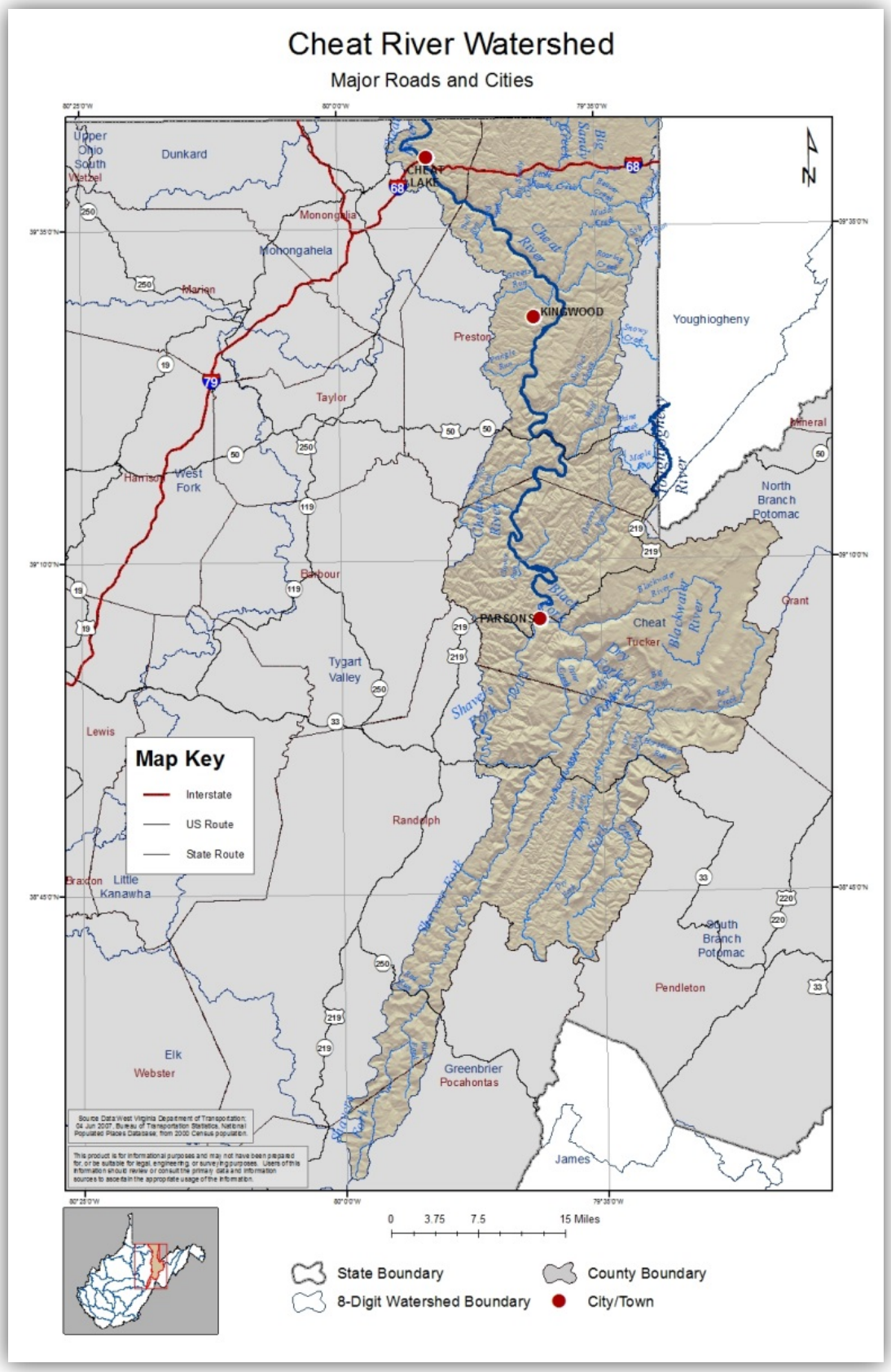
Located in north-central West Virginia, the Cheat River Watershed covers more than 1,324 square miles in West Virginia and contains all, or portions, of five counties (Monongalia, Pocahontas, Preston, Randolph and Tucker). Randolph, Tucker and Preston comprise 94% of the total area of the watershed.

The Cheat River Watershed has 2,538 miles of streams and rivers. The source of the Cheat River is at the confluence of Shavers Fork and Black Fork in the Town of Parsons in Tucker County. The major tributaries include Shavers Fork, Black Fork and Big Sandy Creek.

Additionally, the watershed encompasses all, or portions, of the following state and federal public lands: seven wildlife management areas (Beaver Dam, Blackwater, Cheat, Little River, Otter Creek, Potomac and Snake Hill), three state parks (Blackwater Falls, Canaan Valley and Cass Scenic Railroad), one state forest (Coopers Rock), one national forest (Monongahela) and the Canaan Valley National Wildlife Refuge. The Cheat River Watershed also encompasses Cheat Lake (1,730 acres of surface area) which is located in northeastern Monongalia County.

Demographics

The Cheat River Watershed has a total population of approximately 38,422. The watershed has three cities and towns with a population exceeding 1,000. The largest city within the watershed is Cheat Lake with a population of 7,988, followed by Kingwood (2,939) and Parsons (1,485).


Cheat River Watershed
Major Roads and Cities
Upper Ohio South
Wetzel
Dunkard
Monongalia
Mohongahela
Marion
Preston
KINGWOOD
Youghiogheny
Taylor
Harrison
West Fork
Mineral
North Branch Potomac
Barbour
PARSONS
Cheat
Tucker
Grant
Tygart Valley
Lewis
Map Key
Interstate
US Route
State Route
Randolph
Braxton
Little Kanawha
South Branch Potomac
Pendleton
Elk
Webster
Greenbrier
Pocahontas
James
0 3.75 7.5 15 Miles
State Boundary
8-Digit Watershed Boundary
County Boundary
City/Town

Geography and Geology

The Cheat River Watershed lies within three ecoregions. The majority of the watershed (54%) occupies the Central Appalachians Ecoregion, which is known for its rugged and mountainous terrain, cooler climate and biologically diverse habitat. Nearly 45% of the watershed is contained within the Ridge and Valley Ecoregion, which is characterized by its parallel mountain ridgelines and lowland valleys. Approximately 1% of the watershed lies within the Western Allegheny Plateau Ecoregion, which is comprised of rounded hills with wide fertile valleys, mixed oak forests and agricultural lands. The average elevation for the watershed is approximately 2,270 feet above mean sea level. The highest elevation, 4,845 feet, is located on Back Allegheny Mountain in the Shavers Fork headwaters. The lowest elevation is approximately 870 feet. The average annual temperature is 47 degrees Fahrenheit and ranges from 41 to 53 degrees. The average annual precipitation for the Cheat River Watershed is 51 inches per year.

The majority (86%) of the watershed is covered by forest area, while 6% is planted/cultivated area. Approximately 8% of the land cover is classified as developed and less than 1% is defined as impervious surface area.

The surface geology in the Cheat River Watershed is predominantly (92%) shale and sandstone while there is a small percentage of alluvium and limestone.

The United States Geological Survey (USGS), in conjunction with federal, state and local agencies, including the DEP, cooperatively funds the USGS stream gaging network to monitor water availability. Currently, there are 10 surface water gaging stations and one groundwater monitoring well located within the watershed. The groundwater gaging station is a well site located in Monongalia County, while surface water data is collected from the 10 stream gages located on Big Sandy Creek (1), Cheat Lake (1), Dry Fork (1) and multiple locations along Blackwater River (2), Cheat River (3) and Shavers Fork (2). The recorded data can be accessed at http://waterdata.usgs.gov/nwis.

LQU Data

Table 2-7 contains a list of all Large Quantity User (LQU) facilities in the Cheat Watershed that are currently operating, their Standard Industrial Category (SIC) of use, the average percent of source water withdrawn annually, percent withdrawn from the watershed and county, as well as others if intakes are located elsewhere, and the average amount of water withdrawn by the facility based on the most recent three years of monthly data. A detailed discussion about categories of use type and comparisons of use

to statewide withdrawals and consumption is available in Chapter 2 of the Plan. Chapter 4 of the Plan includes data and discussion about future use projections. The following is a summary of data collected regarding the facilities:

- 13 Public Water Supply facilities
    - 2 closed facilities: Tunnelton Municipal water works in 2009 and Bruceton Mills water Department in 2004
    - The largest withdrawer, Kingwood Water Works, averages 237 million gallons annually
    - The smallest withdrawer, Big Bear Lake Campgrounds, averages only 3.6 million gallons annually
- 3 Recreation facilities: Big Bear Lake Camplands, Snowshoe Mountain and Silver Creek Resort (which quit reporting withdrawals separate from Snowshoe Mountain after 2004).
- 2 Mining facilities that are both now closed
    - Manheim Mine closed in 2005
    - Buckeye Stone Company closed in 2009
- 1 Thermoelectric (coal) facility: Monongahela Power Co. – Albright Power Station
- 1 Timber facility: Kingsford Manufacturing Company
- 1 Agriculture/aquaculture facility: WVDNR – Bowden Hatchery
- 1 Hydroelectric facility: Allegheny Energy Supply – Lake Lynn Power Station

Table 2-7 All facilities withdrawing from Cheat Watershed organized by Use Category and Intake Source and Location (watershed and county). Blanks indicate that no additional withdrawals were occurring.

Facility ID	Facility Name	Use Category	Source and % of 3 Year Average		Watershed and % of 3 Year Average		County and % of 3 Year Average		3 Year Annual Average (gallons)
10097	Allegheny Energy Supply - Lake Lynn Power Station	Hydroelectric	Surface Water 100.00%		Cheat 100.00%		Monongalia 100.00%		627,741,586,112
4300	Big Bear Lake Camplands	Recreation		Groundwater 100.00%	Cheat 100.00%		Preston 100.00%		3,570,707
3226	Canaan Valley State Park	Public water supply	Surface Water 44.03%	Groundwater 55.97%	Cheat 100.00%		Tucker 100.00%		27,256,869
5082	Cheat Mountain Water Company	Public water supply		Groundwater 100.00%	Cheat 74.58%	Elk 25.42%	Pocahontas 100.00%		10,911,345
2106	City of Parsons	Public water supply	Surface Water 100.00%		Cheat 100.00%		Tucker 100.00%		105,971,667
10033	City of Thomas	Public water supply	Surface Water 100.00%		Cheat 100.00%		Tucker 100.00%		33,233,884
2436	Hamrick PSD	Public water supply	Surface Water 100.00%		Cheat 100.00%		Tucker 100.00%		41,204,600
7215	Harman Water Works	Public water supply		Groundwater 100.00%	Cheat 100.00%		Randolph 100.00%		8,445,000
1330	Kingsford Manufacturing Company	Timber	Surface Water 100.00%		Cheat 100.00%		Tucker 100.00%		22,367,502
3444	Kingwood Water Works	Public water supply	Surface Water 100.00%		Cheat 100.00%		Preston 100.00%		236,785,633
2005	Monongahela Power Co - Albright Power Station	Thermoelectric (coal)	Surface Water 100.00%		Cheat 100.00%		Preston 100.00%		843,748,700
1815	Preston County Public Service District #4	Public water supply		Groundwater 100.00%	Cheat 100.00%		Preston 100.00%		166,830,700
3389	Rowlesburg Water Works	Public water supply	Surface Water 100.00%		Cheat 100.00%		Preston 100.00%		46,528,631
4639	Snowshoe Mountain	Recreation	Surface Water >99.99%	Groundwater <0.01%	Cheat 98.26%	Elk 1.74%	Pocahontas 100.00%		459,501,260
1218	Timberline 4 Seasons Utilities	Public water supply		Groundwater 100.00%	Cheat 100.00%		Tucker 100.00%		19,731,813
3280	Town of Davis	Public water supply	Surface Water 100.00%		Cheat 100.00%		Tucker 100.00%		36,554,790
8111	WVDNR - Bowden Hatchery	Agriculture/aquaculture	Surface Water 100.00%		Cheat 100.00%		Randolph 100.00%		1,632,960,000

Figures 2-15 through 2-20 summarize the breakdown of the share total withdrawals occurring among currently operating facilities, the trends in use over time for each industry group, and the amount and share of source water withdrawn by the currently operating LQUs in the watershed.

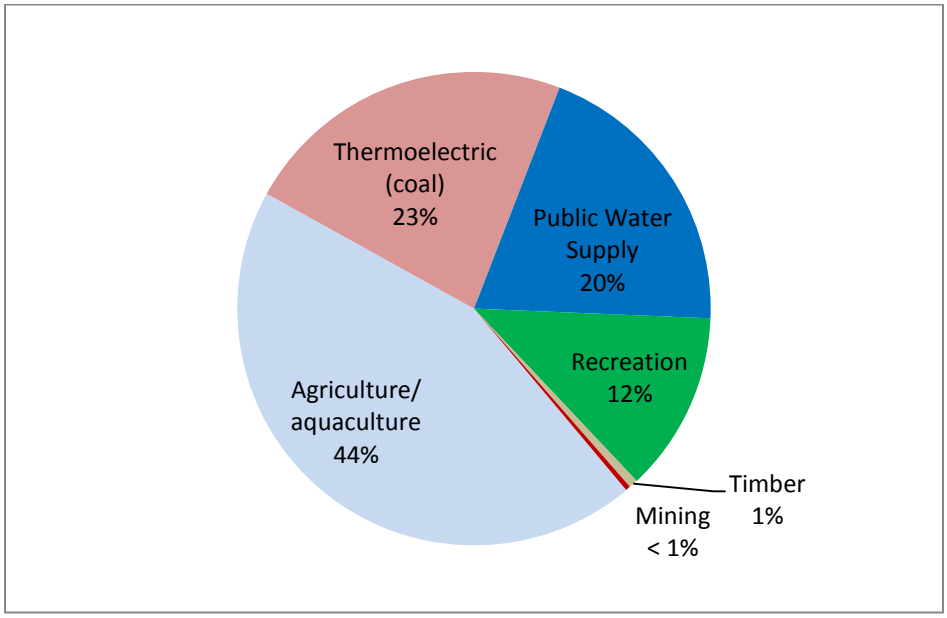
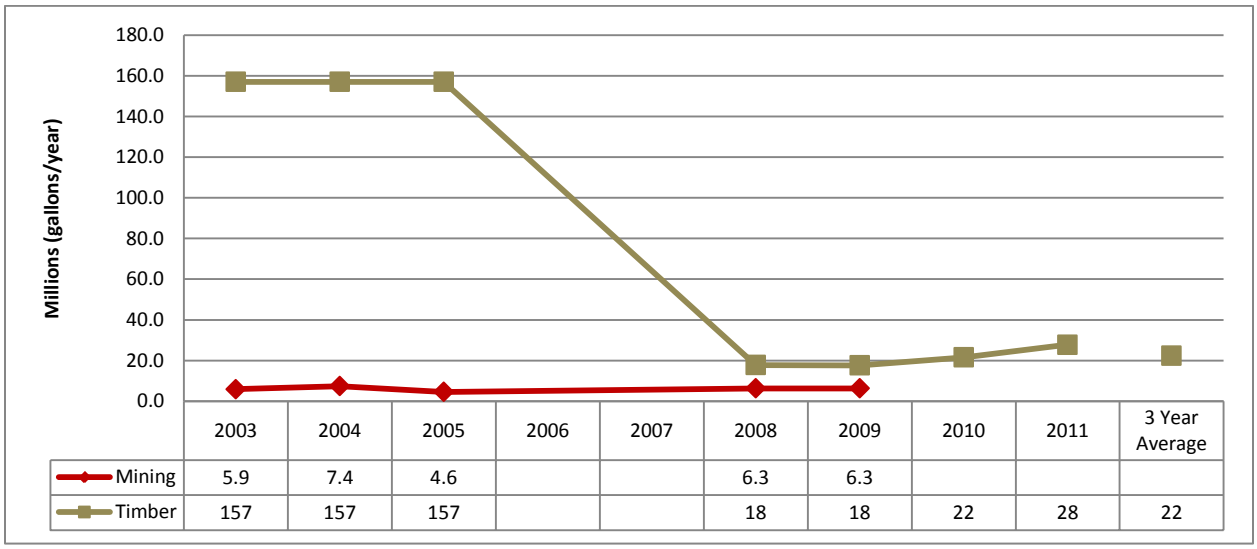
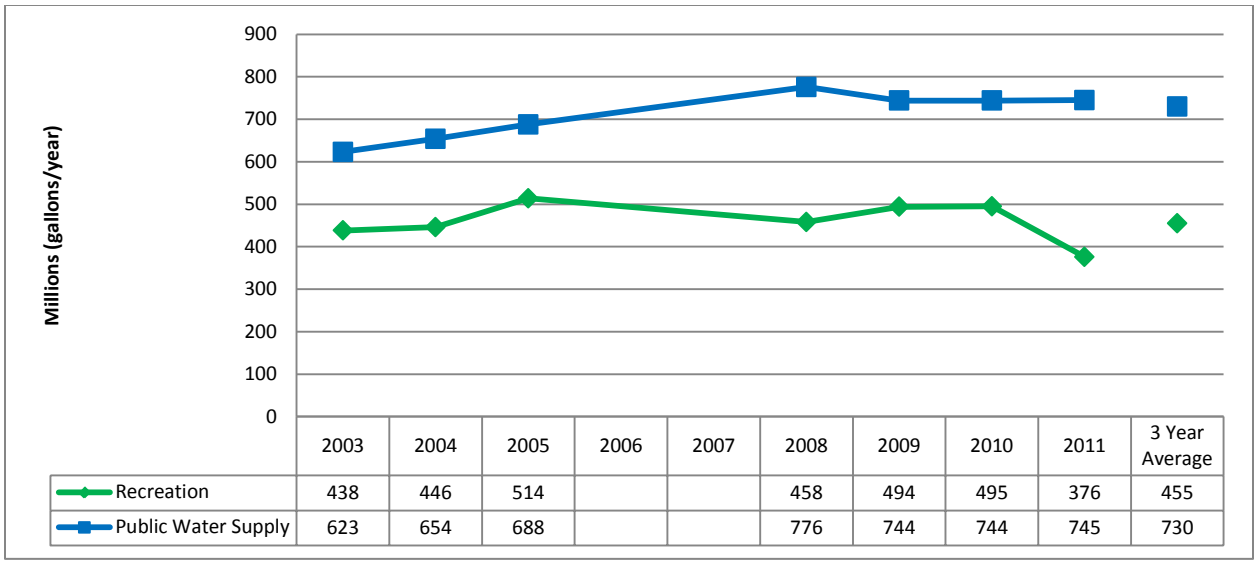


Figure 2-15 Cheat Watershed LQU percent of total average annual water withdrawals by sector (excluding Frac Water*).



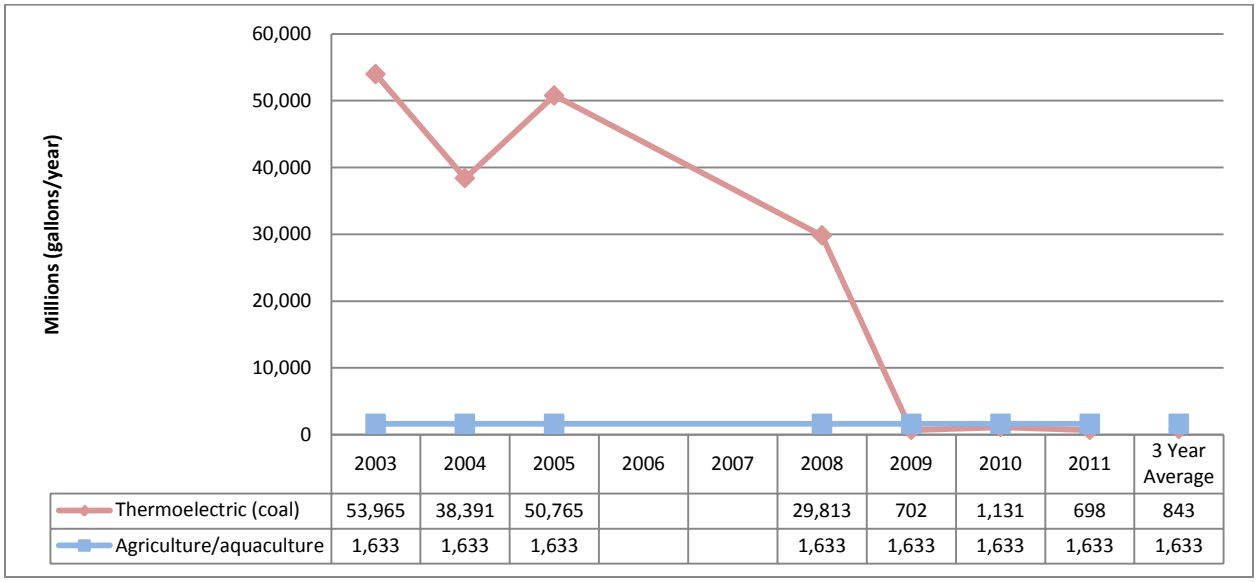
	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Mining	5.9	7.4	4.6			6.3	6.3			
Timber	157	157	157			18	18	22	28	22

Figure 2-16 Cheat Watershed LQU water withdrawal trends for the Mining and Timber SIC categories, measured in millions of gallons per year.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Recreation	438	446	514			458	494	495	376	455
Public Water Supply	623	654	688			776	744	744	745	730

Figure 2-17 Cheat Watershed LQU water withdrawal trends for the Recreation and Public Water Supply SIC categories, measured in millions of gallons per year.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Thermoelectric (coal)	53,965	38,391	50,765			29,813	702	1,131	698	843
Agriculture/aquaculture	1,633	1,633	1,633			1,633	1,633	1,633	1,633	1,633

Figure 2-18 Cheat Watershed LQU water withdrawal trends for the Thermoelectric (coal) and Agriculture/aquaculture SIC categories, measured in millions of gallons per year.

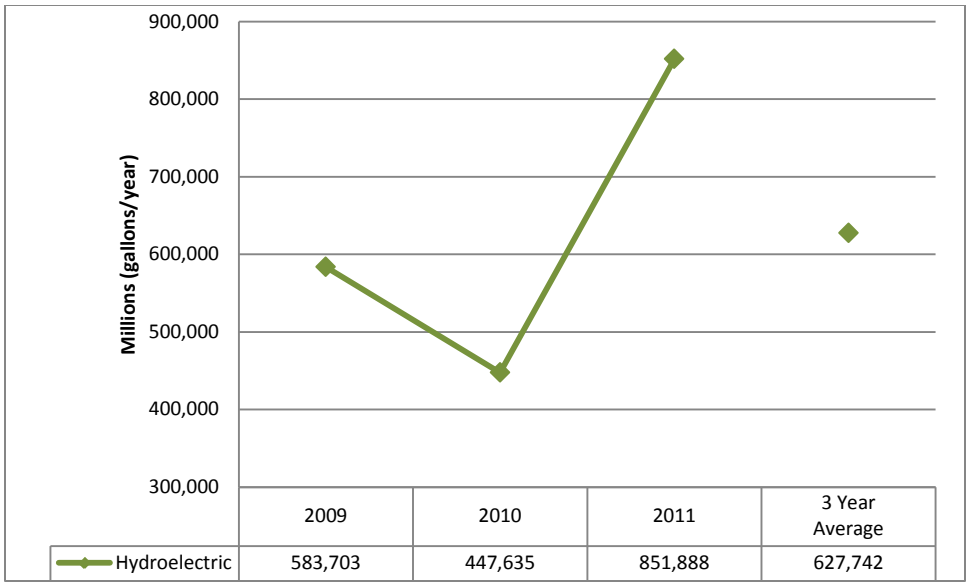


Figure 2-19 Cheat Watershed LQU water withdrawal trends for the Hydroelectric SIC category, measured in millions of gallons per year.

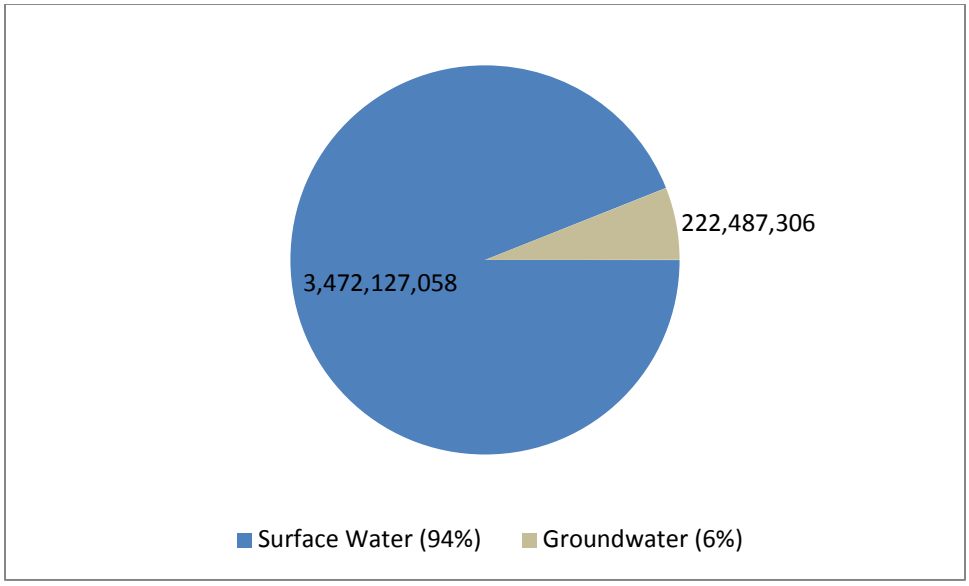


Figure 2-20 Average annual gallons of water withdrawn by LQUs from groundwater and surface water sources in the Cheat Watershed.

Interbasin transfers occur when water is permanently moved from one watershed to another. This can occur in a number of ways. However, only three possible routes of transfer are considered here; see Chapter 2 of the Plan for a discussion of possibilities and data limitations. The following is a detailed list

of interbasin transfers occurring between the Cheat and other HUC-8 watersheds as a result of LQU operations in 2011:

- Withdrawals vs. Stream Discharges
    - Snowshoe Mountain withdraws a three-year average of approximately 8 million gallons of water from a surface water source in the Elk Watershed and approximately 452 million gallons from surface water sources in the Cheat Watershed. Approximately 393.6 million gallons of water are used annually for snowmaking at the Snowshoe and Silver Creek ski slopes in the Cheat Watershed and approximately 8 million gallons are used for irrigation of the Raven Golf Course located in the Elk Watershed.
- Withdrawals vs. POTW discharges
    - Snowshoe Mountain withdraws a three-year average of approximately 8 million gallons of water from a surface water source in the Elk watershed and approximately 452 million gallons from surface water sources in the Cheat Watershed. Some of the water is used as potable supply at various locations. A three-year average of approximately 8.5 million gallons is discharged into the Cheat Watershed via POTW discharge to the Black Run WWTP.
- Purchased water vs. Stream/POTW Discharges
    - None reported

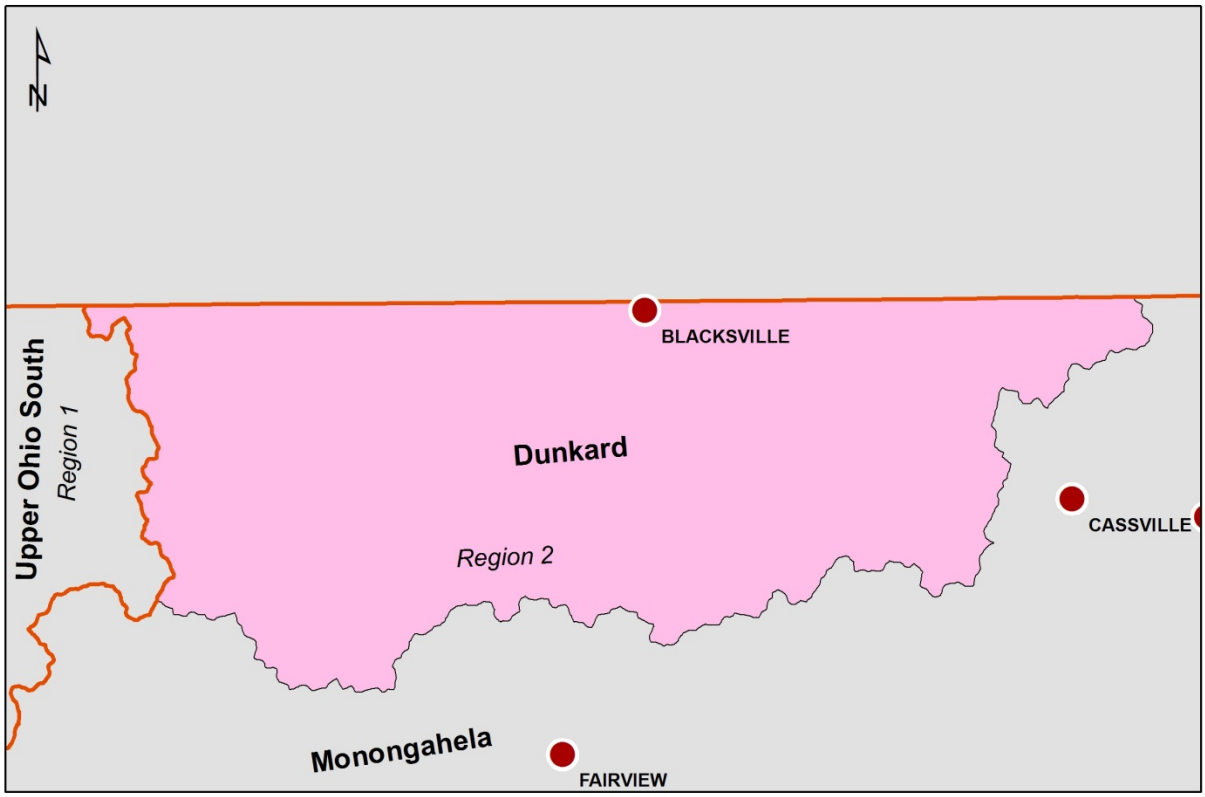
Marcellus Shale

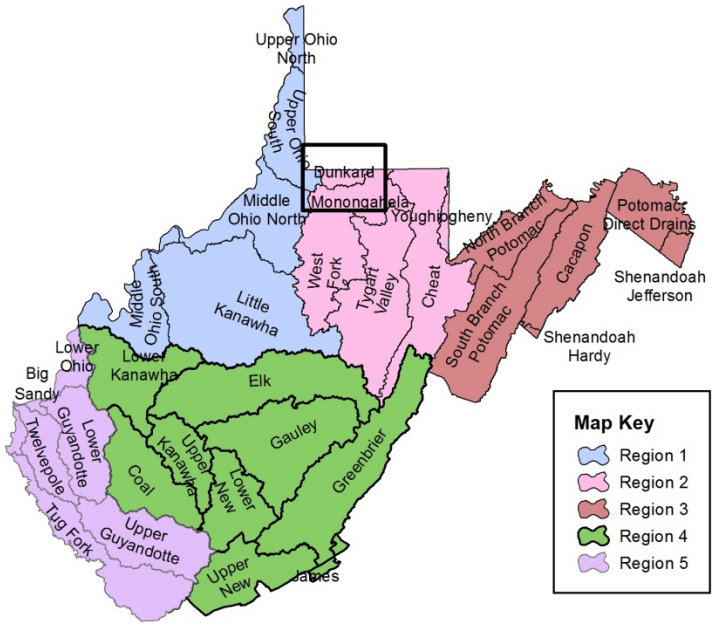
Since the DEP started tracking water use data associated with hydraulic fracturing operations in 2009, approximately 23 million gallons of water have been withdrawn from Cheat River Watershed. In this watershed, all of the water withdrawn has originated from streams or rivers. The most frequently cited stream and river sources from this region are Big Sandy Creek and Little Sandy Creek.

Water Source	2009	2010	2011	Grand Total
Stream/River	0	12,959,856	10,164,840	23,124,696
Grand Total	**0**	**12,959,856**	**10,164,840**	**23,124,696**

Table 2-8 Water use for hydraulic fracturing in the Cheat River Watershed from 2009-2011 in gallons

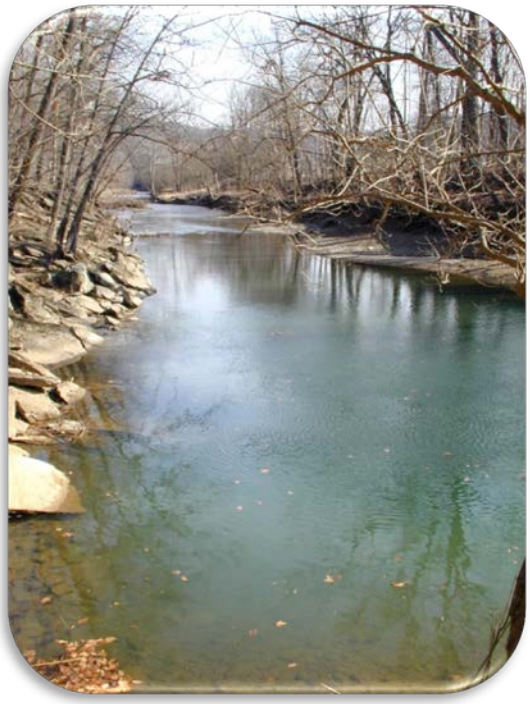
Dunkard Creek Watershed





Dunkard Creek Watershed

Watershed Description



Located in northern West Virginia, the Dunkard Creek Watershed lies along the West Virginia–Pennsylvania border. Covering approximately 109 square miles in West Virginia, the watershed is contained completely within Monongalia County and has a total population of approximately 5,029.

As a component of the Ohio River Drainage Basin, the Dunkard Creek Watershed has 246 miles of streams and rivers including Days Run, Miracle Run and Jakes Run. Additionally, the watershed encompasses all, or portions, of the following state and federal public lands: Pedlar Wildlife Management Area.

Geography and Geology

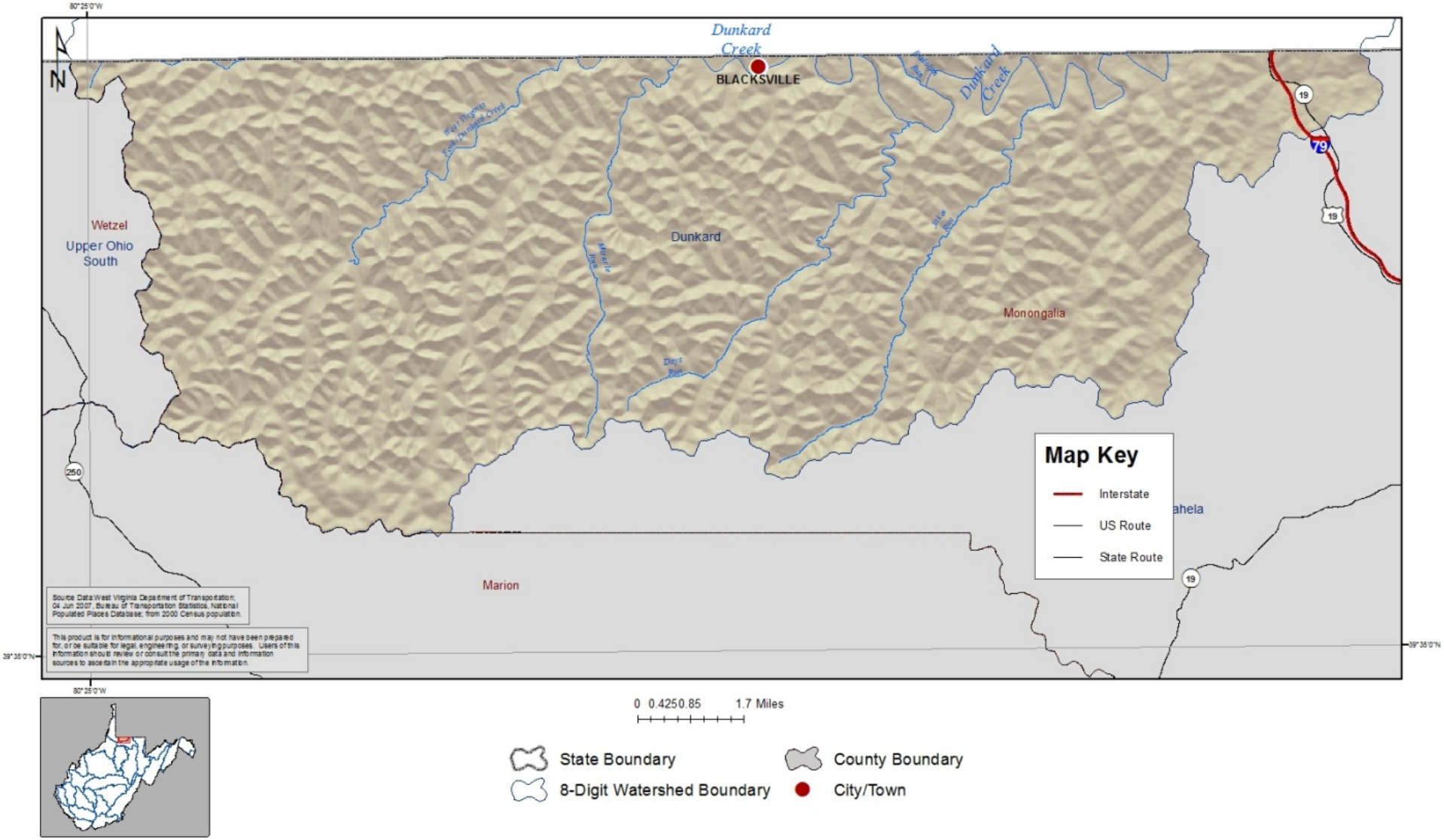
The Dunkard Creek Watershed lies entirely within the Western Allegheny Plateau Ecoregion, which is comprised of rounded hills with wide fertile valleys, mixed oak forests and agricultural lands. The average elevation for the watershed is 1,248 feet above mean sea level and the highest elevation is 1,706. The lowest elevation, 886 feet, is located on Dunkard Creek. The average annual temperature is 53 degrees Fahrenheit and ranges from 51 to 53 degrees. The average annual precipitation for the Dunkard Creek Watershed is 43.88 inches per year.

The majority (84%) of the Dunkard Creek Watershed is covered by deciduous, mixed and evergreen forests, while 6% of the land cover is classified as developed. The remaining land cover consists of grasslands, pastures, barren land, wetlands, crops, shrubs and open water. Only 0.7% of the entire watershed is covered by impervious surfaces.

Geologically, the Dunkard Creek Watershed geology consists predominantly (97%) of sandstone while 3% is comprised of alluvium.

Dunkard Creek Watershed

Major Roads and Cities



LQU Data

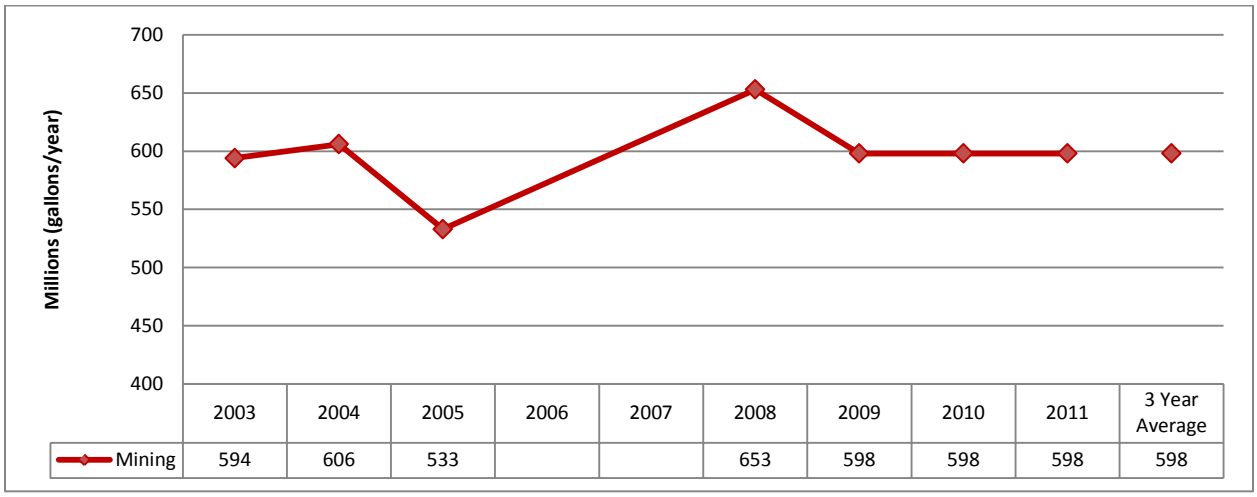
Table 2-9 contains a list of all Large Quantity User (LQU) facilities in the Dunkard Watershed that are currently operating, their Standard Industrial Category (SIC) of use, the average percent of source water withdrawn annually, percent withdrawn from the watershed and county, as well as others if intakes are located elsewhere, and the average amount of water withdrawn by the facility based on the most recent three years of monthly data. A detailed discussion about categories of use type and comparisons of use to statewide withdrawals and consumption is available in Chapter 2 of the Plan. Chapter 4 of the Plan includes data and discussion about future use projections. The following is a summary of data collected regarding the facilities:

- 3 Mining facilities
    - Consol Energy Loverridge withdraws about 6% of its total annual withdrawal from the Dunkard which averages 16 million gallons annually

Table 2-9 All facilities withdrawing from Dunkard Watershed organized by Use Category and Intake Source and Location (watershed and county). Blanks indicate that no additional withdrawals were occurring.

Facility ID	Facility Name	Use Category	Source and % of 3 Year Average		Watershed and % of 3 Year Average		County and % of 3 Year Average		3 Year Annual Average (gallons)
3410	Consol Energy - Blacksville # 2	Mining	Surface Water 100.00%		Dunkard 100.00%		Monongalia 100.00%		260,074,633
3414	Consol Energy - Loveridge	Mining	Surface Water 100.00%		Dunkard 6.73%	Monongahela 93.27%	Monongalia 6.73%	Marion 93.27%	249,201,093
10082	Patriot Coal - Federal #2 Mine	Mining	Surface Water 100.00%		Dunkard 100.00%		Monongalia 100.00%		322,038,452

Figure 2-21 summarizes the trends in use over time for the mining facilities. 100% of the water withdrawn by LQUs in the Dunkard is from surface water sources.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Mining	594	606	533			653	598	598	598	598

Figure 2-21 Dunkard Watershed LQU water withdrawal trends for the Mining SIC category, measured in millions of gallons per year.

Interbasin transfers occur when water is permanently moved from one watershed to another. This can occur in a number of ways. However, only three possible routes of transfer are considered here; see Chapter 2 of the Plan for a discussion of possibilities and data limitations. The following is a detailed list of interbasin transfers occurring between the Dunkard and other HUC-8 watersheds as a result of LQU operations in 2011:

- Withdrawals vs. Stream Discharges
    - Consol Energy – Loveridge withdraws a three-year average of approximately 232 million gallons of surface water from the Monongahela Watershed and approximately 17 million gallons from the Dunkard Watershed each year for operation of a coal preparation plant, underground mine fire suppression, potable water and dust control. A three-year average of approximately 152 million gallons is reportedly discharged into surface waters of the Monongahela Watershed, while approximately 6 million gallons are discharged into the surface waters of the Dunkard Watershed. Another 54.5 million gallons are discharged into the watershed via ground spray and underground usage for dust control and fire suppression.
- Withdrawals vs. POTW discharges
    - None reported

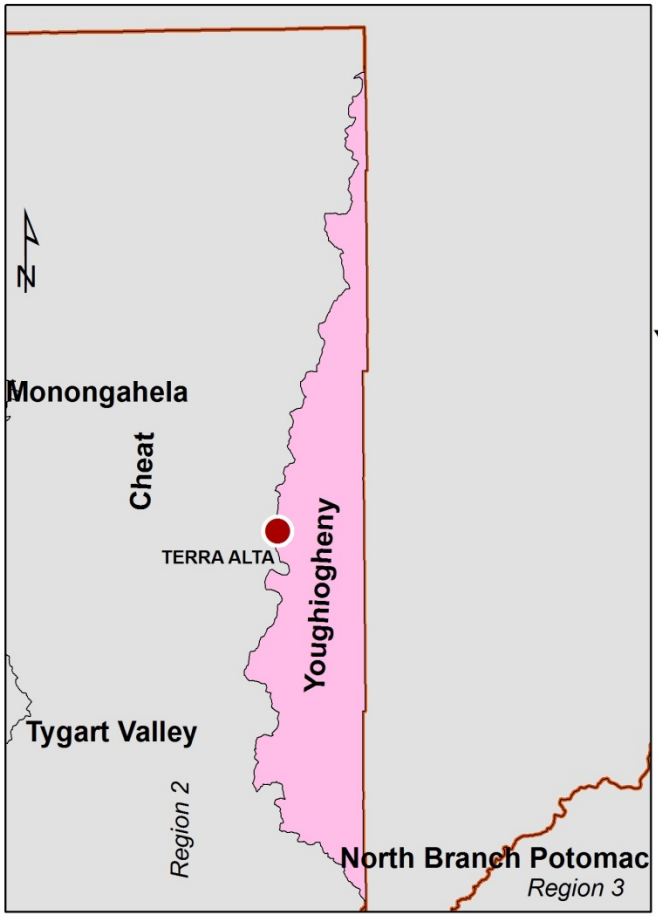
- Purchased water vs. Stream/POTW Discharges
    - None reported

Marcellus Shale

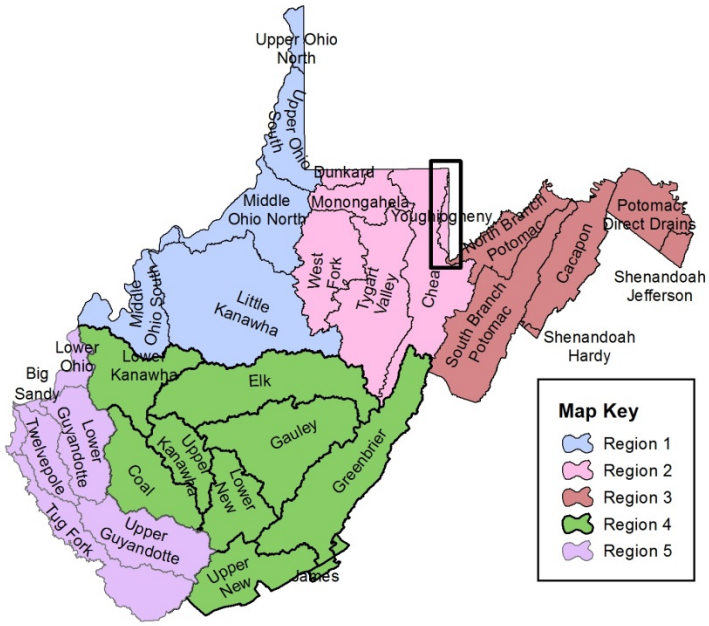
Since the DEP started tracking water use data associated with hydraulic fracturing operations in 2009, approximately three million gallons of water have been withdrawn from Dunkard Creek Watershed. In this watershed, groundwater makes up a sizeable portion of the water used by the oil and gas industry.

Water Source	2009	2010	2011	Grand Total
Groundwater	0	0	1,083,744	1,083,744
Lake/Reservoir/Pond	0	0	1,954,890	1,954,890
Grand Total	**0**	**0**	**3,038,634**	**3,038,634**

Table 2-10 Water use for hydraulic fracturing in the Dunkard Creek Watershed from 2009-2011 in gallons



Youghiogheny River Watershed



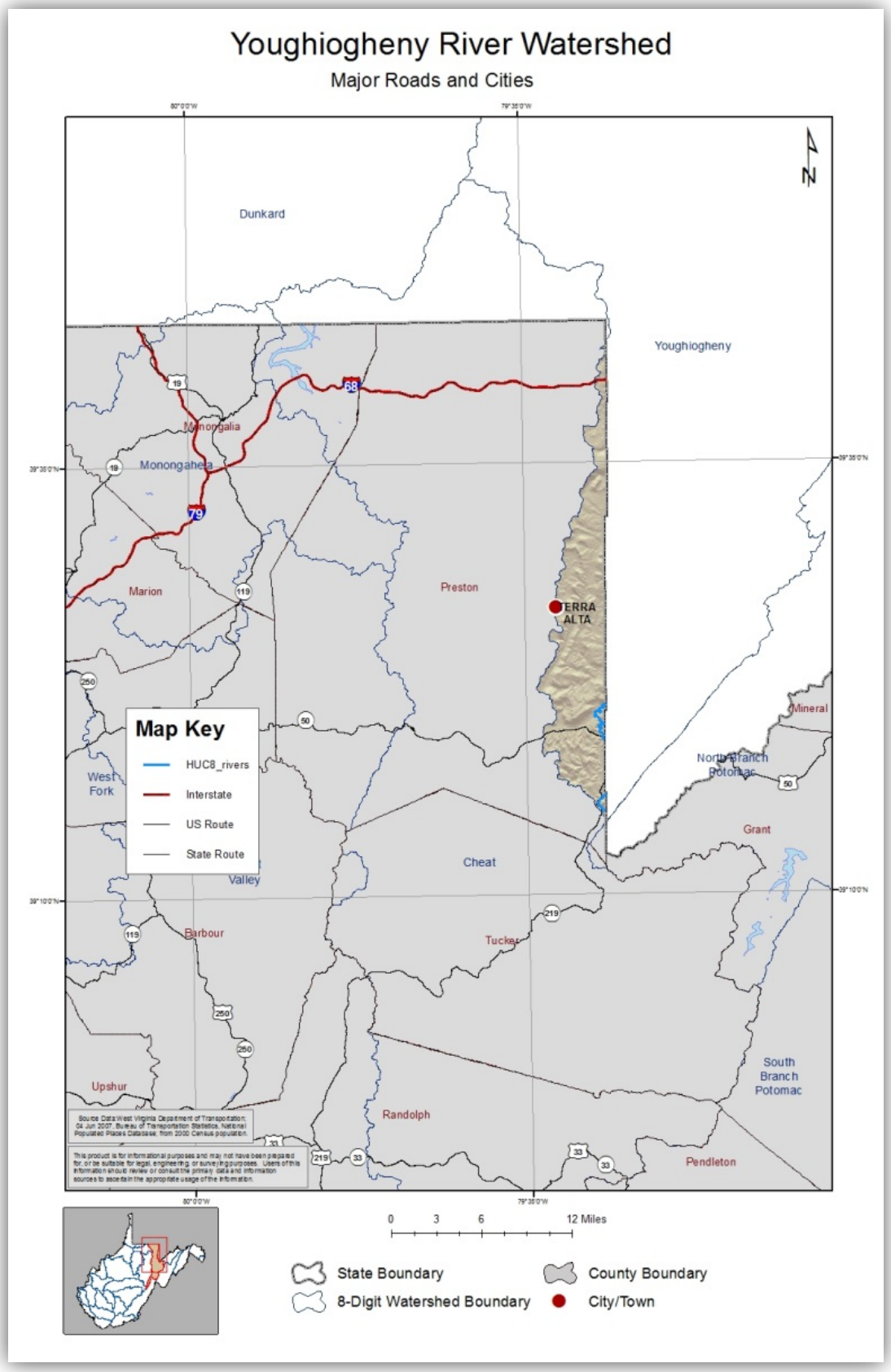
Youghiogheny River Watershed

Watershed Description

Located in north-central West Virginia, the Youghiogheny River Watershed encompasses approximately 72 square miles in West Virginia. The entire watershed lies within Preston County. The watershed has a total population of approximately 3,961 and contains one town with a population exceeding 1,000, which is Terra Alta (1,477).

The Youghiogheny River Watershed has 127 miles of streams and rivers. The source of the Youghiogheny River is located south of the town of Kingwood in Preston County. The major tributaries include Maple Run and Rhine Creek.

Additionally, the watershed encompasses all, or portions, of the following state and federal public lands: one state park (Cathedral), and one national forest (Monongahela).


Youghiogheny River Watershed
Major Roads and Cities
Dunkard
Youghiogheny
Monongalia
Monongahela
Marion
Preston
TERRA ALTA
Mineral
North Branch Potomac
West Fork
Grant
Cheat
Valley
Barbour
Tucker
Upshur
Randolph
South Branch Potomac
Pendleton
Map Key
HUC8_rivers
Interstate
US Route
State Route
0 3 6 12 Miles
State Boundary
County Boundary
8-Digit Watershed Boundary
City/Town

Geography and Geology

The Youghiogheny River Watershed lies within two ecoregions. Approximately half of the watershed occupies the Central Appalachians Ecoregion, which is known for its rugged and mountainous terrain, cooler climate and biologically diverse habitat. The other half of the watershed is contained within the Ridge and Valley Ecoregion, which is characterized by its parallel mountain ridgelines and lowland valleys. The average elevation for the watershed is approximately 2,714 feet above mean sea level. The highest elevation, 3,242 feet, is located on Brushy Knobs approximately two miles north of Aurora, West Virginia. The lowest elevation is approximately 2,187 feet. The average annual temperature is 49 degrees Fahrenheit and ranges from 47 to 49 degrees. The average annual precipitation for the Youghiogheny River Watershed is 50.99 inches per year.

The majority (68%) of the watershed is covered by deciduous, mixed and evergreen forests, while 19% is planted/cultivated area. Approximately 1% is defined as impervious surface area.

The surface geology in the Youghiogheny River Watershed is predominantly (92%) shale and sandstone, while there is a small percentage of alluvium and limestone.

LQU Data

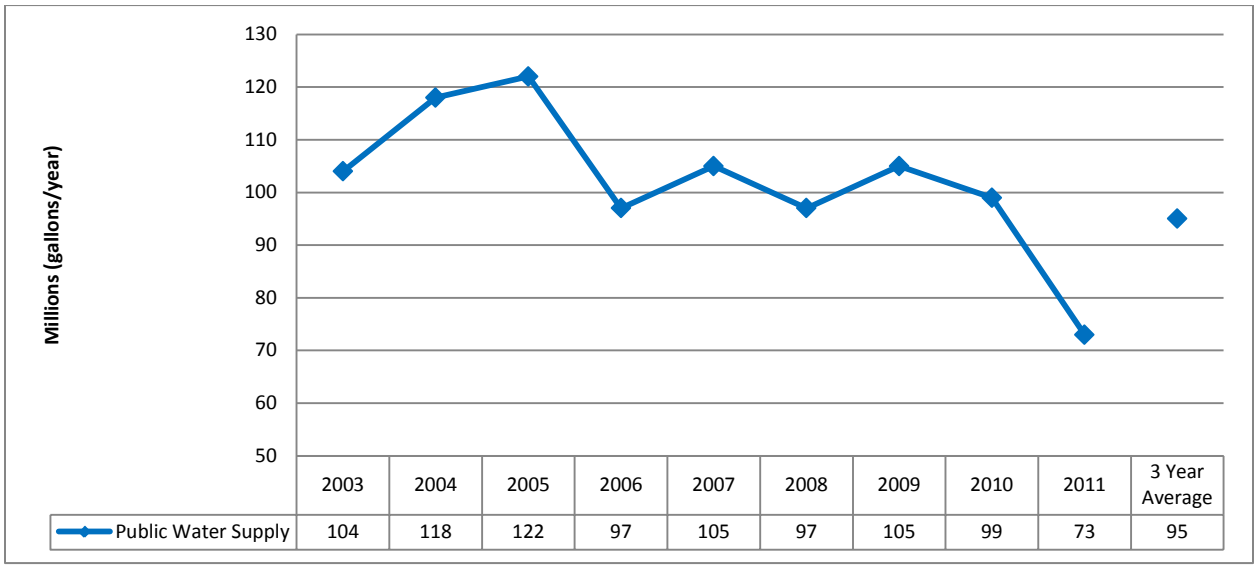
Table 2-11 contains a list of all Large Quantity User (LQU) facilities in the Youghiogheny Watershed that are currently operating, their Standard Industrial Category (SIC) of use, the average percent of source water withdrawn annually, percent withdrawn from the watershed and county, as well as others if intakes are located elsewhere, and the average amount of water withdrawn by the facility based on the most recent three years of monthly data. A detailed discussion about categories of use type and comparisons of use to statewide withdrawals and consumption is available in Chapter 2 of the Plan. Chapter 4 of the Plan includes data and discussion about future use projections. The following is a summary of data collected regarding the facilities:

- 2 Public Water Supply Facilities: Alpine Lake Public Utilities and Terra Alta Water Works, which withdraws twice as much water as Alpine Lake annually.

Table 2-11 All facilities withdrawing from Youghiogheny Watershed organized by Use Category and Intake Source and Location (watershed and county). Blanks indicate that no additional withdrawals were occurring.

Facility ID	Facility Name	Use Category	Source and % of 3 Year Average		Watershed and % of 3 Year Average		County and % of 3 Year Average		3 Year Annual Average (gallons)
2678	Alpine Lake Public Utilities Company	Public water supply		Groundwater 100.00%	Youghiogheny 100.00%		Preston 100.00%		31,950,000
2976	Terra Alta Water Works	Public water supply		Groundwater 100.00%	Youghiogheny 100.00%		Preston 100.00%		63,126,233

Figure 2-22 summarizes the trend in use over time for the Public Water Supply facilities. 100% of the water withdrawn is from groundwater sources.

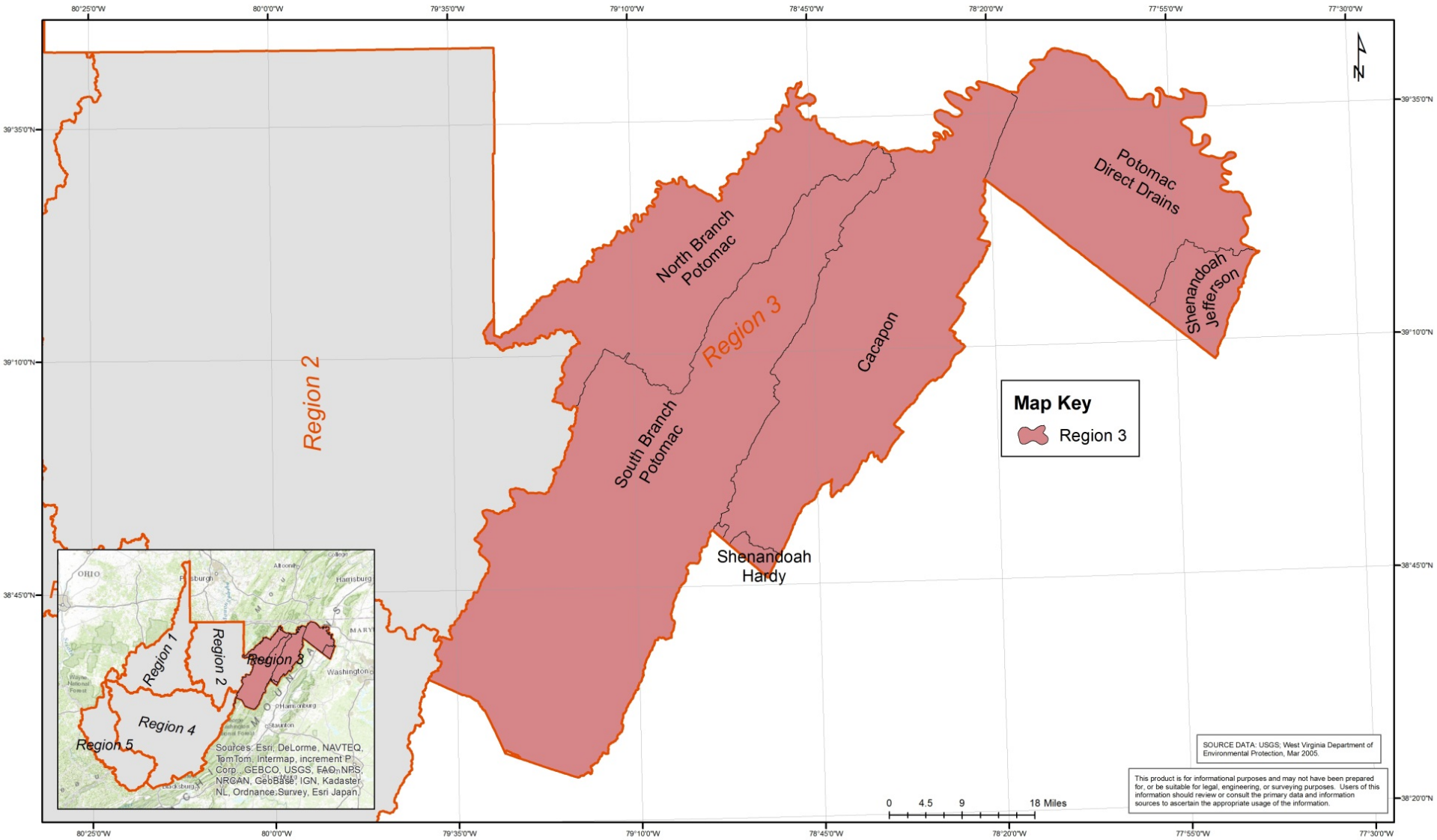


	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Public Water Supply	104	118	122	97	105	97	105	99	73	95

Figure 2-22 Youghiogheny Watershed LQU water withdrawal trends for the Public Water Supply SIC category, measured in millions of gallons per year.

Interbasin transfers occur when water is permanently moved from one watershed to another. This can occur in a number of ways. However, only three possible routes of transfer are considered here; see Chapter 2 of the Plan for a discussion of possibilities and data limitations. There are no reported interbasin transfers occurring between the Youghiogheny and other HUC-8 watersheds as a result of LQU operations in 2011.

Region 3


Region 2
Region 3
North Branch Potomac
South Branch Potomac
Cacapon
Potomac Direct Drains
Shenandoah Jefferson
Shenandoah Hardy
Map Key
Region 3
Region 1
Region 2
Region 3
Region 4
Region 5
Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan.
SOURCE DATA: USGS; West Virginia Department of Environmental Protection, Mar 2005.
This product is for informational purposes and may not have been prepared for, or be suitable for legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the appropriate usage of the information.
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80°0'0"W
79°35'0"W
79°10'0"W
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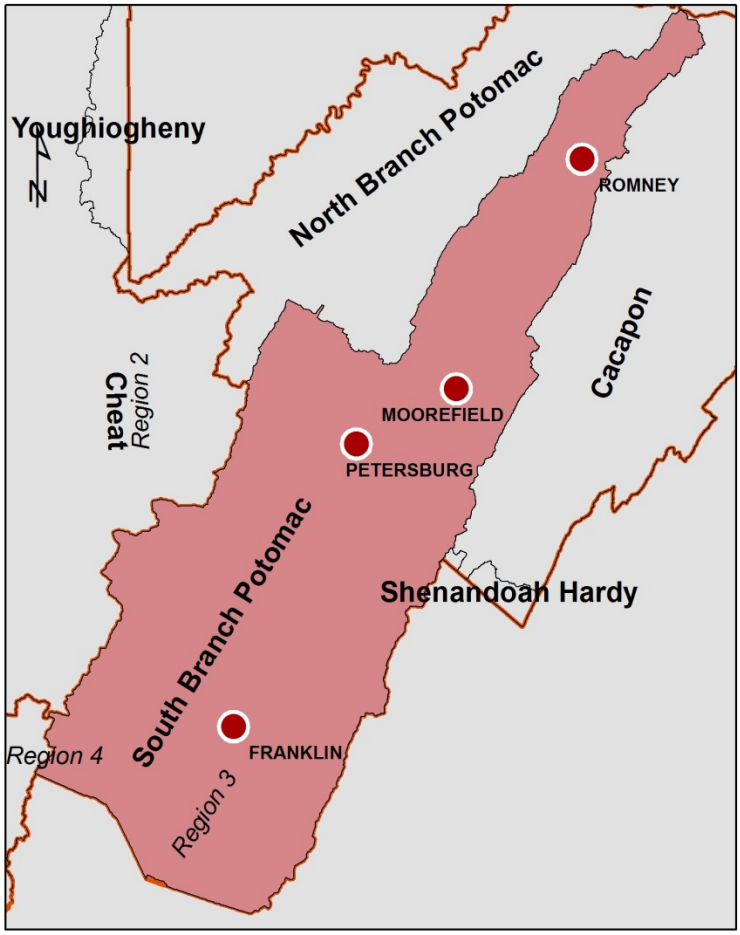
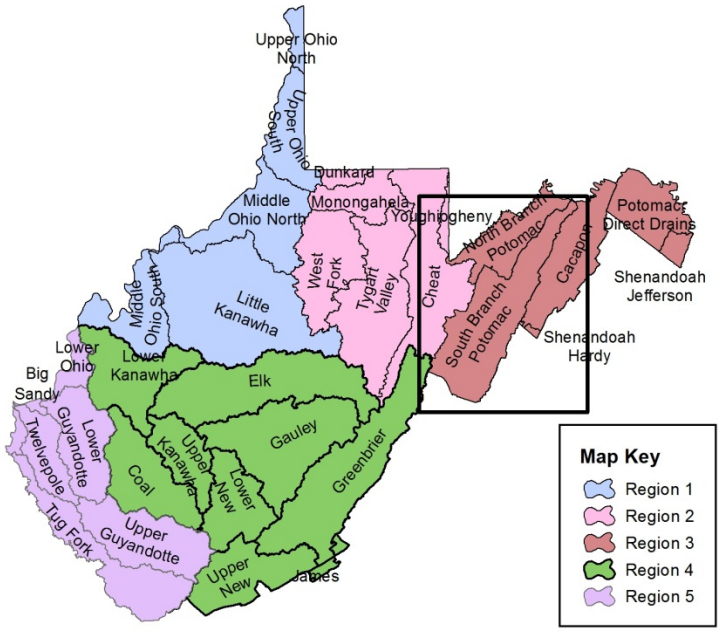


South Branch of the Potomac River



Region 3

South Branch of the Potomac River Watershed

Watershed Description

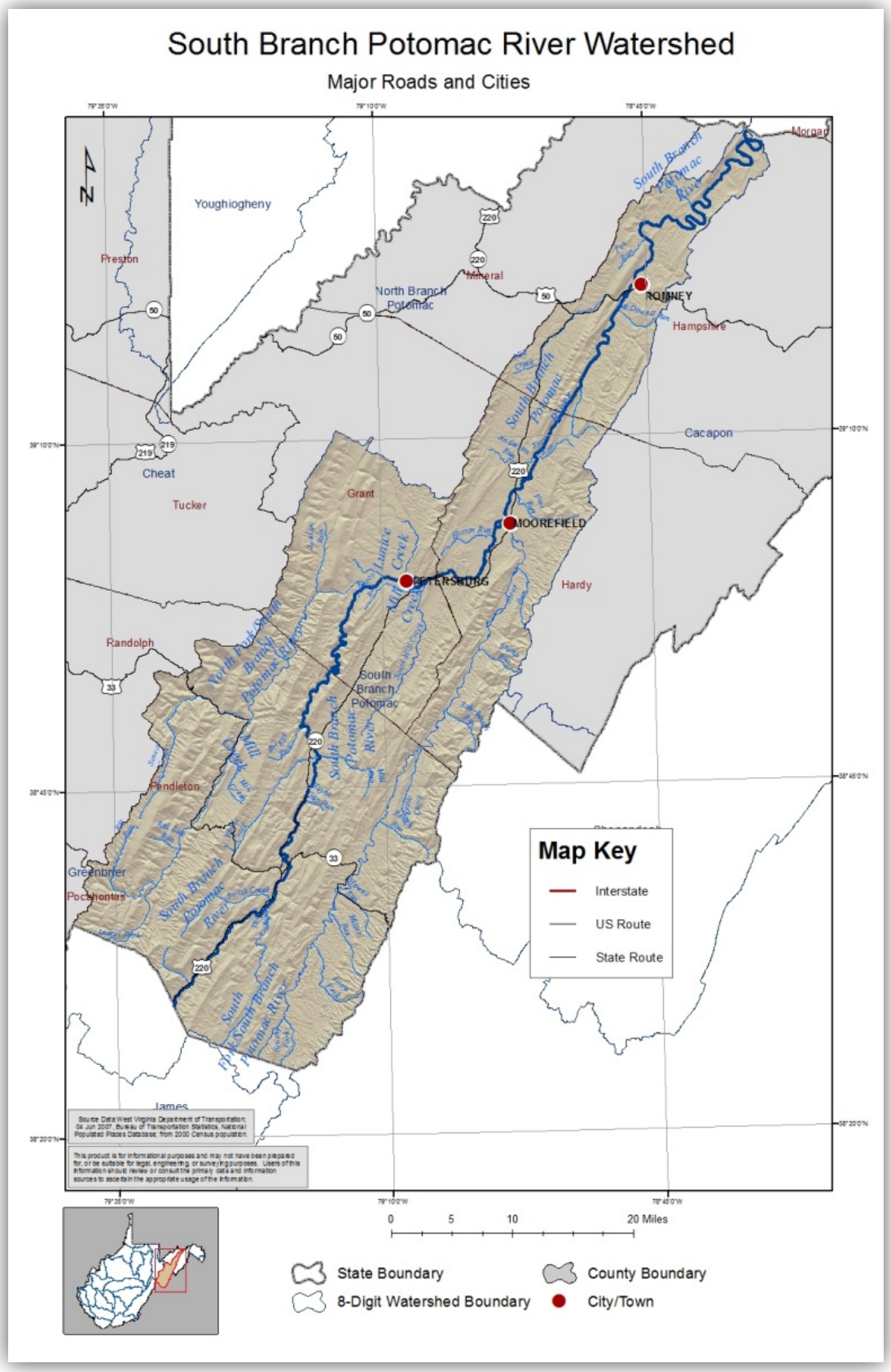
Located in the Eastern Panhandle region of West Virginia, the South Branch of the Potomac River Watershed encompasses approximately 1,480 square miles in West Virginia and contains all, or portions, of four counties (Grant, Hampshire, Hardy and Pendleton). Pendleton accounts for 51% of the watershed.

The South Branch of the Potomac River Watershed has 3,476 miles of streams and rivers. The South Branch of the Potomac River's (South Branch) headwaters are located in Highland County, Virginia. The South Branch enters West Virginia in southern Pendleton County and flows northeasterly to its confluence with the North Branch in northern Hampshire County where they form the Potomac River. The South Branch's major tributaries include North Fork of South Branch, South Fork of South Branch, Mill Creek and Lunice Creek.

Additionally, the watershed encompasses all, or portions, of the following state and federal public lands: seven wildlife management areas (Fort Mill Ridge, Little River, Nathaniel Mountain, Potomac, Shenandoah, South Branch, and Thorn Creek) and two national forests (Monongahela and George Washington).

Demographics

The South Branch of the Potomac River Watershed has a total population of approximately 31,624. The watershed has three cities and towns with a population exceeding 1,500. The largest city within the watershed is Moorefield with a population of 2,544, followed by Petersburg (2,467) and Romney (1,848).


South Branch Potomac River Watershed
Major Roads and Cities
Youghiogheny
Preston
Mineral
Morgan
North Branch Potomac
ROMNEY
Hampshire
Cacapon
Cheat
Tucker
Grant
MOOREFIELD
PETERSBURG
Hardy
Randolph
South Branch Potomac
Pendleton
Greenbrier
Pocahontas
James
Map Key
Interstate
US Route
State Route
0
5
10
20 Miles
State Boundary
County Boundary
8-Digit Watershed Boundary
City/Town

Geography and Geology

The South Branch of the Potomac River Watershed lies within two ecoregions. Only a small portion (1%) lies within the Central Appalachians Ecoregion, which is known for its rugged and mountainous terrain, cooler climate and biologically diverse habitat. The remaining 99% of the watershed is contained within the Ridge and Valley Ecoregion, which is characterized by its parallel mountain ridgelines and lowland valleys. The average elevation for the watershed is approximately 2,051 feet above mean sea level. The highest elevation, 4,863, is located on Spruce Knob and is West Virginia's tallest peak. The lowest elevation is located at the mouth of the South Branch and is approximately 518 feet. The average annual temperature is 48 degrees Fahrenheit and ranges from 43 to 55 degrees. The average annual precipitation for the watershed is 37.65 inches per year.

The majority (81%) of the watershed is covered by deciduous, mixed and evergreen forests, while 14% is planted/cultivated area. Approximately 4% is classified as developed and 1% is defined as impervious surface area.

The surface geology in the watershed is predominantly (82%) shale and sandstone while there is a small percentage of alluvium (4%) and limestone (14%).

The United States Geological Survey (USGS), in conjunction with Federal, State and local agencies, including the DEP, cooperatively funds the USGS stream gaging network to monitor water availability. Currently, there are eight surface water gaging stations located within the watershed. Surface water data is collected and recorded for the sites located on Brushy Fork (1), South Mill Creek (1), North Fork of South Branch (1), and multiple sites on South Fork of South Branch (2) and South Branch (3). The recorded data can be accessed at http://waterdata.usgs.gov/nwis.

LQU Data

Table 3-1 contains a list of all Large Quantity User (LQU) facilities in the South Branch Potomac Watershed that are currently operating, their Standard Industrial Category (SIC) of use, the average percent of source water withdrawn annually, percent withdrawn from the watershed and county, as well as others if intakes are located elsewhere, and the average amount of water withdrawn by the facility based on the most recent three years of monthly data. A detailed discussion about categories of use type and comparisons of use to statewide withdrawals and consumption is available in Chapter 2 of the Plan. Chapter 4 of the Plan includes data and discussion about future use projections. The following is a summary of data collected regarding the facilities:

- 8 Public Water Supply facilities
    - Moorefield Municipal Water System is the largest, withdrawing an average of 1.3 billion gallons annually
    - Green Spring PSD (Springfield) is the smallest, withdrawing an annual average of only 9.4 million gallons
- 3 WVDNR hatcheries
    - Spring Run Hatchery is the largest, averaging 1.7billion gallons annually
- 1 Mining company: Greer Lime Company
- 1 Recreation facility: Valley View Golf Course

Table 3-1 All facilities withdrawing from South Branch Potomac Watershed organized by Use Category and Intake Source and Location (watershed and county). Blanks indicate that no additional withdrawals were occurring.

Facility ID	Facility Name	Use Category	Source and % of 3 Year Average		Watershed and % of 3 Year Average	County and % of 3 Year Average	3 Year Annual Average (gallons)
1794	City of Romney	Public water supply	Surface Water 100.00%		South Branch Potomac 100.00%	Hampshire 100.00%	174,549,000
3076	Franklin Water Treatment Plant	Public water supply	Surface Water 100.00%		South Branch Potomac 100.00%	Pendleton 100.00%	87,390,999
10011	Green Spring PSD (Springfield)	Public water supply	Surface Water 100.00%		South Branch Potomac 100.00%	Hampshire 100.00%	15,290,887
4001	Greer Lime Company	Mining	Surface Water 100.00%		South Branch Potomac 100.00%	Pendleton 100.00%	33,415,680
7102	Moorefield Municipal Water System	Public water supply	Surface Water 100.00%		South Branch Potomac 100.00%	Hardy 100.00%	1,319,921,154
10031	NIOC	Public water supply	Surface Water 100.00%		South Branch Potomac 100.00%	Pendleton 100.00%	9,407,267
2006	Pendleton County PSD- Brandywine	Public water supply	Surface Water 34.98%	Groundwater 65.02%	South Branch Potomac 100.00%	Pendleton 100.00%	13,162,000
1996	Pendleton County PSD- Upper Tract	Public water supply		Groundwater 100.00%	South Branch Potomac 100.00%	Pendleton 100.00%	10,837,983
10010	Town of Petersburg	Public water supply	Surface Water 100.00%		South Branch Potomac 100.00%	Grant 100.00%	310,763,827
4580	Valley View Golf Course	Recreation	Surface Water 100.00%		South Branch Potomac 100.00%	Hardy 100.00%	8,188,418
8106	WVDNR - Petersburg Hatchery	Agriculture/aquaculture	Surface Water 100.00%		South Branch Potomac 100.00%	Grant 100.00%	207,360,000
8158	WVDNR - Reeds Creek Hatchery	Agriculture/aquaculture	Surface Water 100.00%		South Branch Potomac 100.00%	Pendleton 100.00%	466,560,000
8108	WVDNR - Spring Run Hatchery	Agriculture/aquaculture	Surface Water 100.00%		South Branch Potomac 100.00%	Grant 100.00%	1,658,880,000

Figures 3-1 through 3-4 summarize the breakdown of the share total withdrawals occurring among currently operating facilities, the trends in use over time for each industry group, and the amount and share of source water withdrawn by the currently operating LQUs in the watershed.

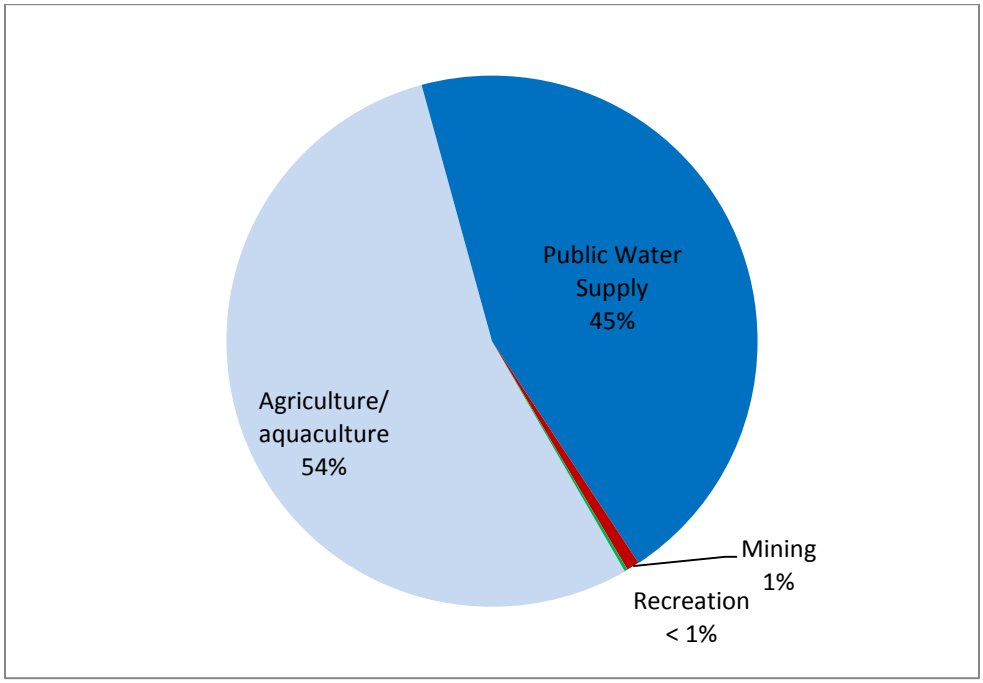
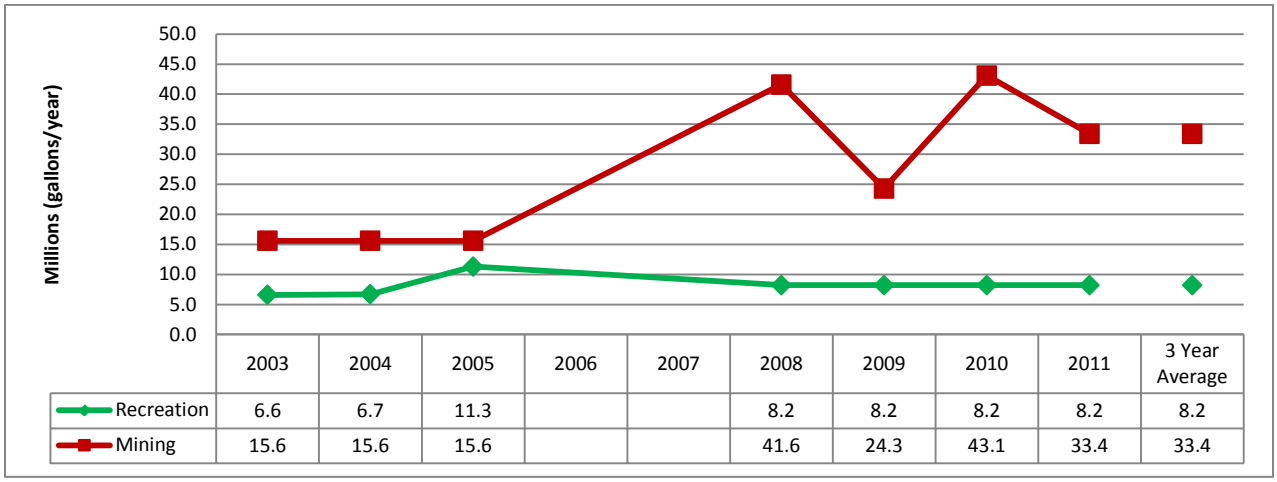
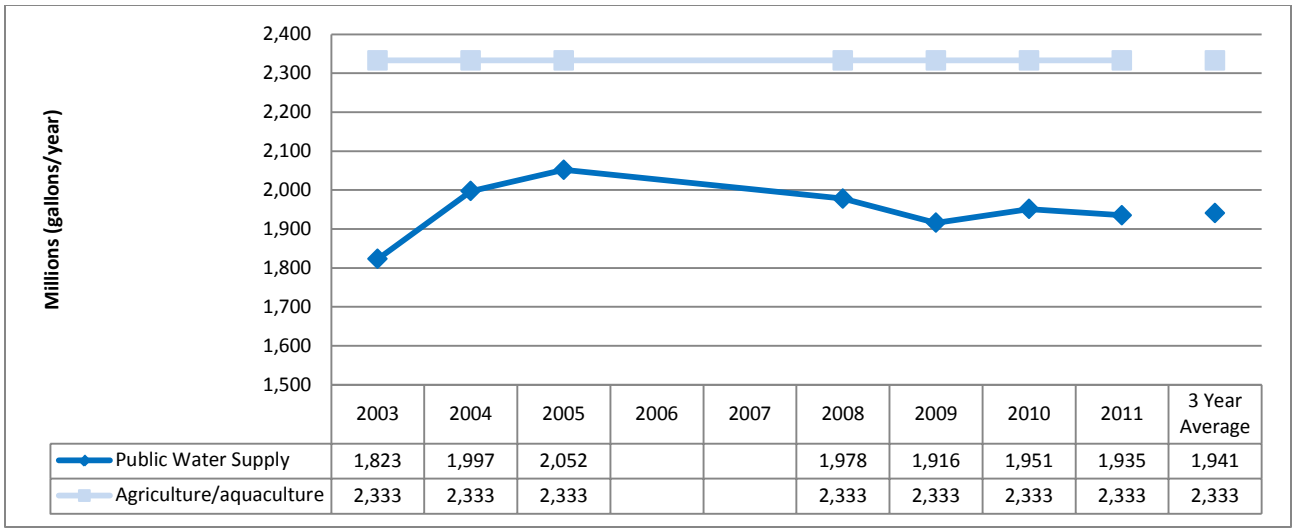


Figure 3-1 South Branch Potomac Watershed LQU percent of total average annual water withdrawals by sector.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Recreation	6.6	6.7	11.3			8.2	8.2	8.2	8.2	8.2
Mining	15.6	15.6	15.6			41.6	24.3	43.1	33.4	33.4

Figure 3-2 South Branch Potomac Watershed LQU water withdrawal trends for the Mining and Recreation SIC categories, measured in millions of gallons per year.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Public Water Supply	1,823	1,997	2,052			1,978	1,916	1,951	1,935	1,941
Agriculture/aquaculture	2,333	2,333	2,333			2,333	2,333	2,333	2,333	2,333

Figure 3-3 South Branch Potomac Watershed LQU water withdrawal trends for the Agriculture/aquaculture and Public Water Supply SIC categories, measured in millions of gallons per year.

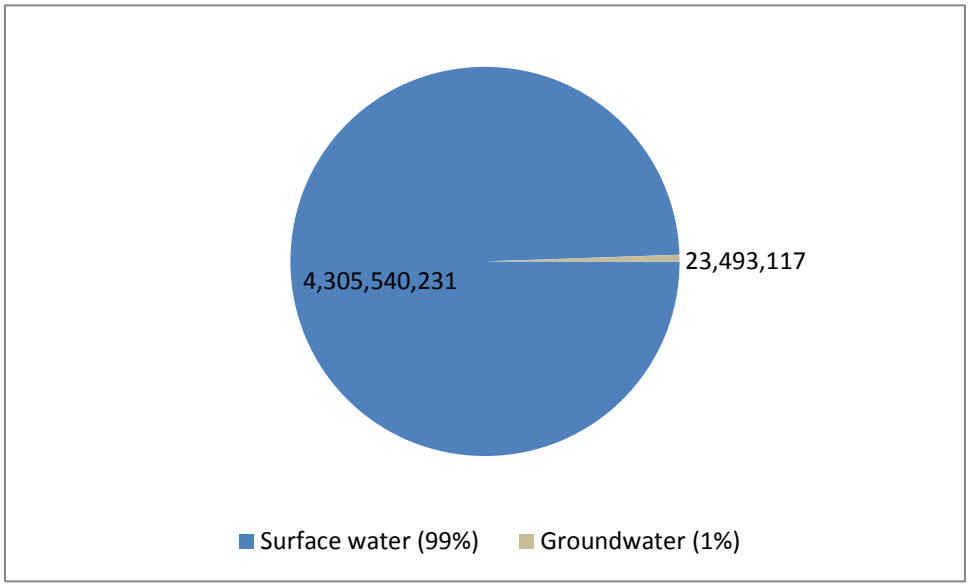
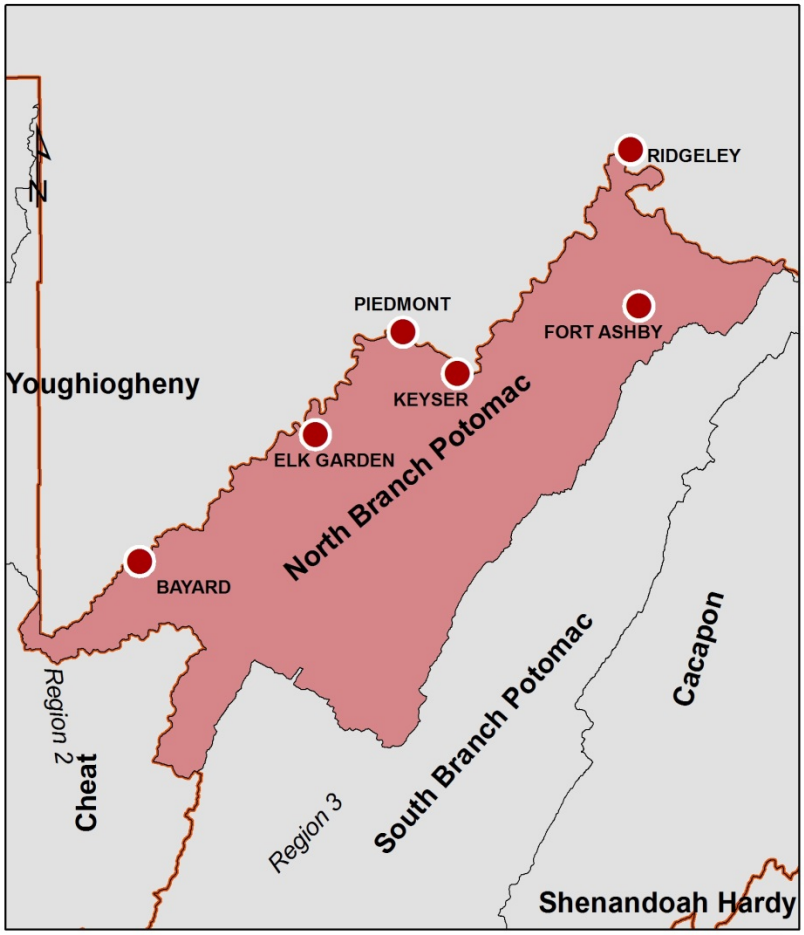
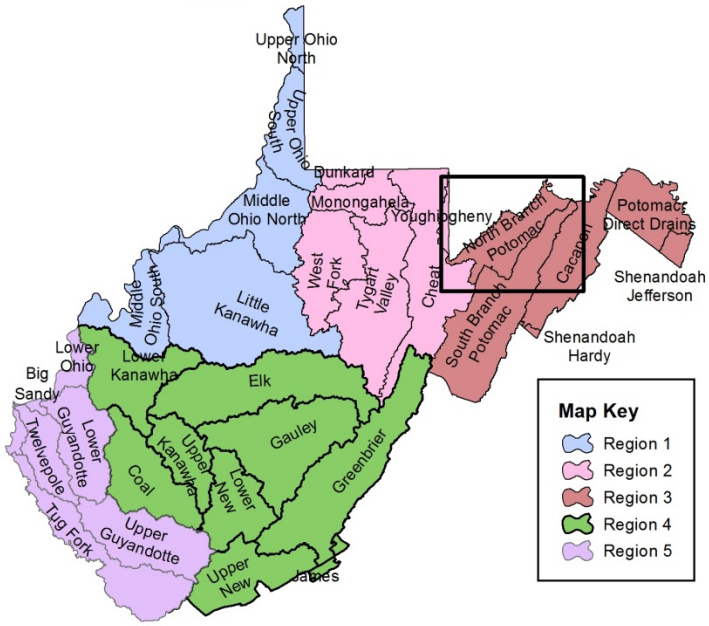


Figure 3-4 Average annual gallons of water withdrawn by LQUs from groundwater and surface water sources in the South Branch Potomac Watershed.

Interbasin transfers occur when water is permanently moved from one watershed to another. This can occur in a number of ways. However, only three possible routes of transfer are considered here; see Chapter 2 of the Plan for a discussion of possibilities and data limitations. There are no reported interbasin transfers occurring between the South Branch Potomac and other HUC-8 watersheds as a result of LQU operations in 2011.

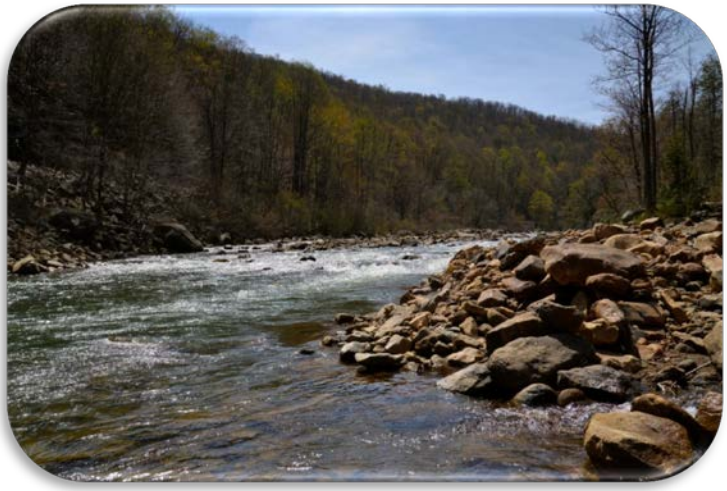


North Branch of the Potomac River



North Branch of the Potomac River Watershed

Watershed Description



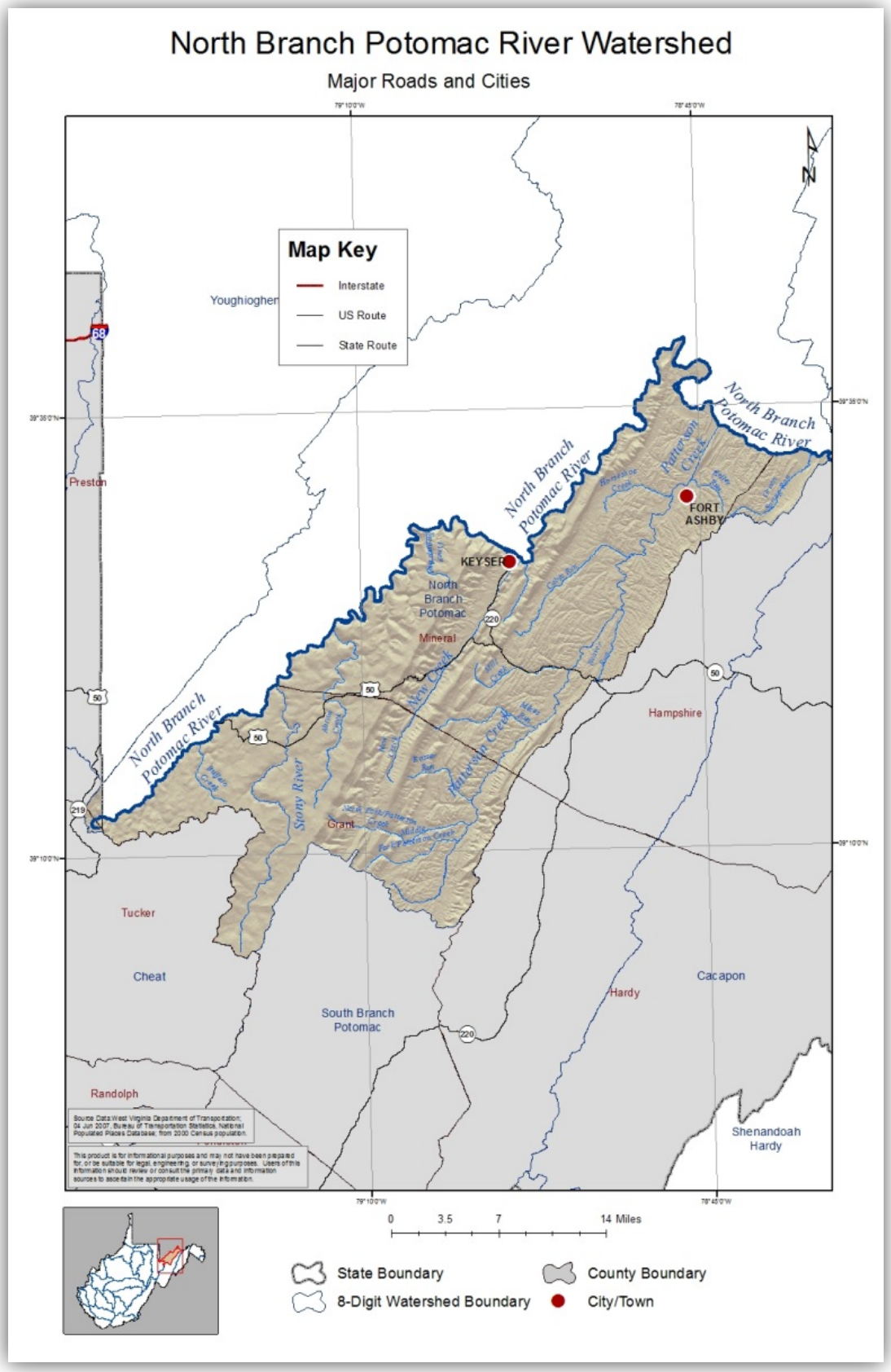
Located in the Eastern Panhandle region of West Virginia, the North Branch of the Potomac River Watershed encompasses approximately 1,343 square miles and contains all, or portions, of five counties (Mineral, Grant, Hampshire, Preston and Tucker). Pendleton and Tucker account for 97% of the watershed area.

The North Branch of the Potomac River Watershed has 1,173 miles of streams and rivers. The source of the North Branch of the Potomac River (North Branch) is identified by the Fairfax Stone at the junction of Tucker, Grant and Preston counties. The North Branch flows northeasterly to its confluence with the South Branch of the Potomac River in northern Hampshire County where they form the Potomac River. The North Branch's major tributaries include Stony River, New Creek and Patterson Creek.

Additionally, the watershed encompasses all, or portions, of the following state and federal public lands: three wildlife management areas (Allegheny, Blackwater and Potomac) and one state park (Fairfax Stone). The watershed also contains two major reservoirs (Jennings Randolph Lake and Mount Storm Lake). Jennings Randolph Lake is a 925-acre reservoir located along the North Branch of the Potomac River in Mineral County on the West Virginia-Maryland border. Mount Storm Lake, constructed for use as a power station cooling pond, is a 1,200-acre reservoir located on the Stony River in Grant County.

Demographics

The North Branch of the Potomac River Watershed has a total population of approximately 31,736. The watershed has two cities and towns with a population exceeding 1,000. The largest city within the watershed is Keyser with a population of 5,439, followed by Fort Ashby (1,380).


North Branch Potomac River Watershed
Major Roads and Cities
Map Key
Interstate
US Route
State Route
Youghiogheny
Preston
Mineral
Hampshire
Grant
Tucker
Cheat
South Branch Potomac
Hardy
Cacapon
Randolph
Shenandoah Hardy
KEYSER
FORT ASHBY
North Branch Potomac
North Branch Potomac River
Stony River
New Creek
Patterson Creek
0 3.5 7 14 Miles
State Boundary
County Boundary
8-Digit Watershed Boundary
City/Town

Geography and Geology

The North Branch of the Potomac River Watershed lies within two ecoregions. Approximately 32% lies within the Central Appalachians Ecoregion, which is known for its rugged and mountainous terrain, cooler climate and biologically diverse habitat. The remaining 68% of the watershed is contained within the Ridge and Valley Ecoregion, which is characterized by its parallel mountain ridgelines and lowland valleys. The average elevation for the watershed is approximately 1,125 feet above mean sea level. The highest elevation, 3,525 feet, is located on the Allegheny Front near the town of Bismark. The lowest elevation is located at the confluence of the North Branch and South Branch and is approximately 518 feet. The average annual temperature is 49 degrees Fahrenheit and ranges from 43 to 53 degrees. The average annual precipitation for the watershed is 39.54 inches per year.

The majority (79%) of the watershed is covered by deciduous, mixed and evergreen forests, while 13% is planted/cultivated area. Approximately 5% is classified as developed and 1% is defined as impervious surface area.

The surface geology in the watershed is predominantly (88%) shale and sandstone while there is a small percentage of alluvium (3%) and limestone (9%).

The United States Geological Survey (USGS), in conjunction with federal, state and local agencies, including the DEP, cooperatively funds the USGS stream gaging network to monitor water availability. Currently, there are four surface water gaging stations and one groundwater gaging station located within the watershed. The groundwater gaging station is a well site located in Mineral County, while surface water data is collected and recorded for the sites located on Abram Creek, Linton Creek, Patterson Creek, and Painter Run. The recorded data can be accessed at http://waterdata.usgs.gov/nwis.

LQU Data

Table 3-2 contains a list of all Large Quantity User (LQU) facilities in the North Branch Potomac Watershed that are currently operating, their Standard Industrial Category (SIC) of use, the average percent of source water withdrawn annually, percent withdrawn from the watershed and county, as well as others if intakes are located elsewhere, and the average amount of water withdrawn by the facility based on the most recent three years of monthly data. A detailed discussion about categories of use type and comparisons of use to statewide withdrawals and consumption is available in Chapter 2 of

the Plan. Chapter 4 of the Plan includes data and discussion about future use projections. The following is a summary of data collected regarding the facilities:

- 7 Public Water Supply facilities
    - 1 closure in 2010, Green Spring Valley PSD
    - Frankfort Public Service District and the City of Keyser are the largest withdrawers having annual averages of 205 million and 395 million gallons, respectively.
    - Fountain Public Service District and Town of Carpendale are the smallest public supply LQUs withdrawing an average of 21 and 23 million gallons annually, respectively
- 2 Thermoelectric (coal) facilities
    - 1 closure in 2010, North Branch Power Station
    - Mount Storm Power Station currently operational.
- 1 Industrial facility: Allegany Ballistics Laboratory

Table 3-2 All facilities withdrawing from North Branch Potomac Watershed organized by Use Category and Intake Source and Location (watershed and county). Blanks indicate that no additional withdrawals were occurring.

Facility ID	Facility Name	Use Category	Source and % of 3 Year Average		Watershed and % of 3 Year Average		County and % of 3 Year Average		3 Year Annual Average (gallons)
2398	Allegany Ballistics Laboratory	Industrial	Surface Water 13.73%	Groundwater 86.27%	North Branch Potomac 100.00%		Mineral 100.00%		69,240,020
10022	City of Keyser	Public water supply	Surface Water 100.00%		North Branch Potomac 100.00%		Mineral 100.00%		395,109,333
1134	Fountain Public Service District	Public water supply		Groundwater 100.00%	North Branch Potomac 100.00%		Grant 41.56%	Mineral 58.44%	20,812,070
7869	Frankfort Public Service District	Public water supply	Surface Water 100.00%		North Branch Potomac 100.00%		Mineral 100.00%		204,603,636
2699	Mount Storm Power Station	Thermoelectric (coal)	Surface Water 100.00%		North Branch Potomac 100.00%		Grant 100.00%		403,202,680,000
3178	Mt. Top Public Service District	Public water supply	Surface Water 100.00%		North Branch Potomac 100.00%		Grant 100.00%		62,147,037
10023	Piedmont Municipal Water Works	Public water supply	Surface Water 100.00%		North Branch Potomac 100.00%		MD 100.00%		37,384,667
2085	Town of Carpendale	Public water supply		Groundwater 100.00%	North Branch Potomac 100.00%		Mineral 100.00%		22,940,333

Figures 3-5 through 3-7 summarize the breakdown of the share total withdrawals occurring among currently operating facilities, the trends in use over time for each industry group for currently operating LQUs in the watershed. 100% of the water withdrawn from the North Branch Potomac Watershed is from surface water sources.

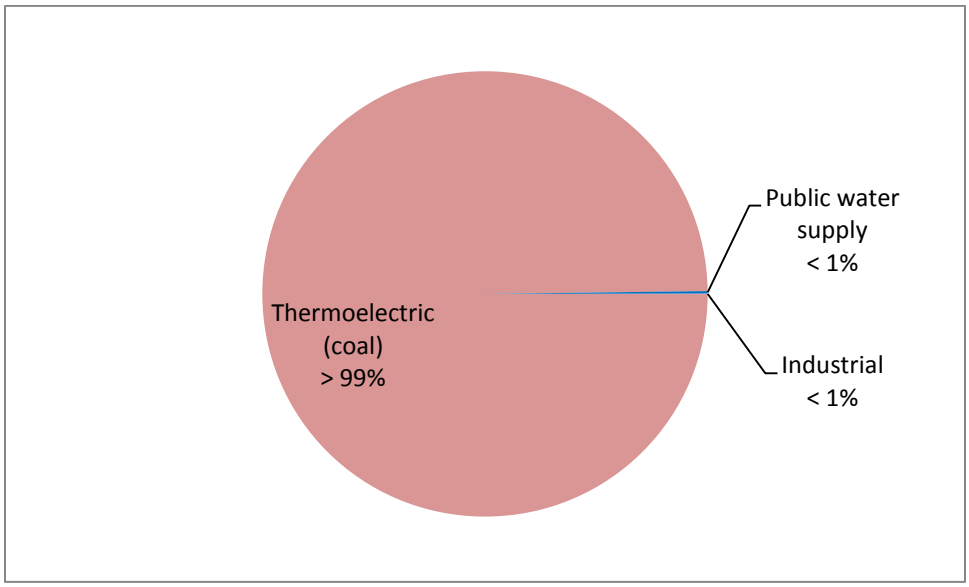


Figure 3-5 North Branch Potomac Watershed LQU percent of total average annual water withdrawals by sector.

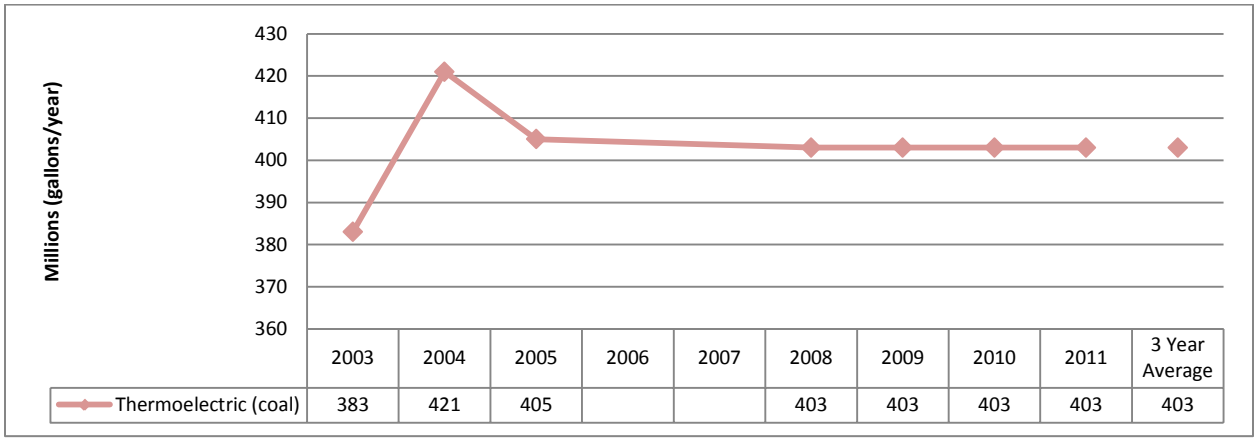
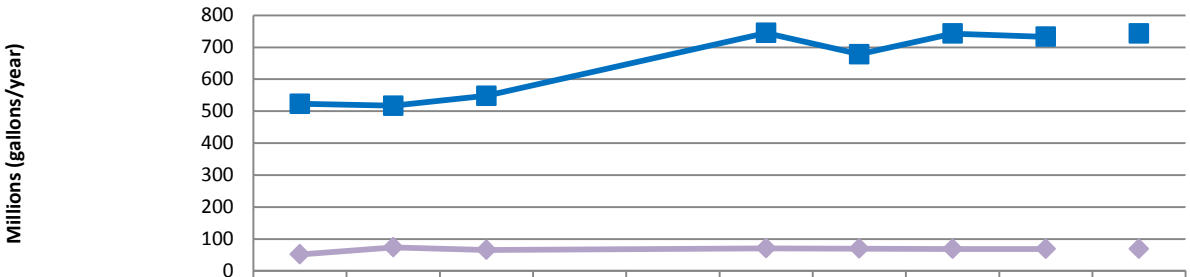


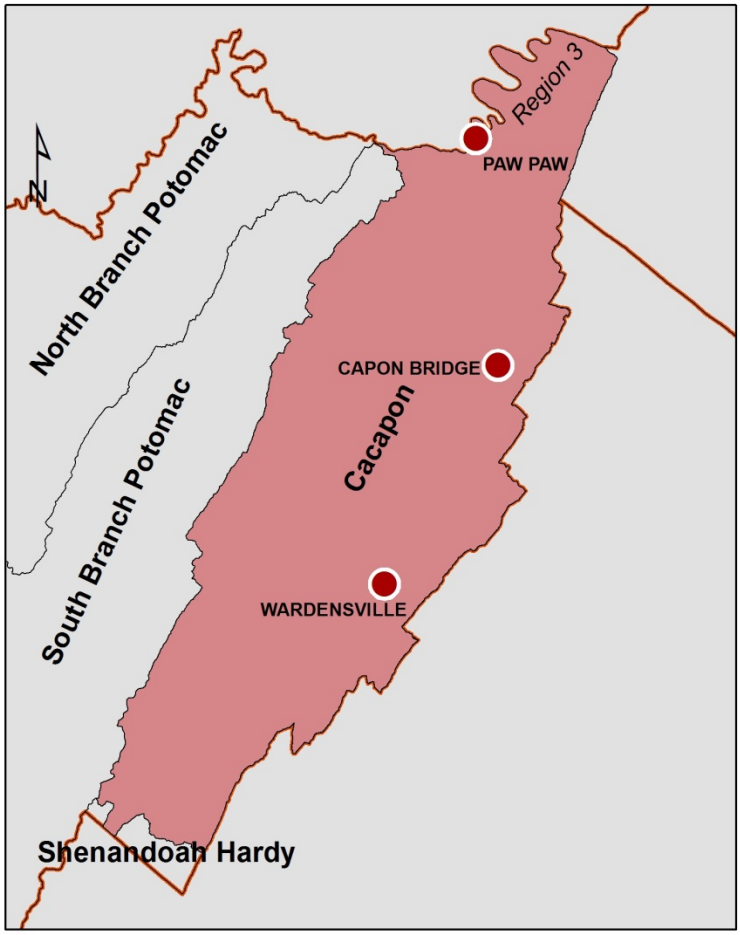
Figure 3-6 North Branch Potomac Watershed LQU water withdrawal trends for the Thermoelectric (coal) SIC category, measured in millions of gallons per year.



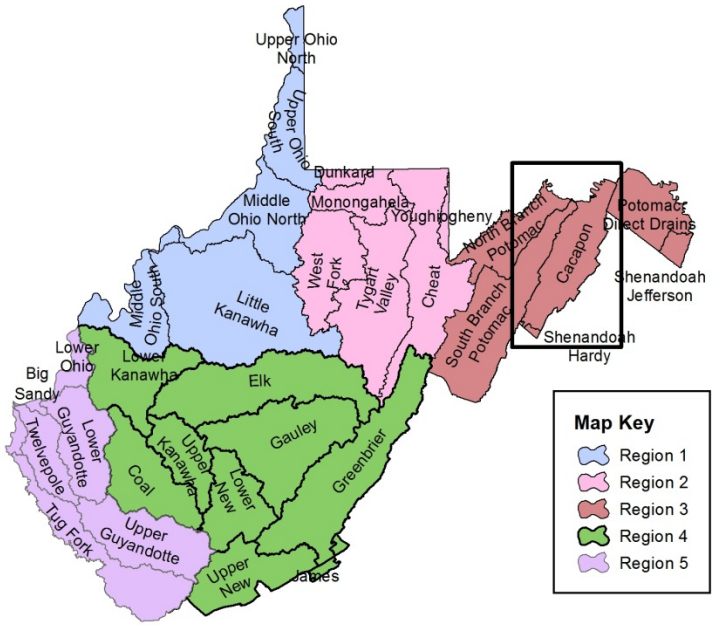
	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Industrial	52	74	66			71	70	69	69	69
Public water supply	523	517	548			745	678	743	733	743

Figure 3-7 North Branch Potomac Watershed LQU water withdrawal trends for the Public Water Supply and Industrial SIC categories, measured in millions of gallons per year.

Interbasin transfers occur when water is permanently moved from one watershed to another. This can occur in a number of ways. However, only three possible routes of transfer are considered here; see Chapter 2 of the Plan for a discussion of possibilities and data limitations. There are no reported interbasin transfers occurring between the North Branch Potomac and other HUC-8 watersheds as a result of LQU operations in 2011.



Cacapon River Watershed



Cacapon River Watershed

Watershed Description

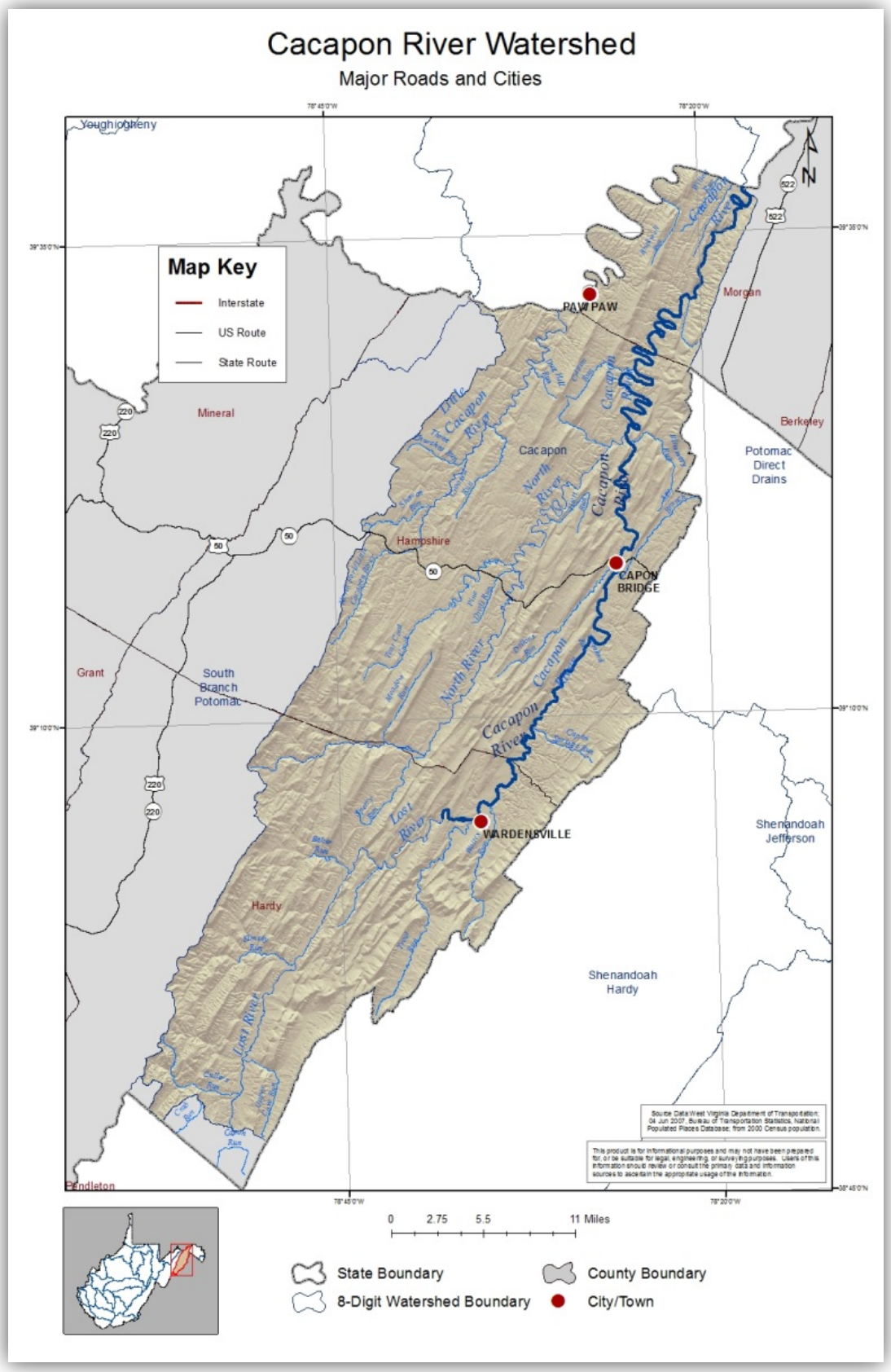
Located in the Eastern Panhandle region of West Virginia, the Cacapon River Watershed encompasses approximately 840 square miles in West Virginia and contains all, or portions, of three counties (Hampshire, Hardy and Morgan). Hampshire and Hardy account for 91% of the watershed area.

The Cacapon River Watershed has 1,971 miles of streams and rivers. The Cacapon River begins as the Lost River in southern Hardy County, which sinks underground near the town of McCauley and flows northeasterly before resurfacing near Wardensville in Hardy County to become the Cacapon. The river meanders northeasterly to its confluence with the Potomac River in northern Morgan County on the West Virginia-Maryland border. The Cacapon River's major tributaries include Trout Run, Capon Springs Run, Mill Branch, Dillons Run, Edwards Run and North River.

Additionally, the watershed encompasses all, or portions, of the following state and federal public lands: five wildlife management areas (Edwards Run, Nathaniel Mountain, Short Mountain, Warden Lake and Wardensville), two state parks (Cacapon and Lost River) and one national forest (George Washington).

Demographics

The Cacapon River Watershed has a total population of approximately 24,853. The largest towns in the watershed are Paw Paw (508), Capon Bridge (355) and Wardensville (271).


Cacapon River Watershed
Major Roads and Cities
Map Key
Interstate
US Route
State Route
Youghiogheny
Mineral
Morgan
Berkeley
Potomac Direct Drains
Cacapon
Hampshire
Grant
South Branch Potomac
Hardy
Shenandoah Jefferson
Shenandoah Hardy
Pendleton
PAW PAW
CAPON BRIDGE
WARDENSVILLE
Little Cacapon River
North River
Cacapon River
Lost River
0 2.75 5.5 11 Miles
State Boundary
8-Digit Watershed Boundary
County Boundary
City/Town

Geography and Geology

The Cacapon River Watershed lies entirely within the Ridge and Valley Ecoregion, which is characterized by its parallel mountain ridgelines and lowland valleys. The average elevation for the watershed is approximately 1,493 feet above mean sea level. The highest elevation, 3,301 feet, is located at Mill Mountain in eastern Hardy County on the West Virginia-Virginia border. The lowest elevation is located at the confluence of the Cacapon River and Potomac River and is approximately 400 feet. The average annual temperature is 49 degrees Fahrenheit and ranges from 45 to 53 degrees. The average annual precipitation for the watershed is 37.84 inches per year.

The majority (84%) of the watershed is covered by deciduous, mixed and evergreen forests, while 12% is planted/cultivated area. Approximately 4% is classified as developed and 0.63% is defined as impervious surface area.

The surface geology in the watershed is predominantly (86%) shale and sandstone while there is a small percentage of alluvium (4%) and limestone (10%).

The United States Geological Survey (USGS), in conjunction with federal, state and local agencies, including the DEP, cooperatively funds the USGS stream gaging network to monitor water availability. Currently, there are three surface water gaging stations and one groundwater gaging station located within the watershed. The groundwater gaging station is a well site located in Hardy County, while surface water data is collected and recorded for the sites located on Cacapon River (1), Parker Hollow Run (1) and Waites Run (1). The recorded data can be accessed at http://waterdata.usgs.gov/nwis.

LQU Data

Table 3-3 contains a list of all Large Quantity User (LQU) facilities in the Cacapon Watershed that are currently operating, their Standard Industrial Category (SIC) of use, the average percent of source water withdrawn annually, percent withdrawn from the watershed and county, as well as others if intakes are located elsewhere, and the average amount of water withdrawn by the facility based on the most recent three years of monthly data. A detailed discussion about categories of use type and comparisons of use to statewide withdrawals and consumption is available in Chapter 2 of the Plan. Chapter 4 of the Plan includes data and discussion about future use projections. The following is a summary of data collected regarding the facilities:

- 3 Public Water Supply facilities
    - Wardensville Water Department is the largest withdrawer, averaging an annual withdrawal of 31 million gallons
- 1 Recreational facility: Capon Springs Hotel
    - Capon Springs Hotel comprises 11% of the annual LQU withdrawals in the watershed, averaging 7.6 million gallons annually

Table 3-3 All facilities withdrawing from Cacapon Watershed organized by Use Category and Intake Source and Location (watershed and county). Blanks indicate that no additional withdrawals were occurring.

Facility ID	Facility Name	Use Category	Source and % of 3 Year Average		Watershed and % of 3 Year Average		County and % of 3 Year Average		3 Year Annual Average (gallons)
2649	Capon Springs Hotel	Recreation		Groundwater 100.00%	Cacapon 100.00%		Hampshire 100.00%		7,642,633
1311	Paw Paw Municipal Water and Sewer System	Public water supply	Surface Water 100.00%		Cacapon 100.00%		Morgan 100.00%		13,362,333
1986	Town of Capon Bridge Water Department	Public water supply		Groundwater 100.00%	Cacapon 100.00%		Hampshire 100.00%		19,885,633
1477	Wardensville Water Department	Public water supply	Surface Water 100.00%		Cacapon 100.00%		Hardy 100.00%		30,820,100

Figures 3-8 through 3-11 summarize the breakdown of the share total withdrawals occurring among currently operating facilities, the trends in use over time for each industry group, and the amount and share of source water withdrawn by the currently operating LQUs in the watershed.

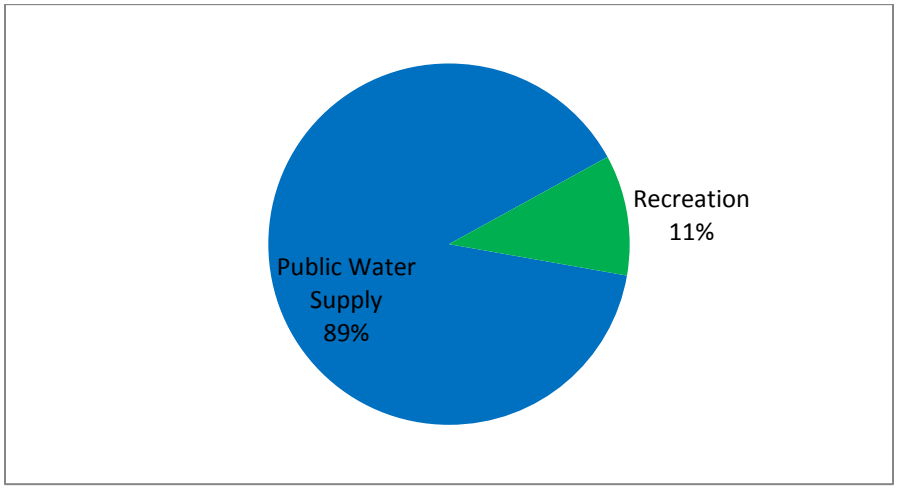
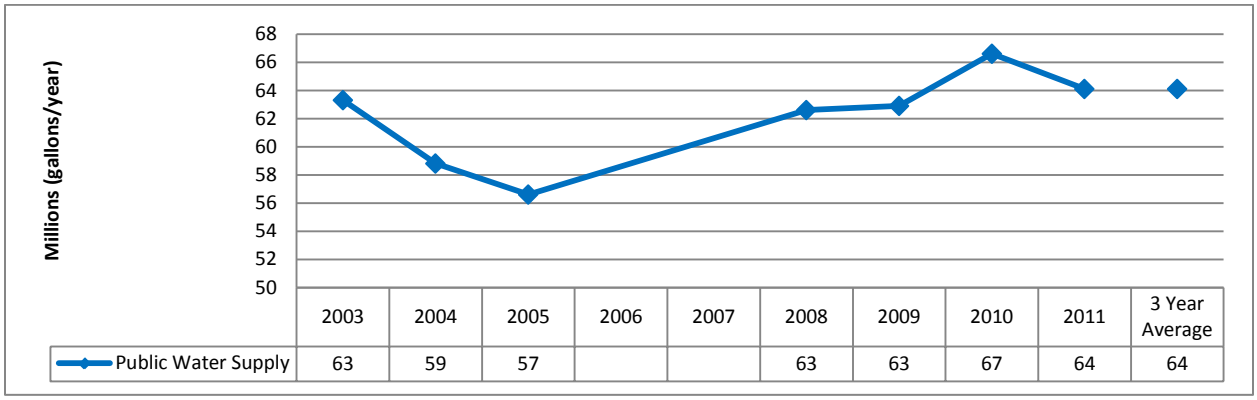


Figure 3-8 Cacapon Watershed LQU percent of total average annual water withdrawals by sector.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Public Water Supply	63	59	57			63	63	67	64	64

Figure 3-9 Cacapon Watershed LQU water withdrawal trends for the Public Water Supply SIC category, measured in millions of gallons per year.

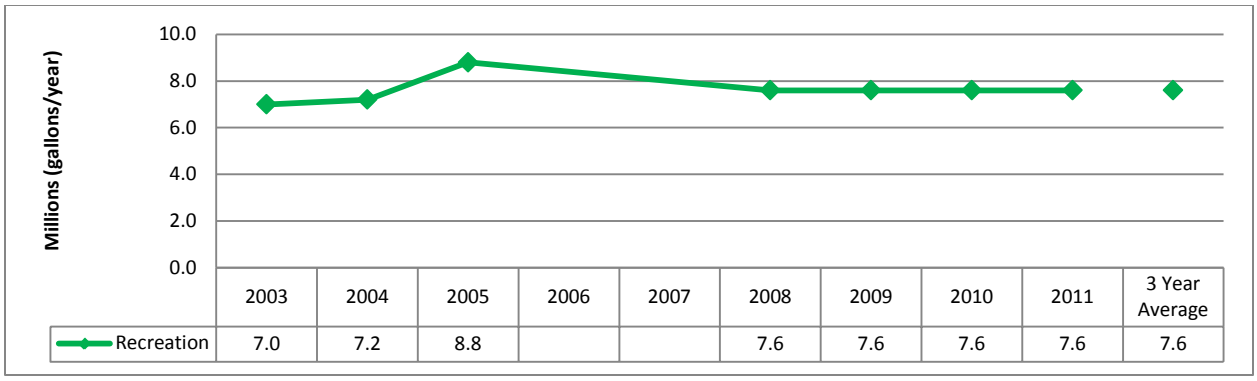


Figure 3-10 Cacapon Watershed LQU water withdrawal trends for the Recreation SIC category, measured in millions of gallons per year.

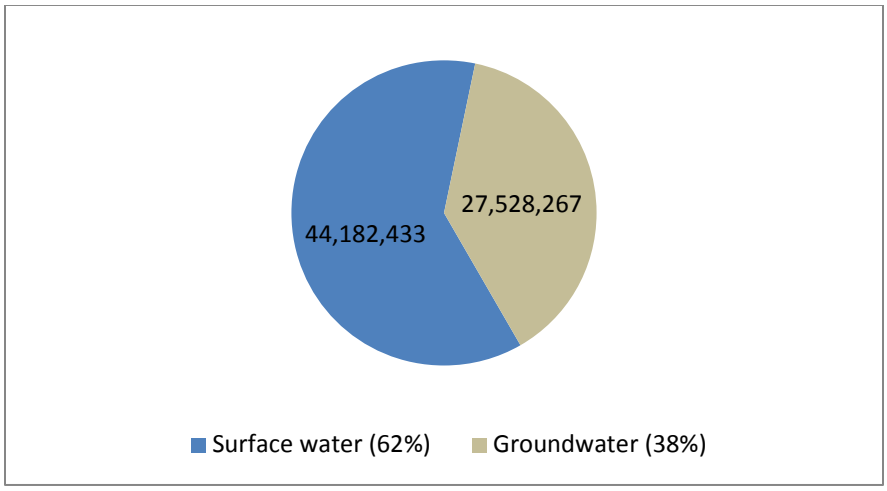
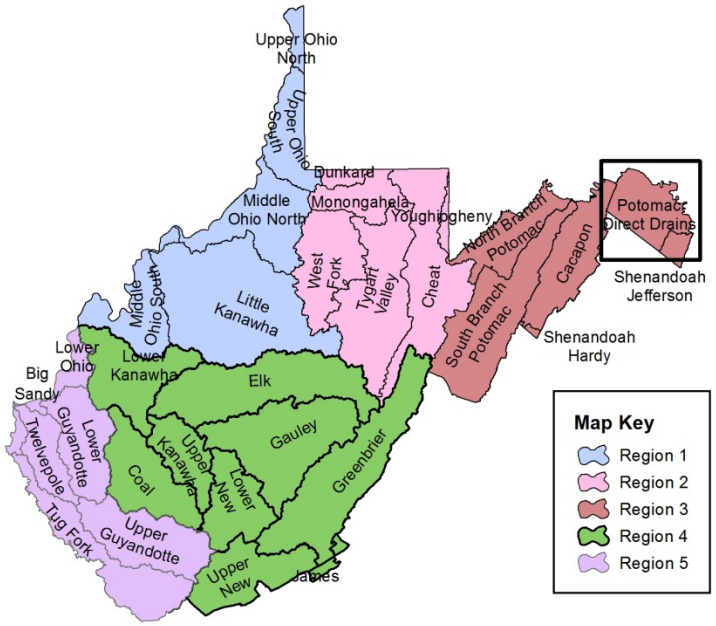


Figure 3-11 Average annual gallons of water withdrawn by LQUs from groundwater and surface water sources in the Cacapon Watershed.

Interbasin transfers occur when water is permanently moved from one watershed to another. This can occur in a number of ways. However, only three possible routes of transfer are considered here; see Chapter 2 of the Plan for a discussion of possibilities and data limitations. There are no reported interbasin transfers occurring between the Cacapon and other HUC-8 watersheds as a result of LQU operations in 2011.

Potomac Direct Drains Watershed



Potomac Direct Drains Watershed

Watershed Description

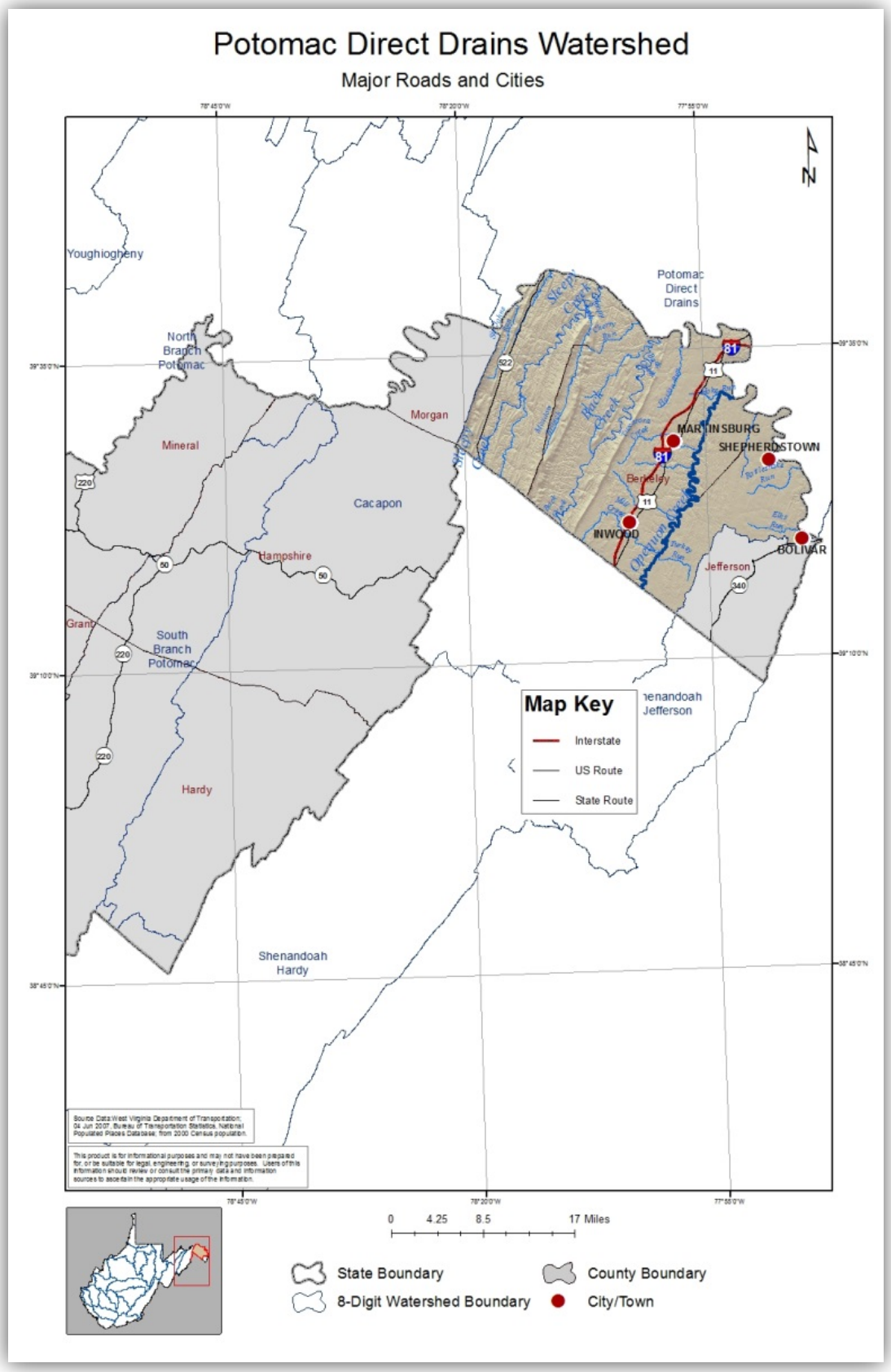
Located in the Eastern Panhandle region of West Virginia, the Potomac Direct Drains Watershed encompasses approximately 593 square miles in West Virginia and contains all, or portions, of three counties (Berkeley, Morgan and Jefferson). Berkeley and Morgan account for 82% of the watershed area.

The Potomac Direct Drains Watershed has 1,085 miles of streams and rivers. The Potomac River Mainstem flows east-southeasterly through the watershed along the West Virginia-Maryland border. The Potomac River's major tributaries include Opequon Creek, Back Creek, Sleepy Creek and Town Run.

Additionally, the watershed encompasses all, or portions, of the following state and federal public lands: two wildlife management areas (Sleepy Creek and Widmeyer), two state parks (Berkeley Springs and Cacapon) and one national park (Harpers Ferry National Historical Park).

Demographics

The Potomac Direct Drains Watershed has a total population of approximately 141,044. The watershed has four cities/towns with a population exceeding 1,000 residents. The largest city in the watershed is Martinsburg with a population of 17,227, followed by Inwood (2,954), Shepherdstown (1,734) and Bolivar (1,045).


Potomac Direct Drains Watershed
Major Roads and Cities
Youghiogheny
North Branch Potomac
Mineral
Morgan
Cacapon
Hampshire
Grant
South Branch Potomac
Hardy
Shenandoah
Hardy
Potomac Direct Drains
MARTINSBURG
SHEPHERDSTOWN
Berkeley
INWOOD
BOLIVAR
Jefferson
Map Key
Interstate
US Route
State Route
0 4.25 8.5 17 Miles
State Boundary
County Boundary
8-Digit Watershed Boundary
City/Town

Geography and Geology

The Potomac Direct Drains Watershed lies within two ecoregions. The majority (99%) occupies the Ridge and Valley Ecoregion, which is characterized by its parallel mountain ridgelines and lowland valleys. There is a small portion (1%) in the southeast of the watershed that resides in the Blue Ridge Ecoregion, which is known for its forested slopes, cold winters and mild summers. The average elevation for the watershed is approximately 646 feet above mean sea level. The highest elevation, 2,615 feet, is located on High Point in Morgan County. The lowest elevation, 300 feet, is located at the confluence of the Shenandoah River and Potomac River at Harpers Ferry. The average annual temperature is 51 degrees Fahrenheit and ranges from 49 to 55 degrees. The average annual precipitation for the watershed is 37.69 inches per year.

The majority (69%) of the watershed is covered by deciduous, mixed and evergreen forests, while 22% is planted/cultivated area. Approximately 8% is classified as developed and 5% is defined as impervious surface area.

The surface geology in the watershed consists of shale (48%), limestone (38%) and sandstone (9%), while there is a small percentage of dolostone and alluvium.

The United States Geological Survey (USGS), in conjunction with federal, state and local agencies, including the DEP, cooperatively funds the USGS stream gaging network to monitor water availability. Currently, there are seven surface water gaging stations and three groundwater gaging stations located within the watershed. The groundwater gaging stations are well sites located in Berkeley County and Jefferson County while surface water data is collected and recorded for the sites located on an unnamed tributary to Warm Springs Run (1), Back Creek (1), Mill Creek (1), Opequon Creek (1), Rockymarsh Run (1) Tuscarora Creek (1), and Back Creek (1). The recorded data can be accessed at http://waterdata.usgs.gov/nwis.

LQU Data

Table 3-4 contains a list of all Large Quantity User (LQU) facilities in the Potomac Direct Drains Watershed that are currently operating, their Standard Industrial Category (SIC) of use, the average percent of source water withdrawn annually, percent withdrawn from the watershed and county, as well as others if intakes are located elsewhere, and the average amount of water withdrawn by the facility based on the most recent three years of monthly data. A detailed discussion about categories of use type and comparisons of use to statewide withdrawals and consumption is available in Chapter 2 of

the Plan. Chapter 4 of the Plan includes data and discussion about future use projections. The following is a summary of data collected regarding the facilities:

- 19 Public Water Supply facilities
    - 3 closed: Berkeley County PSD –TP2 in 2009, Shepherdstown Water Department and Parkview Woodland MHP closed in 2010
- 3 Agriculture/aquaculture facilities all using similar amounts of water
- 3 Industrial facilities.
    - One closed in 2006: Creo Manufacturing LLC.
    - Capitol Cement Corporation is the largest withdrawer, averaging 2.9 billion gallons annually
- 2 Recreation facilities
- 1 Mining facility: US Silica Company

Table 3-4 All facilities withdrawing from Potomac Direct Drains Watershed organized by Use Category and Intake Source and Location (watershed and county). Blanks indicate that no additional withdrawals were occurring.

Facility ID	Facility Name	Use Category	Source and % of 3 Year Average		Watershed and % of 3 Year Average		County and % of 3 Year Average		3 Year Annual Average (gallons)
7133	Berkeley County PSD - BHWTP	Public water supply	Surface Water 100.00%		Potomac Direct Drains 100.00%		Berkeley 100.00%		636,676,000
10002	Berkeley County PSD - PRWTP	Public water supply	Surface Water 100.00%		Potomac Direct Drains 100.00%		Berkeley 100.00%		1,015,631,333
7134	Berkeley County PSWD - GFU	Public water supply		Groundwater 100.00%	Potomac Direct Drains 100.00%		Berkeley 100.00%		26,127,667
2547	Berkeley Springs Water Works	Public water supply	Surface Water 100.00%		Potomac Direct Drains 100.00%		Morgan 100.00%		156,177,605
1097	Burr Industrial Park	Public water supply		Groundwater 100.00%	Potomac Direct Drains 100.00%		Jefferson 100.00%		26,513,300
1159	Cacapon State Park	Public water supply		Groundwater 100.00%	Potomac Direct Drains 100.00%		Morgan 100.00%		25,577,333
5089	Capitol Cement Corporation	Industrial		Groundwater 100.00%	Potomac Direct Drains 100.00%		Berkeley 100.00%		2,912,696,000
3872	City of Martinsburg	Public water supply	Surface Water 57.34%	Groundwater 42.66%	Potomac Direct Drains 100.00%		Berkeley 100.00%		1,460,137,934
5128	Cress Creek Country Club	Recreation	Surface Water >99.99%	Groundwater <0.01%	Potomac Direct Drains >99.99%	Shenandoah Jefferson <0.01%	Jefferson 100.00%		13,735,000
7934	Deerwood	Public water supply		Groundwater 100.00%	Potomac Direct Drains 100.00%		Berkeley 100.00%		8,171,333
4387	Fox Glen Utilites	Public water supply		Groundwater 100.00%	Potomac Direct Drains 100.00%		Jefferson 100.00%		49,463,867
4331	Harpers Ferry Water Works	Public water supply	Surface Water 100.00%		Potomac Direct Drains 100.00%		Jefferson 100.00%		105,044,667
1153	Meadowbrook Water System	Public water supply		Groundwater 100.00%	Potomac Direct Drains 100.00%		Jefferson 100.00%		30,304,833
3626	National Center for Cool & Cold Water Aquaculture	Agriculture/aquaculture	Surface Water 43.64%	Groundwater 56.36%	Potomac Direct Drains 100.00%		Jefferson 100.00%		307,087,120
1224	National Conservation Training Center	Industrial		Groundwater 100.00%	Potomac Direct Drains 100.00%		Jefferson 100.00%		11,128,533
10074	River Bend Membership Corporation	Recreation		Groundwater 100.00%	Potomac Direct Drains 100.00%		Berkeley 100.00%		30,458,373
1078	Rocky Glen	Public water supply		Groundwater 100.00%	Potomac Direct Drains 100.00%		Berkeley 100.00%		23,454,651
1151	Shenandoah Junction Public Water	Public water supply		Groundwater 100.00%	Potomac Direct Drains 100.00%		Jefferson 100.00%		15,338,233
4213	The Conservation Fund Freshwater Institute	Agriculture/aquaculture	Surface Water 100.00%		Potomac Direct Drains 100.00%		Jefferson 100.00%		341,207,333
7050	The Woods & Walden Woods Subdivision	Public water supply		Groundwater 100.00%	Potomac Direct Drains 100.00%		Berkeley 100.00%		22,723,601
7070	The Woods II & Walden Woods Subdivision	Public water supply		Groundwater 100.00%	Potomac Direct Drains 100.00%		Berkeley 100.00%		31,686,523
4004	U S Silica Company	Mining	Surface Water 100.00%		Potomac Direct Drains 100.00%		Morgan 100.00%		388,230,585
7615	VAMC Martinsburg	Public water supply		Groundwater 100.00%	Potomac Direct Drains 100.00%		Berkeley 100.00%		78,610,842
8155	WVDNR - Ridge Hatchery	Agriculture/aquaculture	Surface Water 100.00%		Potomac Direct Drains 100.00%		Morgan 100.00%		233,280,000

Figures 3-12 through 3-15 summarize the breakdown of the share total withdrawals occurring among currently operating facilities, the trends in use over time for each industry group, and the amount and share of source water withdrawn by the currently operating LQUs in the watershed.

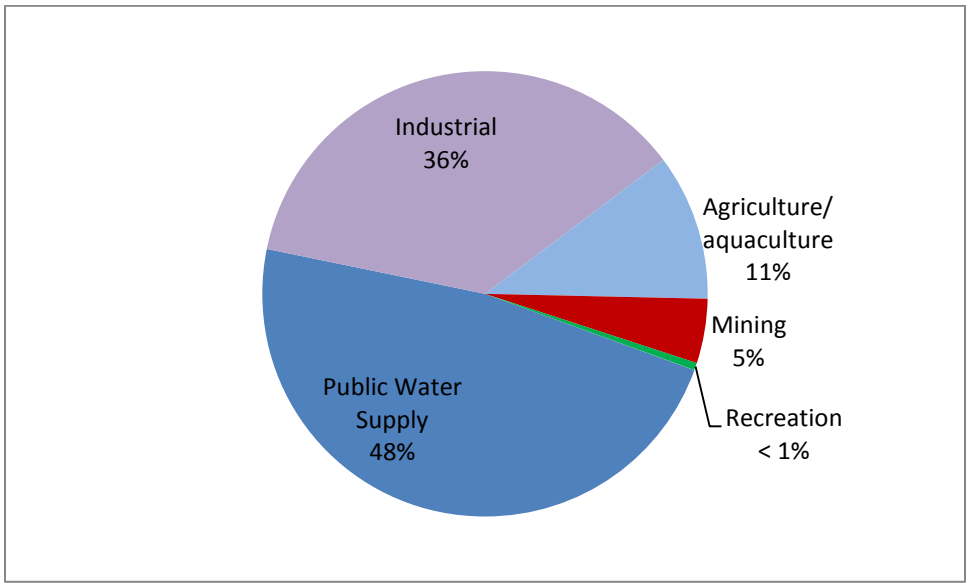
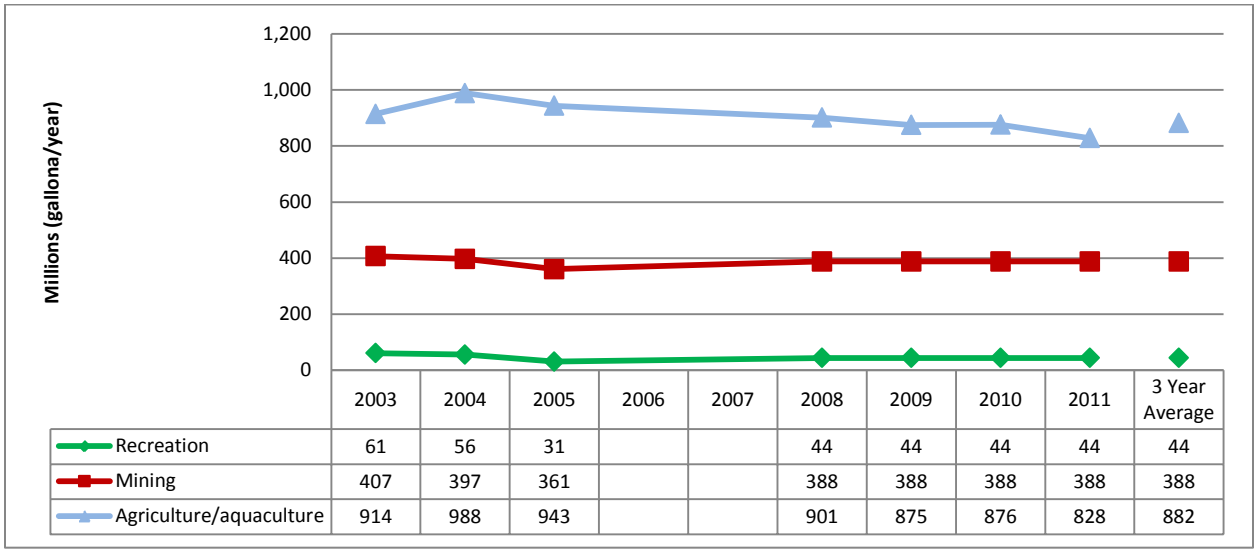
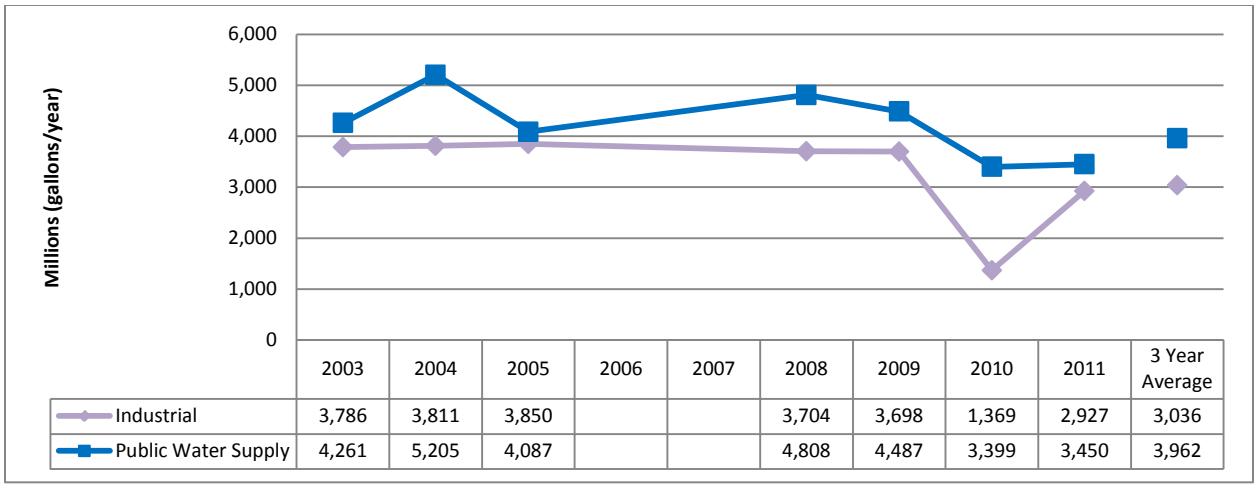


Figure 3-12 Potomac Direct Drains Watershed LQU percent of total average annual water withdrawals by sector.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Recreation	61	56	31			44	44	44	44	44
Mining	407	397	361			388	388	388	388	388
Agriculture/aquaculture	914	988	943			901	875	876	828	882

Figure 3-13 Potomac Direct Drains Watershed LQU water withdrawal trends for the Agriculture/aquaculture, Mining, and Recreation SIC categories, measured in millions of gallons per year.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Industrial	3,786	3,811	3,850			3,704	3,698	1,369	2,927	3,036
Public Water Supply	4,261	5,205	4,087			4,808	4,487	3,399	3,450	3,962

Figure 3-14 Potomac Direct Drains Watershed LQU water withdrawal trends for the Public Water Supply and Industrial SIC categories, measured in millions of gallons per year.

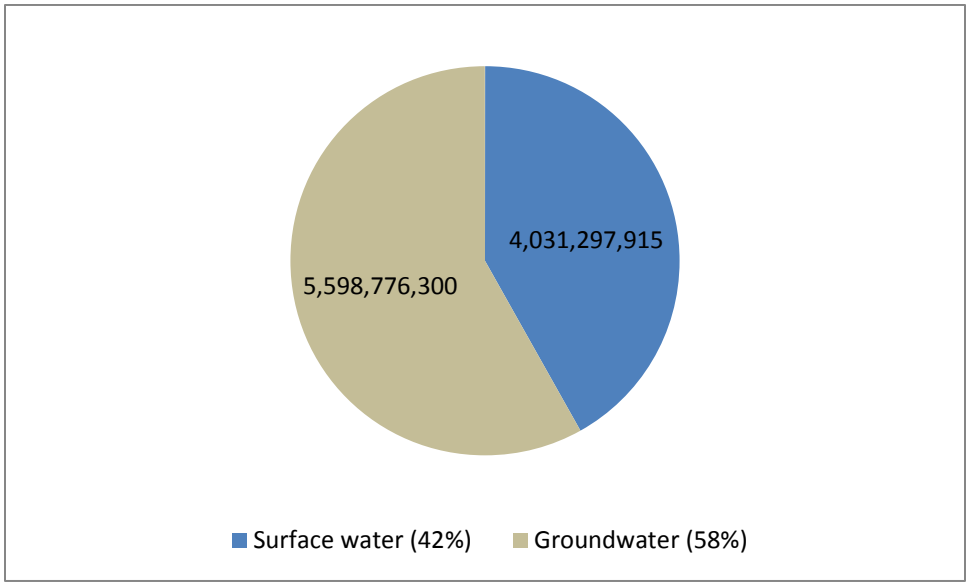
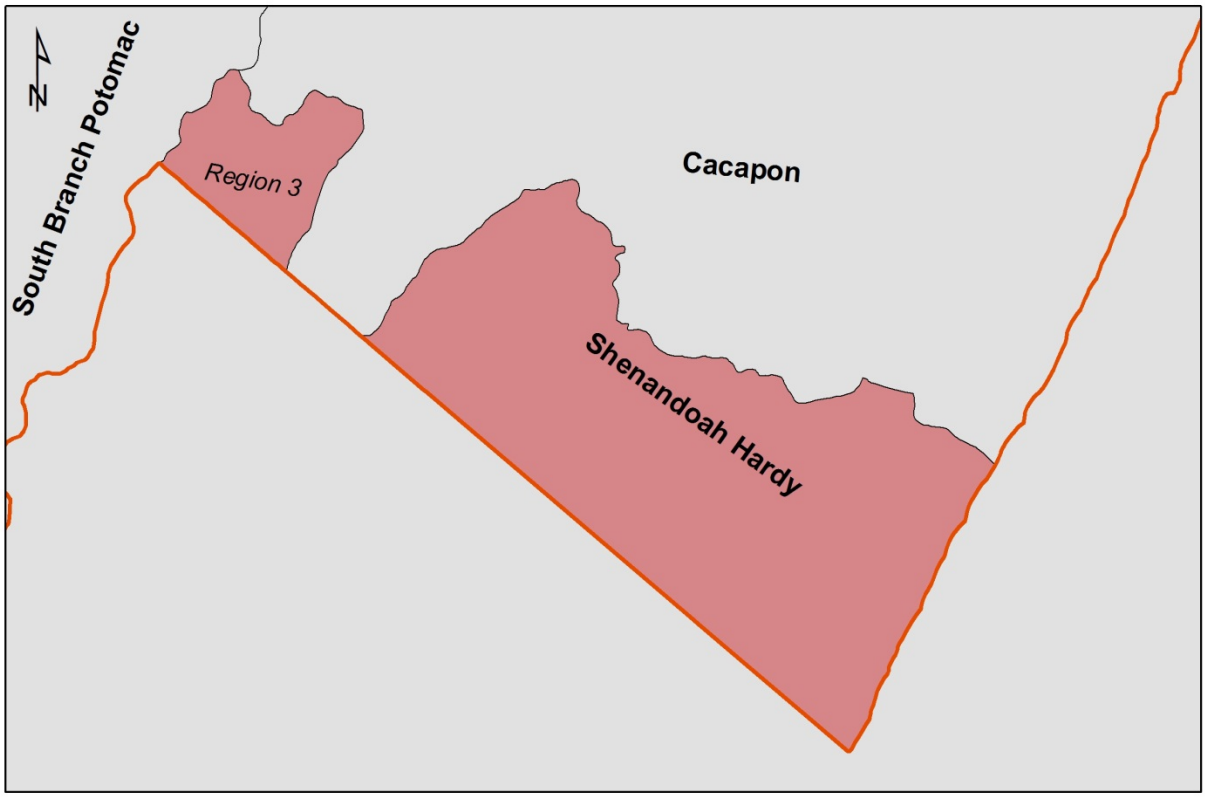
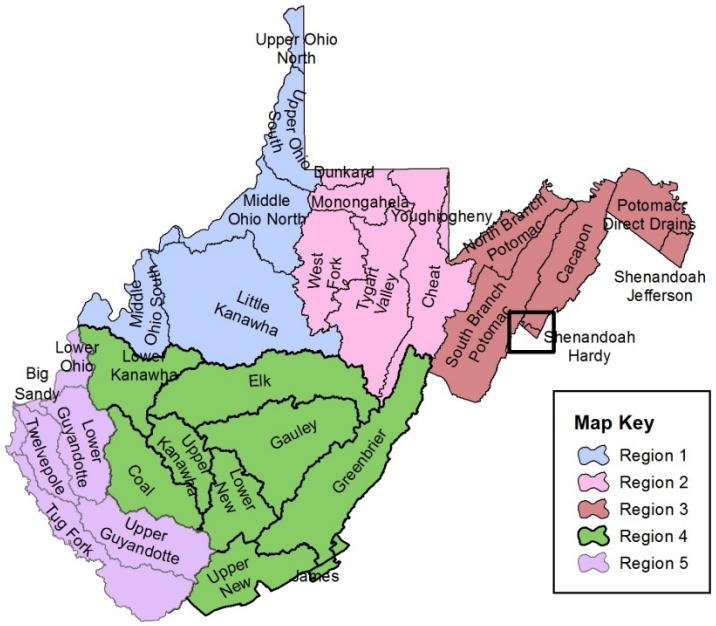


Figure 3-15 Average annual gallons of water withdrawn by LQUs from groundwater and surface water sources in the Potomac Direct Drains Watershed.

Interbasin transfers occur when water is permanently moved from one watershed to another. This can occur in a number of ways. However, only three possible routes of transfer are considered here; see Chapter 2 of the Plan for a discussion of possibilities and data limitations. There is one recreation facility that reports having withdrawal locations in both the Potomac Direct Drains and Shenandoah Jefferson watersheds. However, because the facility has not reported any actual withdrawal quantities occurring in the Shenandoah Jefferson Watershed, there are no reported interbasin transfers occurring between Potomac Direct Drains and other HUC-8 watersheds as a result of LQU operations in 2011.

Shenandoah Hardy Watershed





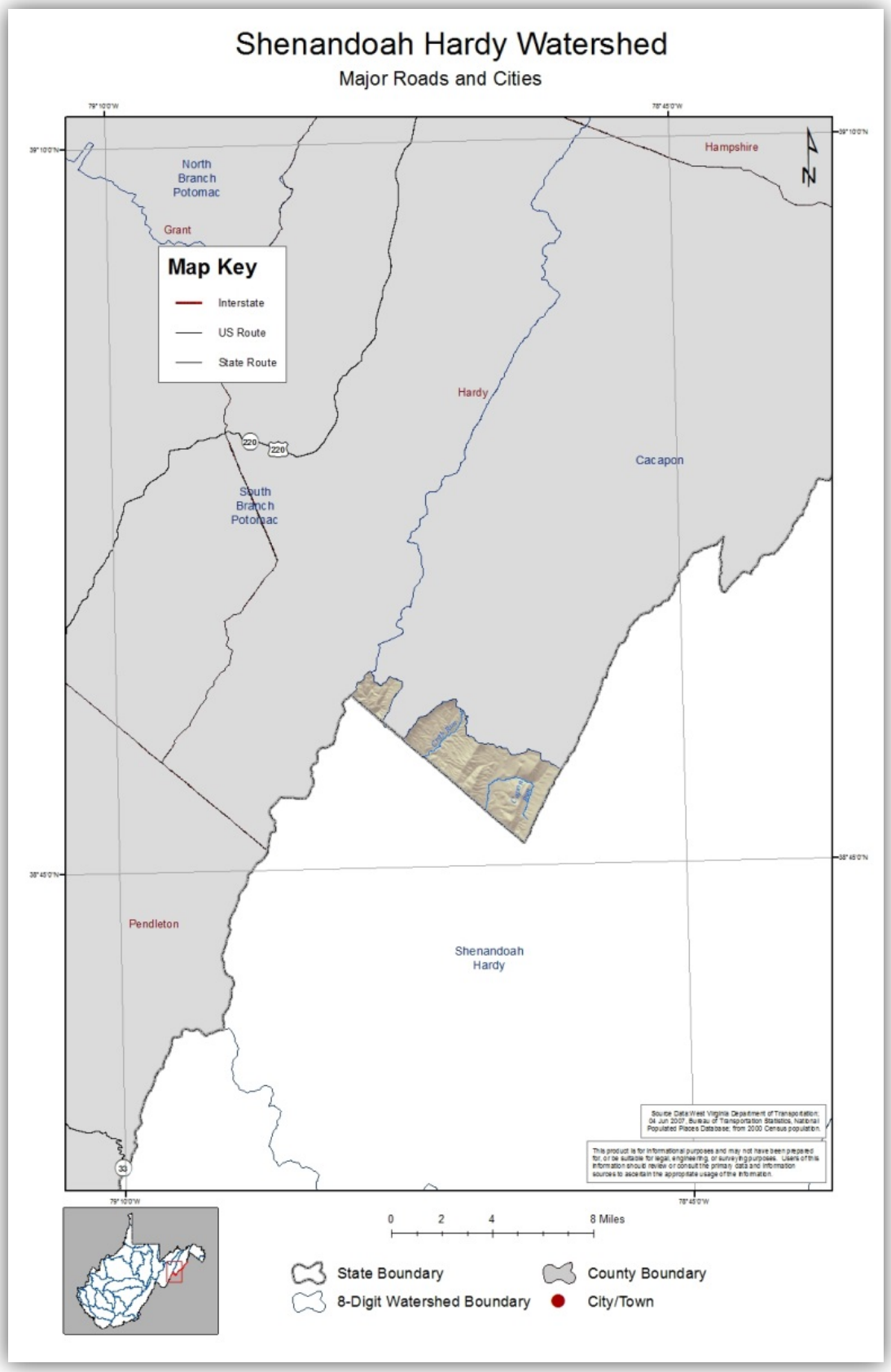
Shenandoah Hardy Watershed

Watershed Description

Located in the Eastern Panhandle region of West Virginia, the Shenandoah Hardy Watershed lies along the West Virginia–Virginia border. Covering approximately 17 square miles in West Virginia, the watershed is contained completely within Hardy County and has a total population of approximately 195 residents.

As a component of Shenandoah River mainstem, the Shenandoah Hardy Watershed has 47 miles of streams and rivers including Capon Run, Crab Run and Spring Run.

Additionally, the watershed encompasses all, or portions, of the following state and federal public lands: one wildlife management area (Wardensville) and one national forest (George Washington).


Shenandoah Hardy Watershed
Major Roads and Cities
North Branch Potomac
Grant
Hampshire
Map Key
Interstate
US Route
State Route
Hardy
Cacapon
South Branch Potomac
Pendleton
Shenandoah Hardy
0 2 4 8 Miles
State Boundary
County Boundary
8-Digit Watershed Boundary
City/Town

Geography and Geology

The Shenandoah Hardy Watershed lies entirely within the Ridge and Valley Ecoregion, which is comprised of parallel mountain ridgelines and lowland valleys. The average elevation for the watershed is 2,143 feet above mean sea level. The highest elevation, 2,930 feet, is located on Flattop Mountain. The lowest elevation, 1,526 feet, is located on a section of Capon Run near the West Virginia-Virginia border.

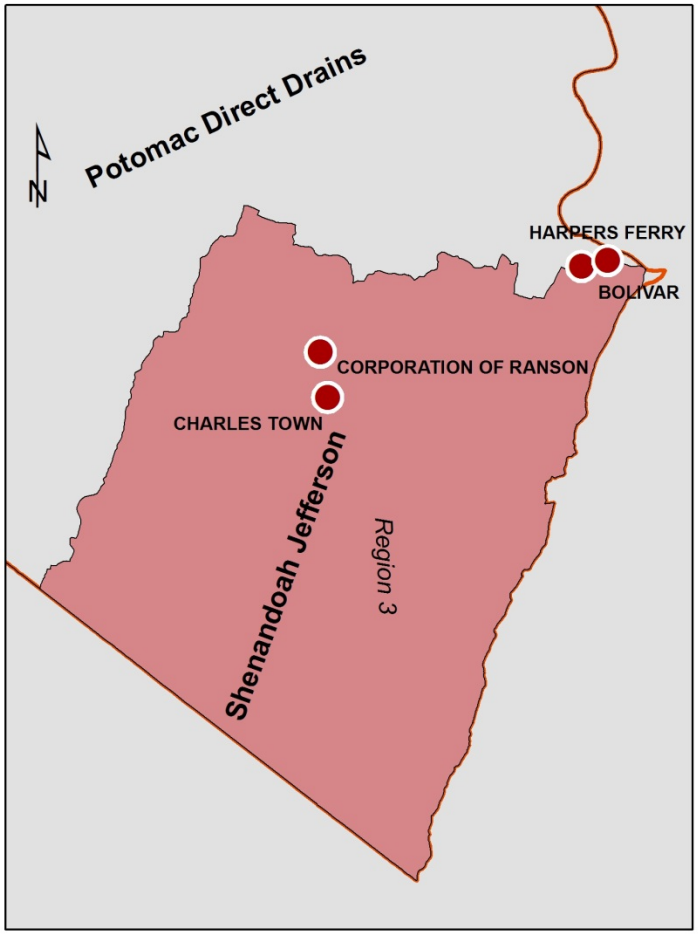
The average annual temperature is 49 degrees Fahrenheit and ranges from 49 to 51 degrees. The average annual precipitation for the watershed is 38.71 inches per year.

The majority (87%) of the Shenandoah Hardy Watershed is covered by deciduous, mixed and evergreen forests, while only 5% of the land cover is classified as developed. The remaining land cover consists of grasslands, pastures, barren land, wetlands, crops, shrubs and open water. Only 0.78% of the entire watershed is covered by impervious surfaces.

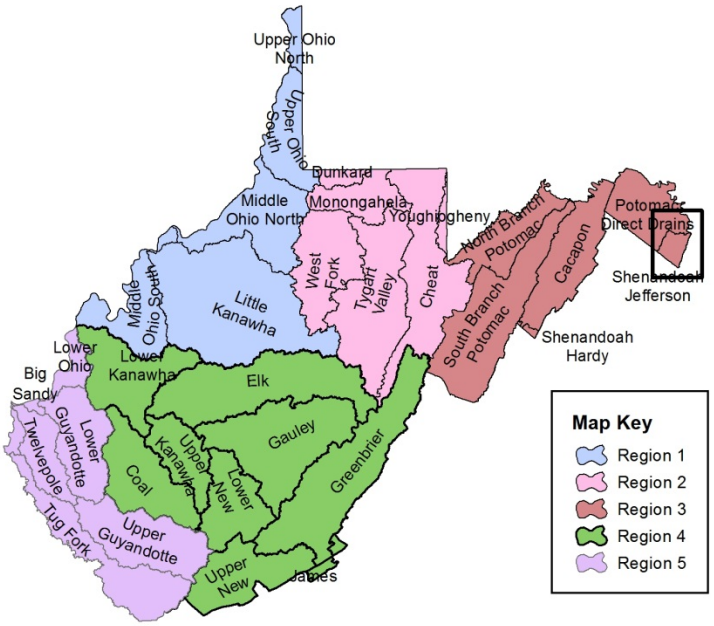
The surface geology in the watershed is predominantly comprised of (85%) of shale and sandstone (11%), while 4% of the geology is limestone.

LQU Data

There are no LQUs in this watershed in West Virginia.



Shenandoah Jefferson Watershed



Shenandoah Jefferson Watershed

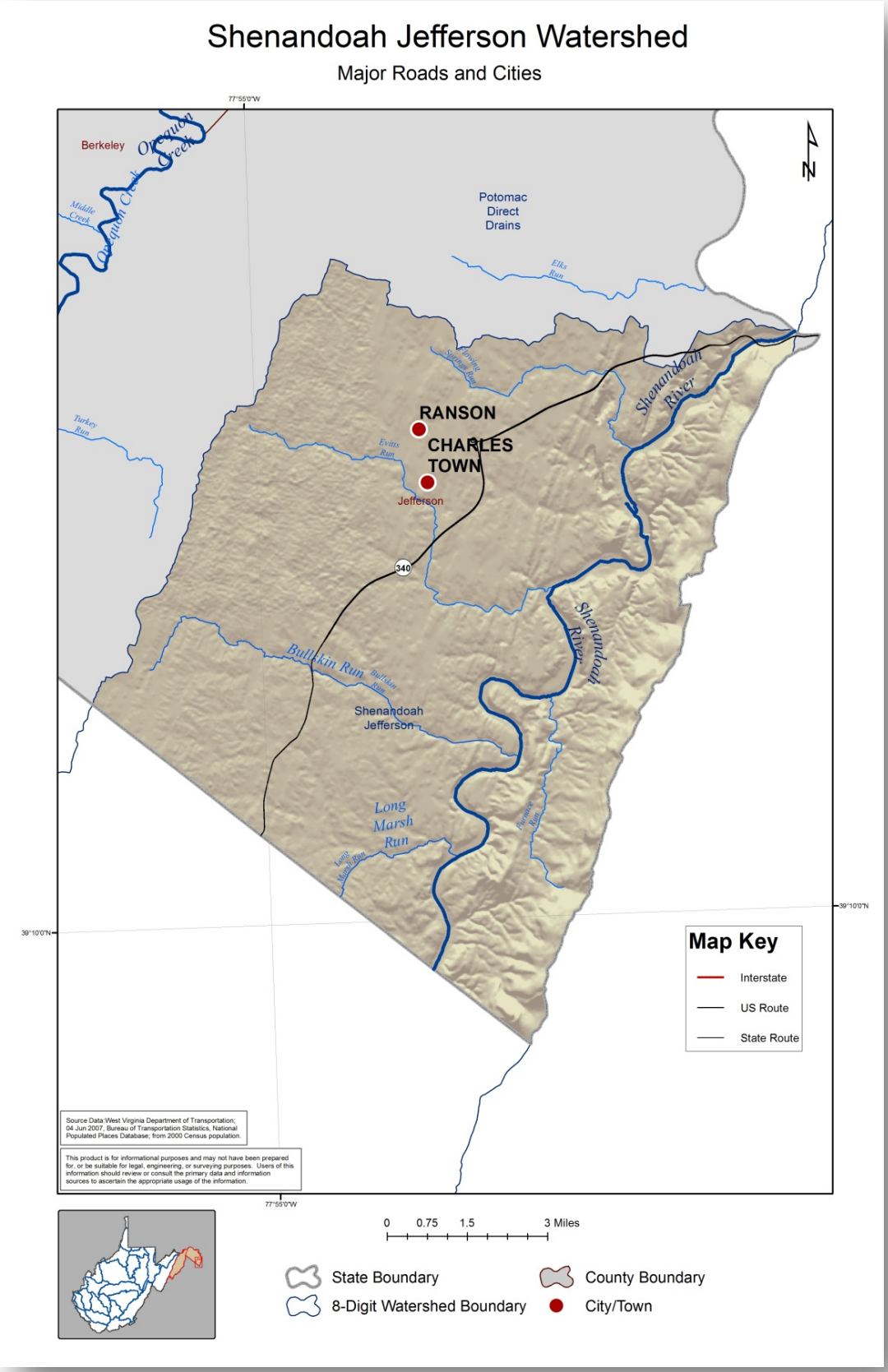
Watershed Description

Located in the Eastern Panhandle region of West Virginia, the Shenandoah Jefferson Watershed lies along the West Virginia–Virginia border. Covering approximately 103 square miles in West Virginia, the watershed is contained completely within Jefferson County. The Shenandoah Jefferson Watershed has 140 miles of streams and rivers and contains the Shenandoah River mainstem. The Shenandoah River flows northeasterly through the watershed to its confluence with the Potomac River at Harpers Ferry, West Virginia. The Shenandoah River's major tributaries include Long Marsh Run, Bullskin Run, Furnace Run, Evitts Run and Flowing Springs Run.

Additionally, the watershed encompasses all, or portions, of the following state and federal public lands: one wildlife management area (Shannondale Springs) and one national historical park (Harpers Ferry).

Demographics

The Shenandoah Jefferson Watershed has a total population of approximately 31,591 residents. There are two cities with a total population exceeding 2,000. The city with the largest population is Charles Town (5,259), followed by Ranson (4,440).


Shenandoah Jefferson Watershed
Major Roads and Cities
77°55'0"W
Berkeley
Opequon Creek
Middle Creek
Potomac Direct Drains
Elks Run
Turkey Run
Evitts Run
RANSON
CHARLES TOWN
Jefferson
340
Shenandoah River
Bullskin Run
Shenandoah Jefferson
Long Marsh Run
Large Marsh Run
Flowing Spring Run
39°10'0"N
Map Key
Interstate
US Route
State Route
Source Data:West Virginia Department of Transportation; 04 Jun 2007, Bureau of Transportation Statistics, National Populated Places Database; from 2000 Census population.
This product is for informational purposes and may not have been prepared for, or be suitable for legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the appropriate usage of the information.
0 0.75 1.5 3 Miles
State Boundary
8-Digit Watershed Boundary
County Boundary
City/Town

Geography and Geology

The Shenandoah Jefferson Watershed lies within two ecoregions. The majority (77%) is contained within the Ridge and Valley Ecoregion, which is comprised of parallel mountain ridgelines and lowland valleys. The eastern portion (23%) of the watershed occupies the Blue Ridge Ecoregion, which is known for its forested slopes, cold winters and mild summers. The average elevation for the watershed is 554 feet above mean sea level. The highest elevation, 1,706 feet, is located on a ridge along the West Virginia-Virginia border. The lowest elevation, 300 feet, is located at the confluence of the Shenandoah River and Potomac River and is the lowest point in West Virginia.

The average annual temperature is 53 degrees Fahrenheit and ranges from 51 to 55 degrees. The average annual precipitation for the watershed is 38.10 inches per year.

The majority (49%) of the Shenandoah Jefferson Watershed land cover is classified as planted/cultivated. Twenty-nine percent of the watershed is covered by deciduous, mixed and evergreen forests, while 18% of the land cover is defined as developed. The remaining land cover consists of barren land, wetlands, shrubs and open water. Approximately 6.89% of the entire watershed is covered by impervious surfaces.

The surface geology in the watershed is predominantly (61%) comprised of limestone. The remaining geology consists of phyllite (12%), quartzite (11%), dolostone (8%) and shale (8%).

The United States Geological Survey (USGS), in conjunction with federal, state and local agencies, including the DEP, cooperatively funds the USGS stream gaging network to monitor water availability. Currently, there are two surface water gaging stations located within the watershed. Surface water data is collected and recorded for the sites located on the Shenandoah River at Millville (1) and Bullskin Run below Kabletown (1). The recorded data can be accessed at http://waterdata.usgs.gov/nwis.

LQU Data

Table 3-5 contains a list of all Large Quantity User (LQU) facilities in the Shenandoah Jefferson Watershed that are currently operating, their Standard Industrial Category (SIC) of use, the average percent of source water withdrawn annually, percent withdrawn from the watershed and county, as well as others if intakes are located elsewhere, and the average amount of water withdrawn by the facility based on the most recent three years of monthly data. A detailed discussion about categories of use type and comparisons of use to statewide withdrawals and consumption is available in Chapter 2 of

the Plan. Chapter 4 of the Plan includes data and discussion about future use projections. The following is a summary of data collected regarding the facilities:

- 4 Public Water Supply facilities
    - 1 closed in 2008: Tuscawilla Utilities
    - Charles Town Water Treatment Plant is the largest user, averaging 616 million gallons annually
- 3 Timber facilities
    - 1 closed in 2009: UFP Eastern Division
    - Ox Paperboard withdraws the most water, averaging 36 million gallons annually
- 2 Recreation facilities
    - Locust Hill Golf Course withdraws all the recreation water
    - Cress Creek Country Club has an intake in the Shenandoah Jefferson Watershed but has not reported any withdrawals here
- 1 Hydroelectric facility: Allegheny Energy Supply – Millville Power Station

Table 3-5 All facilities withdrawing from Shenandoah Jefferson Watershed organized by Use Category and Intake Source and Location (watershed and county). Blanks indicate that no additional withdrawals were occurring.

Facility ID	Facility Name	Use Category	Source and % of 3 Year Average		Watershed and % of 3 Year Average		County and % of 3 Year Average		3 Year Annual Average (gallons)
10099	Allegheny Energy Supply - Millville Power Station	Hydroelectric	Surface Water 100.00%		Shenandoah Jefferson 100.00%		Jefferson 100.00%		177,149,617,587
4086	Charles Town Water Treatment Plant	Public water supply	Surface Water 100.00%		Shenandoah Jefferson 100.00%		Jefferson 100.00%		616,400,487
5128	Cress Creek Country Club	Recreation	Surface Water >99.99%	Groundwater <0.01%	Potomac Direct Drains >99.99%	Shenandoah Jefferson <0.01%	Jefferson 100.00%		13,735,000
7675	Locust Hill Golf Course	Recreation	Surface Water 91.47%	Groundwater 8.53%	Shenandoah Jefferson 100.00%		Jefferson 100.00%		43,910,667
2811	Ox Paperboard	Timber	Surface Water 99.08%	Groundwater 0.92%	Shenandoah Jefferson 100.00%		Jefferson 100.00%		35,573,300
5183	UFP Ranson, LLC	Timber		Groundwater 100.00%	Shenandoah Jefferson 100.00%		Jefferson 100.00%		6,999,907
1152	Walnut Grove	Public water supply		Groundwater 100.00%	Shenandoah Jefferson 100.00%		Jefferson 100.00%		92,505,933
1156	Westridge Hills Water Works	Public water supply		Groundwater 100.00%	Shenandoah Jefferson 100.00%		Jefferson 100.00%		8,870,100

Figures 3-16 through 3-20 summarize the breakdown of the share total withdrawals occurring among currently operating facilities, the trends in use over time for each industry group, and the amount and share of source water withdrawn by the currently operating LQUs in the watershed.

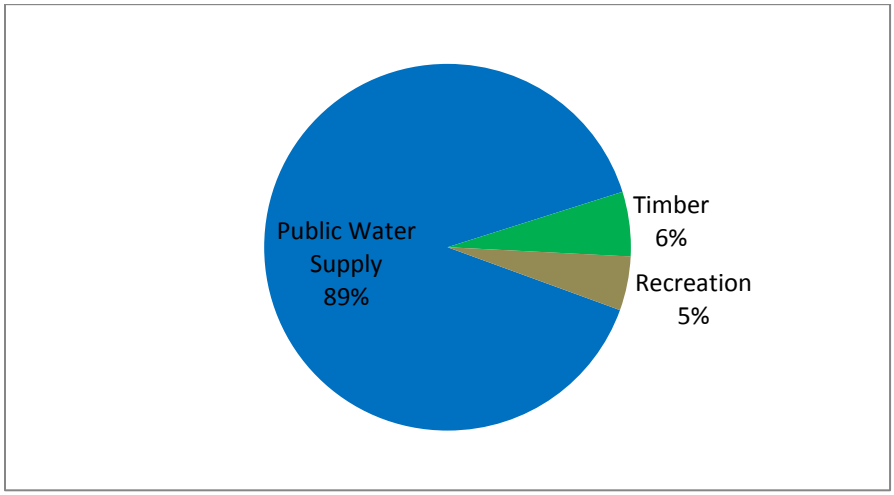


Figure 3-16 Shenandoah Jefferson Watershed LQU percent of total average annual water withdrawals by sector (excluding hydroelectric).

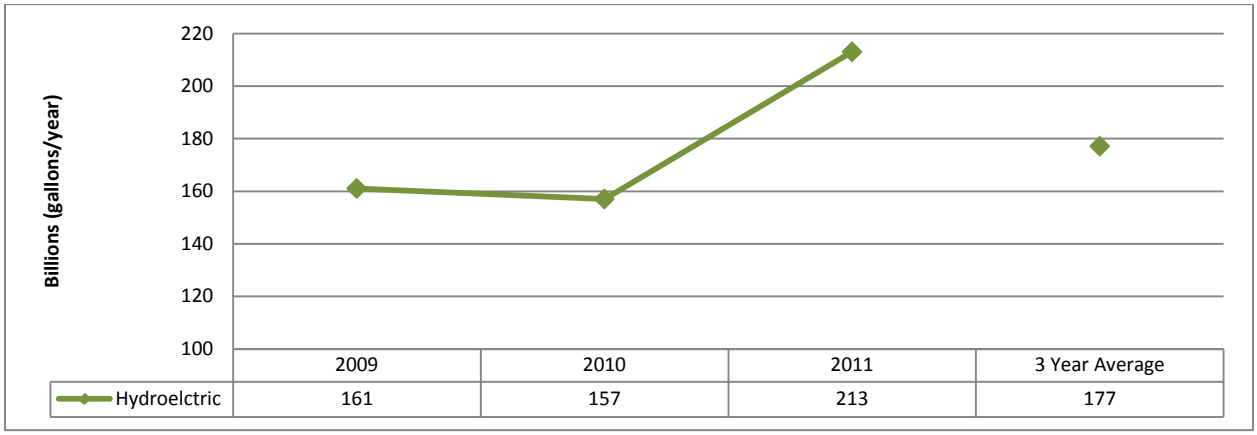


Figure 3-17 Shenandoah Jefferson Watershed LQU water withdrawal trends for the Hydroelectric SIC category, measured in billions of gallons per year.

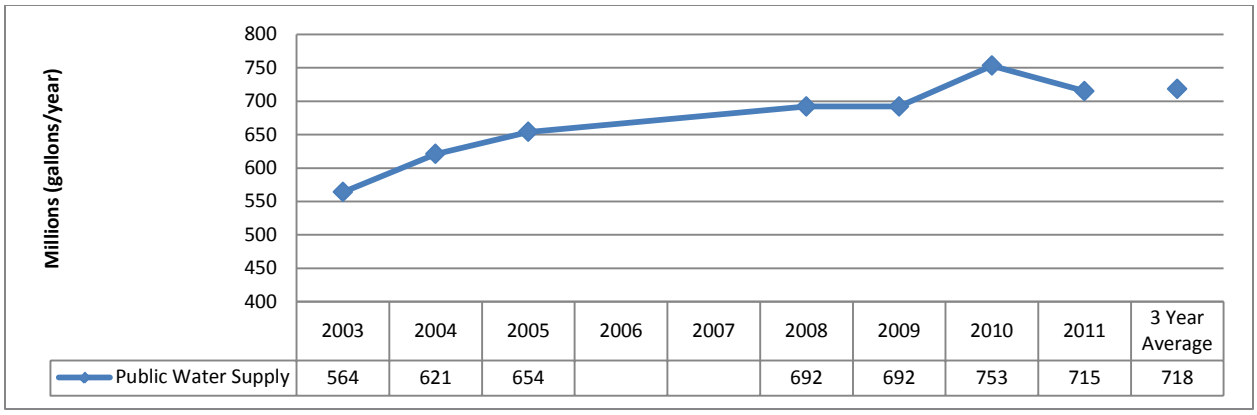


Figure 3-18 Shenandoah Jefferson Watershed LQU water withdrawal trends for the Public Water Supply SIC categories, measured in millions of gallons per year.

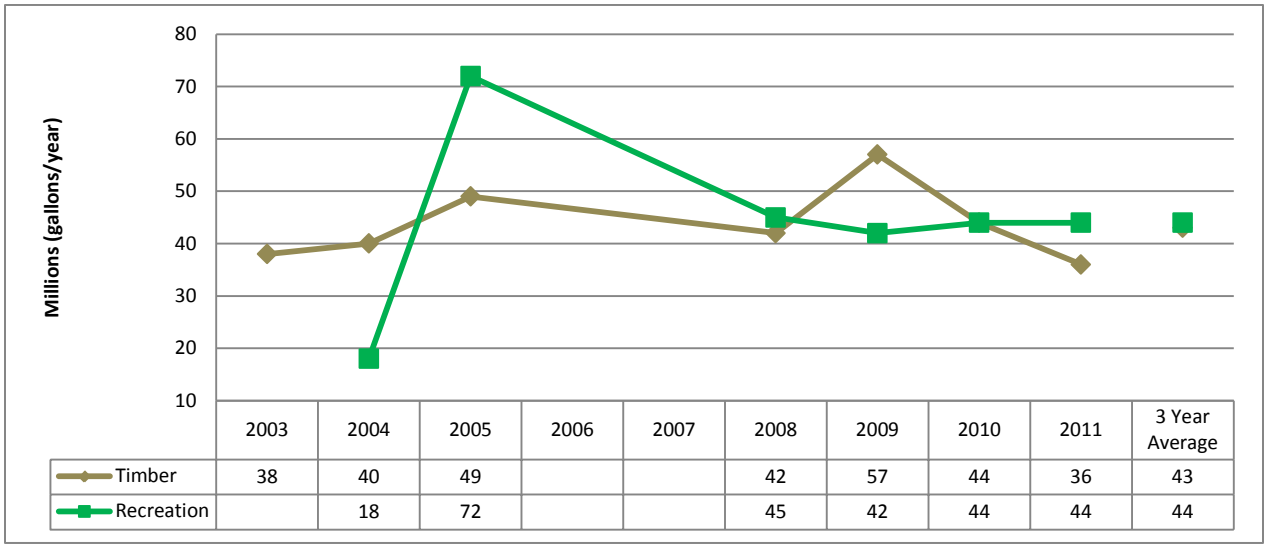


Figure 3-19 Shenandoah Jefferson Watershed LQU water withdrawal trends for the Recreation and Timber SIC categories, measured in millions of gallons per year.

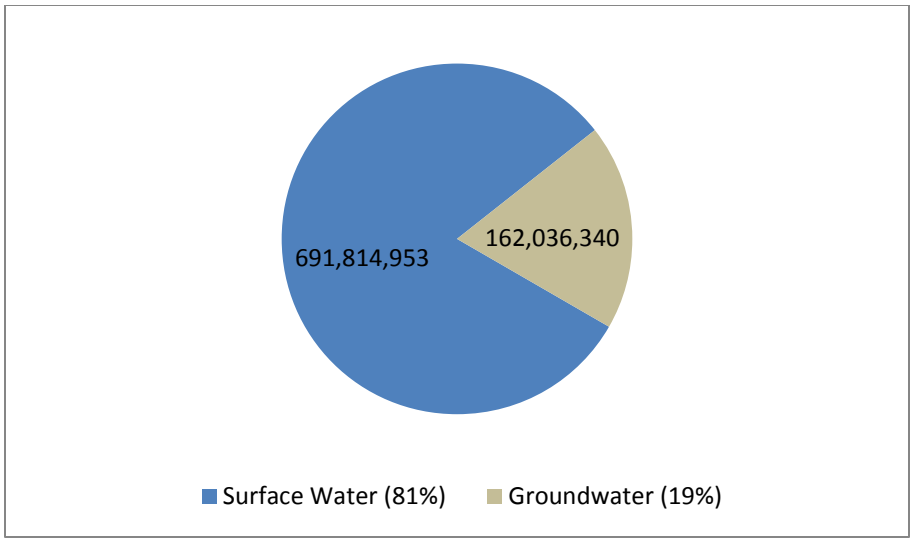
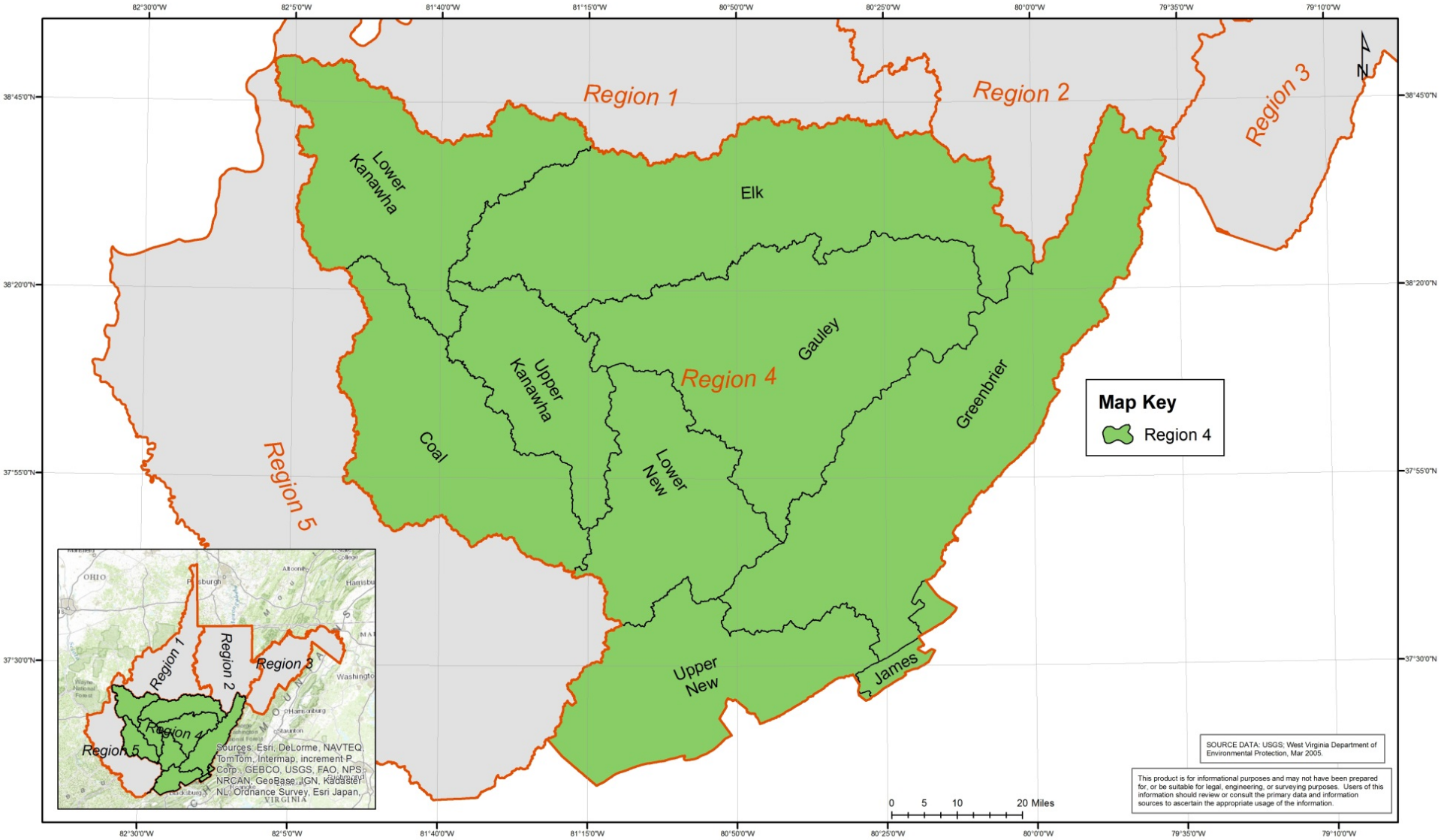


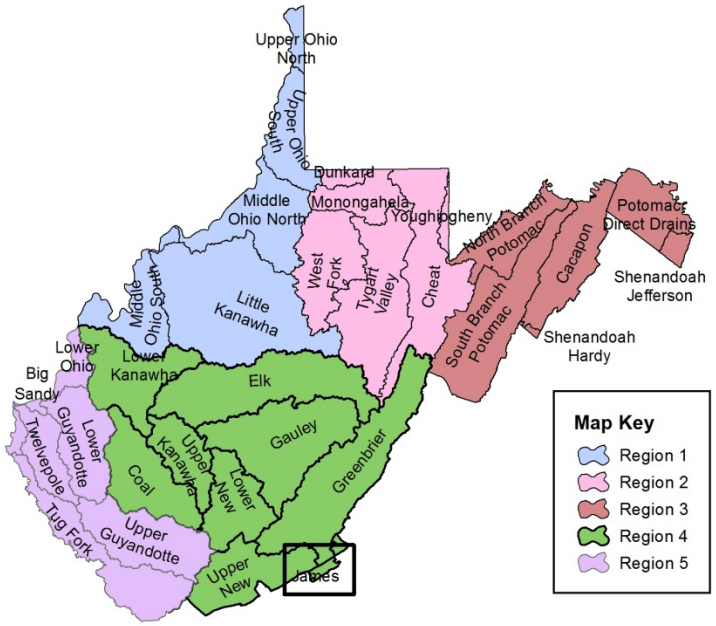
Figure 3-20 Average annual gallons of water withdrawn by LQUs from groundwater and surface water sources in the Shenandoah Jefferson Watershed.

Interbasin transfers occur when water is permanently moved from one watershed to another. This can occur in a number of ways. However, only three possible routes of transfer are considered here; see Chapter 2 of the Plan for a discussion of possibilities and data limitations. There is one recreation facility that reports having withdrawal locations in both the Potomac Direct Drains and Shenandoah Jefferson watersheds. However, because the facility has not reported any actual withdrawal quantities occurring in the Shenandoah Jefferson Watershed, there are no reported interbasin transfers occurring between Shenandoah Jefferson and other HUC-8 watersheds as a result of LQU operations in 2011.

Region 4


Region 1
Region 2
Region 3
Region 4
Region 5
Lower Kanawha
Elk
Upper Kanawha
Gauley
Coal
Lower New
Greenbrier
Upper New
James
Map Key
Region 4
SOURCE DATA: USGS; West Virginia Department of Environmental Protection, Mar 2005.
This product is for informational purposes and may not have been prepared for, or be suitable for legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the appropriate usage of the information.
0 5 10 20 Miles
82°30'0"W
82°5'0"W
81°40'0"W
81°15'0"W
80°50'0"W
80°25'0"W
80°0'0"W
79°35'0"W
79°10'0"W
38°45'0"N
38°20'0"N
37°55'0"N
37°30'0"N
Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster, NL, Ordnance Survey, Esri Japan,

James River Watershed



Region 4

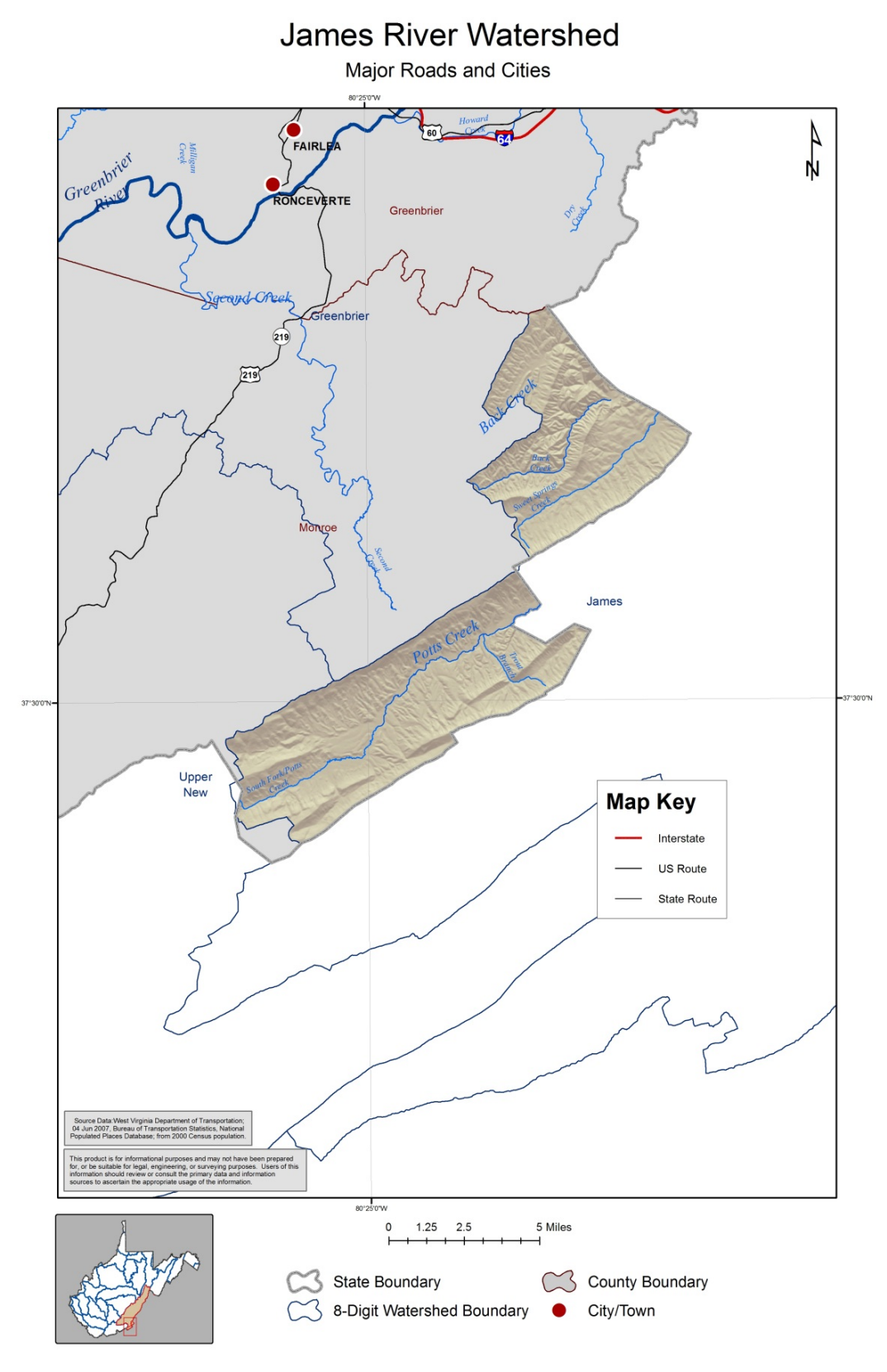
James River Watershed

Watershed Description

Located in southeastern West Virginia, the James River Watershed lies along the West Virginia–Virginia border. Covering approximately 71 square miles, the watershed is contained completely within Monroe County and has a total population of approximately 454.

A component of the Chesapeake Bay Drainage Basin, the James River Watershed has 217 miles of streams and rivers including Potts Creek, North Fork of Potts Creek and South Fork of Potts Creek.

Additionally, the watershed encompasses all, or portions, of the following state and federal public lands: three wildlife management areas (Cove Creek, Moncove Lake and Potts Creek) and two national forests (Jefferson and George Washington).


James River Watershed
Major Roads and Cities
80°25'0"W
FAIRLEA
RONCEVERTE
Greenbrier River
Milligan Creek
Howard Creek
Dry Creek
Greenbrier
Second Creek
Greenbrier
Back Creek
Bard Creek
Sweet Springs Creek
Monroe
Second Creek
James
Potts Creek
Trail Branch
37°30'0"N
Upper New
South Fork Potts Creek
Map Key
Interstate
US Route
State Route
Source Data:West Virginia Department of Transportation; 04 Jun 2007, Bureau of Transportation Statistics, National Populated Places Database; from 2000 Census population.
This product is for informational purposes and may not have been prepared for, or be suitable for legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the appropriate usage of the information.
0 1.25 2.5 5 Miles
State Boundary
County Boundary
8-Digit Watershed Boundary
City/Town

Geography and Geology

The James River Watershed lies within two ecoregions. More than 96% of the watershed occupies the Ridge and Valley Ecoregion, which is comprised of parallel mountain ridgelines and lowland valleys. A small region in the northwest portion of the watershed lies within the Central Appalachians Ecoregion and is characterized by rugged and mountainous terrain, cooler climate and a biologically diverse habitat. The average elevation for the watershed is 2,676 feet above mean sea level, with the highest elevation, 3932 feet, located at Arnolds Knob on Potts Mountain. The lowest elevation, 1,868 feet, is located on a section of Potts Creek near the West Virginia-Virginia border.

The average annual temperature is 49 degrees Fahrenheit and ranges from 47 to 53 degrees. The average annual precipitation for the James River Watershed is 42.19 inches per year.

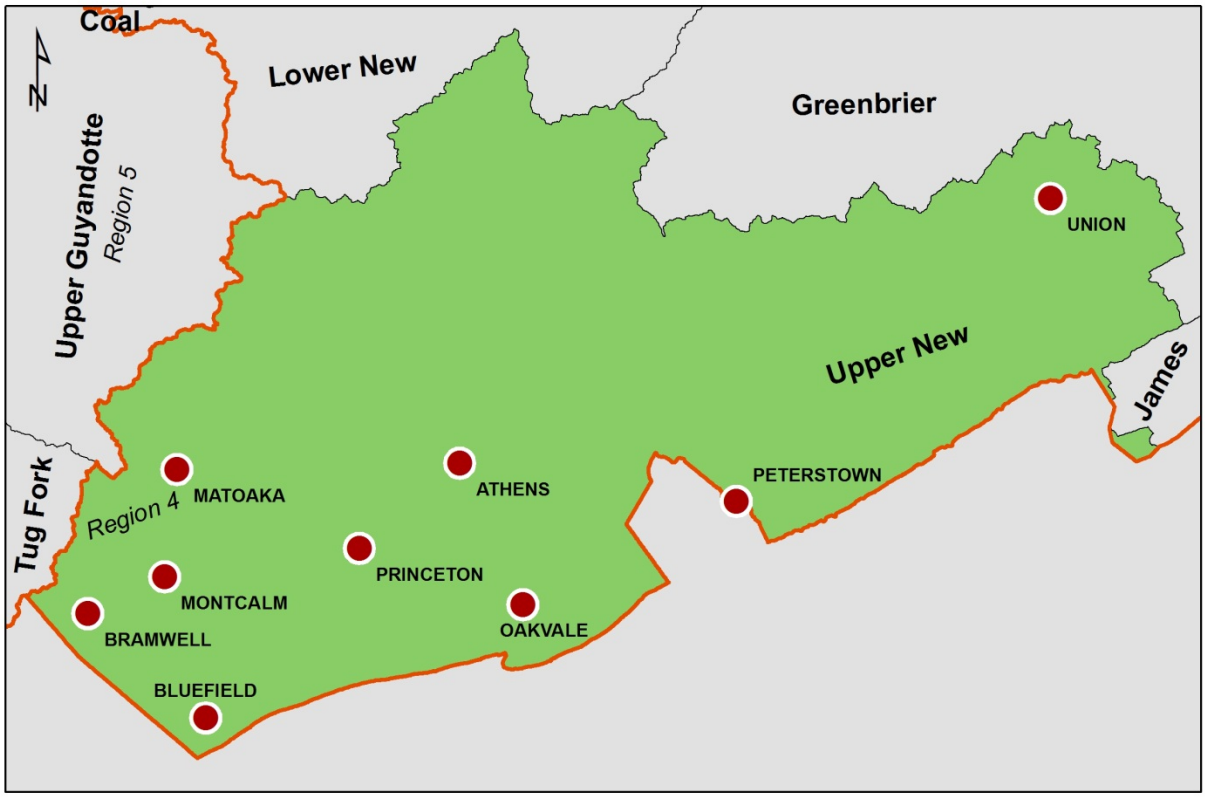
The majority (85%) of the James River Watershed is covered by deciduous, mixed and evergreen forests, while only 4% of the land cover is classified as developed. The remaining land cover consists of grasslands, pastures, barren land, wetlands, crops, shrubs and open water. Only 0.48% of the entire watershed is covered by impervious surfaces.

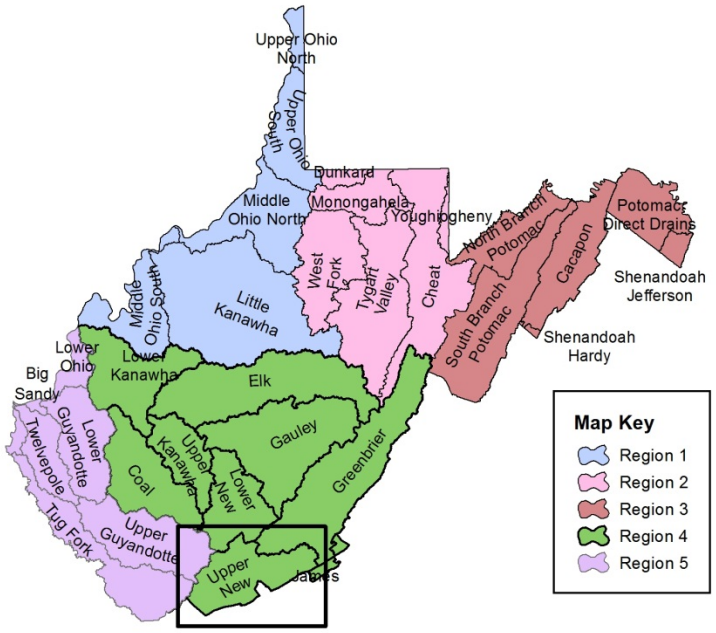
Geologically, the James River Watershed consists predominantly (85%) of sandstone, shale and siltstone while 14% is comprised of limestone.

LQU Data

There are no LQUs in this watershed in West Virginia.

Upper New River Watershed





Upper New River Watershed

Watershed Description

Located in southern West Virginia, the Upper New River Watershed covers a total area of approximately 800 square miles in West Virginia. The watershed lies within Mercer, Monroe and Summers counties and shares a border with the Commonwealth of Virginia.

The Upper New River Watershed has 2,000 miles of streams and rivers. The New River mainstem flows northerly from the Virginia border through Summers County, West Virginia in the central portion of the watershed. Major tributaries for the New River include Indian Creek, Brush Creek and the Bluestone River. The Upper New River Watershed is also home to Bluestone Lake, a 2,642-acre (normal pool) reservoir created by the Bluestone Dam which maintains a minimum flow release of 610 cubic feet per second.

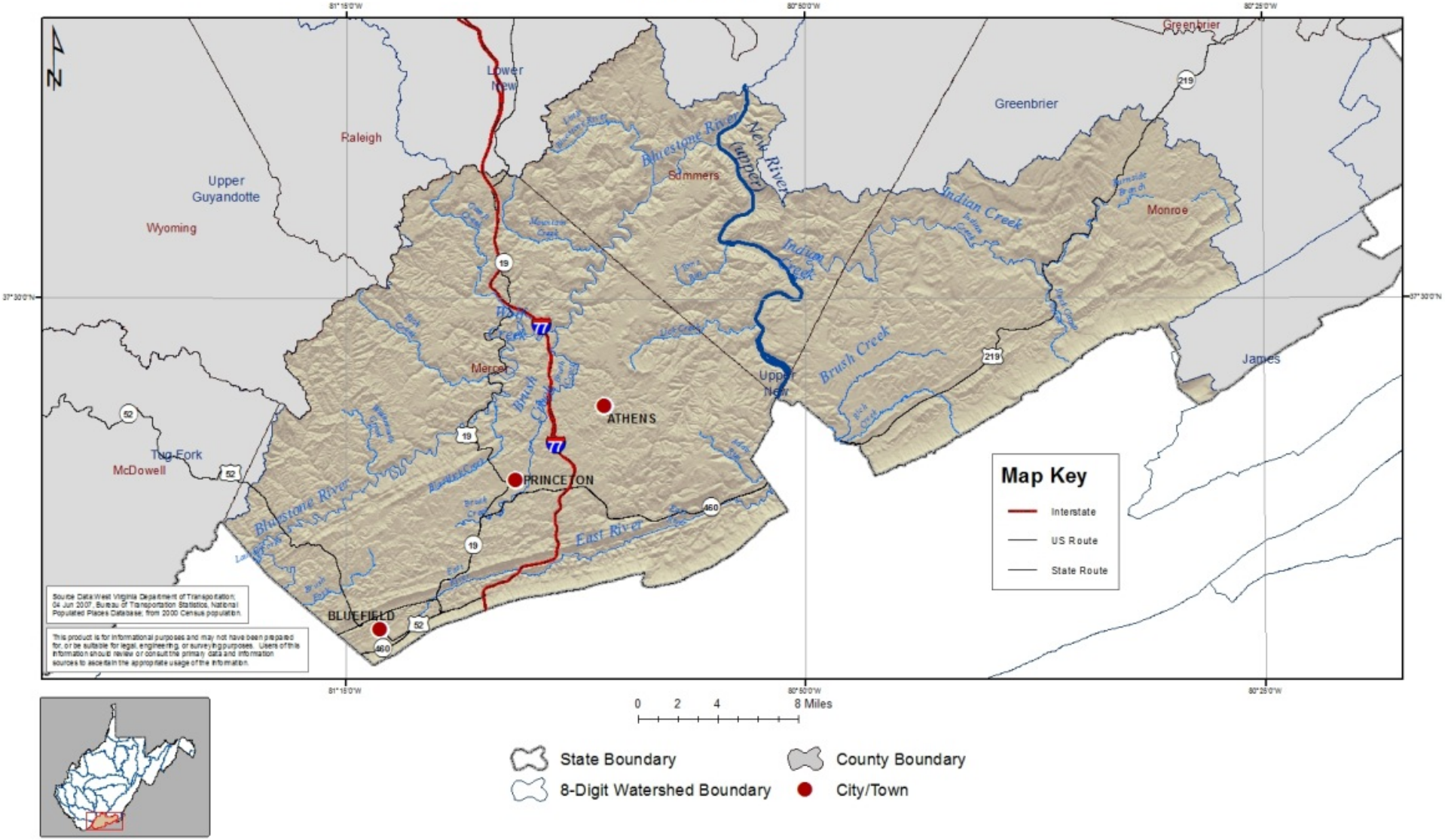
Additionally, the watershed encompasses all, or portions, of the following state and federal public lands: four state parks (Bluestone, Pipestem, Camp Creek and Pinnacle Rock), one state forest (Camp Creek), three wildlife management areas (Tate Lohr, Bluestone Lake and Potts Creek) and one national forest (Jefferson). As well, the Upper New River Watershed is home to the Bluestone National Scenic River.

Demographics

The Upper New River Watershed has a total population of approximately 75,569. The watershed has three cities and towns with a population exceeding 1,000. The largest city within the watershed is Bluefield with a total population of 10,447, followed by the city of Princeton (6,432) and the town of Athens (1,048).

Upper New River Watershed

Major Roads and Cities



Geography and Geology

The Upper New River Watershed lies within two ecoregions. The southern portion of the watershed lies within the Ridge and Valley Ecoregion, which is characterized by its parallel mountain ridgelines and lowland valleys. The northern portion of the watershed is contained within the Central Appalachians Ecoregion, which is known for its rugged and mountainous terrain, cooler climate and biologically diverse habitat. The average elevation for the watershed is 2,335 feet above mean sea level, with the highest elevation of 4,069 feet at Buckhorn Knob on East River Mountain in Mercer County. The lowest elevation, approximately 1,365 feet, is located in the northern portion of the watershed below the Bluestone Dam in Summers County. The average annual temperature is 50 degrees Fahrenheit and ranges from 47 to 53 degrees. The average annual precipitation for the Upper New River Watershed is 38.04 inches per year.

The Upper New River Watershed is dominated by forests. Approximately 71% of the total land area consists of deciduous, evergreen and mixed growth forests. Cultivated crops and pastures comprise 14% of the total land cover, while 10% of the land cover is classified as developed. Impervious surfaces account for 4 pervious of the watershed's surface area.

The surface geology in the Upper New River Watershed is predominantly (74%) shale and siltstone. There eastern region of the watershed bordering Wyoming and Raleigh counties consists of sandstone, while the mountainous terrain along the southern border of the watershed is comprised of limestone.

The United States Geological Survey (USGS), in conjunction with federal, state and local agencies, including the DEP, cooperatively funds the USGS stream gaging network to monitor water availability. Currently, there are four surface water gaging stations within the watershed. The sites are located on the East River (1), Indian Creek (1), Middle Fork Brush Creek (1) and Bluestone River (1). The recorded data can be accessed at http://waterdata.usgs.gov/nwis.

LQU data

Table 4-1 contains a list of all Large Quantity User (LQU) facilities in the Upper New Watershed that are currently operating, their Standard Industrial Category (SIC) of use, the average percent of source water withdrawn annually, percent withdrawn from the watershed and county, as well as others if intakes are located elsewhere, and the average amount of water withdrawn by the facility based on the most recent three years of monthly data. A detailed discussion about categories of use type and comparisons of use to statewide withdrawals and consumption is available in Chapter 2 of the Plan. Chapter 4 of the Plan

includes data and discussion about future use projections. The following is a summary of data collected regarding the facilities:

- 10 Public Water Supply facilities
    - 2 are managed by West Virginia American Water (Bluefield and Bluestone)
- 1 Agriculture/aquaculture: WVDNR Tate Lohr Hatchery
- 1 Industrial facility: Goodrich Corporation

Table 4-1 All facilities withdrawing from Upper New Watershed organized by Use Category and Intake Source and Location (watershed and county). Blanks indicate that no additional withdrawals were occurring.

Facility ID	Facility Name	Use Category	Source and % of 3 Year Average		Watershed and % of 3 Year Average		County and % of 3 Year Average		3 Year Annual Average (gallons)
1325	Athens Water Plant	Public water supply	Surface Water 100.00%		Upper New 100.00%		Mercer 100.00%		172,351,000
3863	Bluewell Public Service District	Public water supply	Surface Water 93.04%	Groundwater 6.96%	Upper New 100.00%		Mercer 100.00%		219,013,396
2202	Goodrich Corporation	Industrial	Surface Water 91.22%	Groundwater 8.78%	Upper New 100.00%		Monroe 100.00%		19,179,191
7840	Green Valley / Glenwood PSD / New Glenwood	Public water supply	Surface Water 100.00%		Upper New 100.00%		Mercer 100.00%		224,192,212
10083	Green Valley/Glenwood PSD - Bulltail Water Plant	Public water supply	Surface Water 100.00%		Upper New 100.00%		Mercer 100.00%		81,086,667
4882	Matoaka Water Works	Public water supply		Groundwater 100.00%	Upper New 100.00%		Mercer 100.00%		19,779,483
10021	Pocahontas Water System	Public water supply	Surface Water 100.00%		Upper New 100.00%		Mercer 100.00%		125,378,553
10027	Red Sulphur Public Service District	Public water supply	Surface Water 70.12%	Groundwater 29.88%	Upper New 100.00%		Monroe 100.00%		131,528,051
10061	Town of Union	Public water supply		Groundwater 100.00%	Upper New 100.00%		Monroe 100.00%		32,972,537
2367	West Virginia American Water - Bluefield	Public water supply	Surface Water 100.00%		Upper New 100.00%		Mercer 100.00%		670,095,333
2533	West Virginia American Water - Bluestone	Public water supply	Surface Water 100.00%		Upper New 100.00%		Summers 100.00%		978,392,333
8115	WVDNR - Tate Lohr Hatchery	Agriculture/aquaculture	Surface Water 100.00%		Upper New 100.00%		Mercer 100.00%		129,600,000

Figures 4-1 through 4-4 summarize the breakdown of the share total withdrawals occurring among currently operating facilities, the trends in use over time for each industry group, and the amount and share of source water withdrawn by the currently operating LQUs in the watershed.

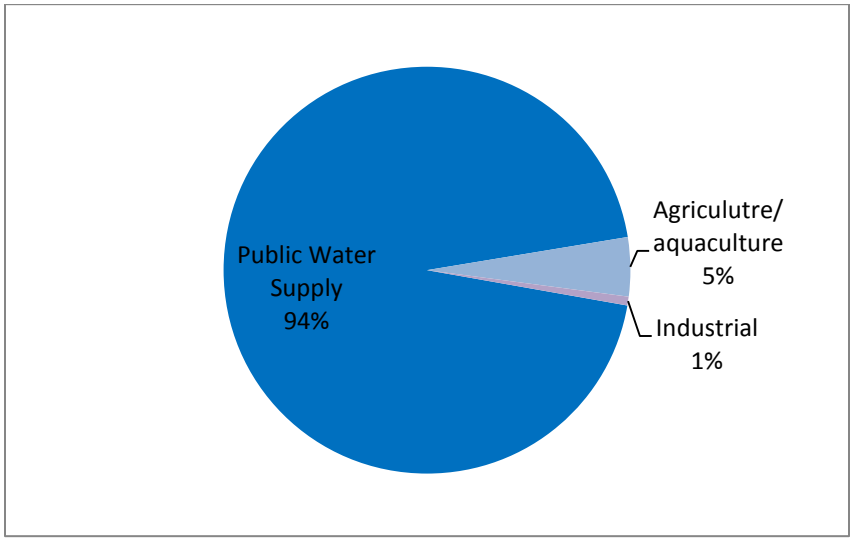
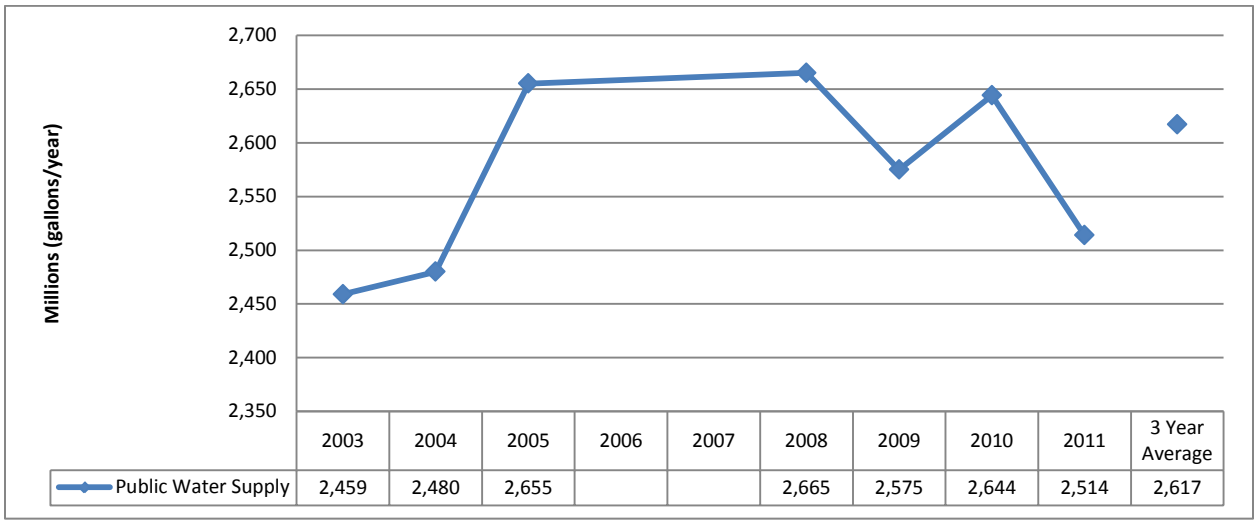
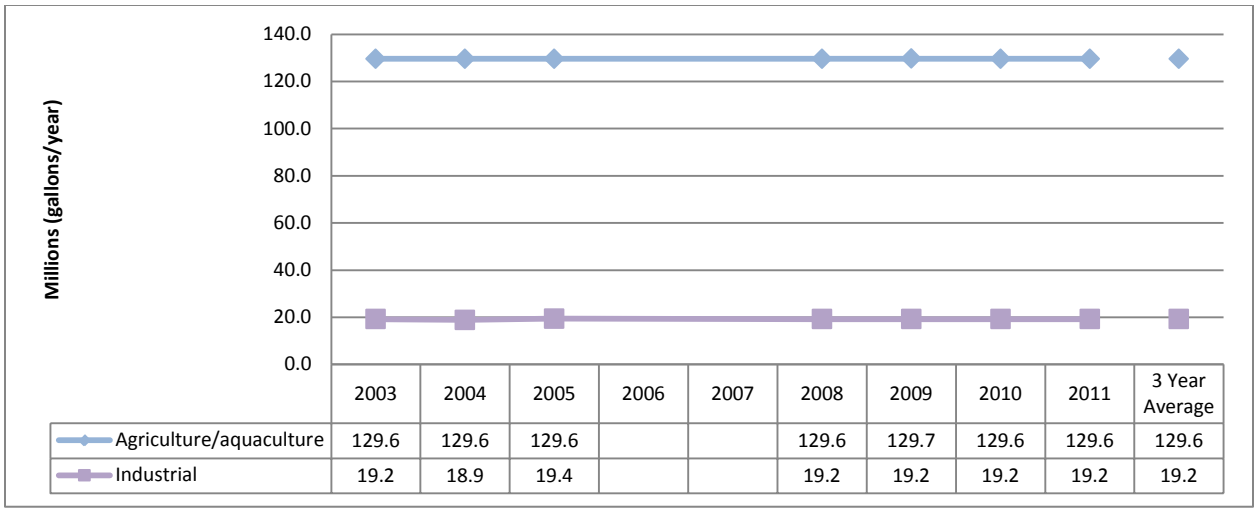


Figure 4-1 Upper New Watershed LQU percent of total average annual water withdrawals by sector.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Public Water Supply	2,459	2,480	2,655			2,665	2,575	2,644	2,514	2,617

Figure 4-2 Upper New Watershed LQU water withdrawal trends for the Public Water Supply SIC category, measured in millions of gallons per year.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Agriculture/aquaculture	129.6	129.6	129.6			129.6	129.7	129.6	129.6	129.6
Industrial	19.2	18.9	19.4			19.2	19.2	19.2	19.2	19.2

Figure 4-3 Upper New Watershed LQU water withdrawal trends for the Agriculture/Aquaculture and Industrial SIC categories, measured in millions of gallons per year.

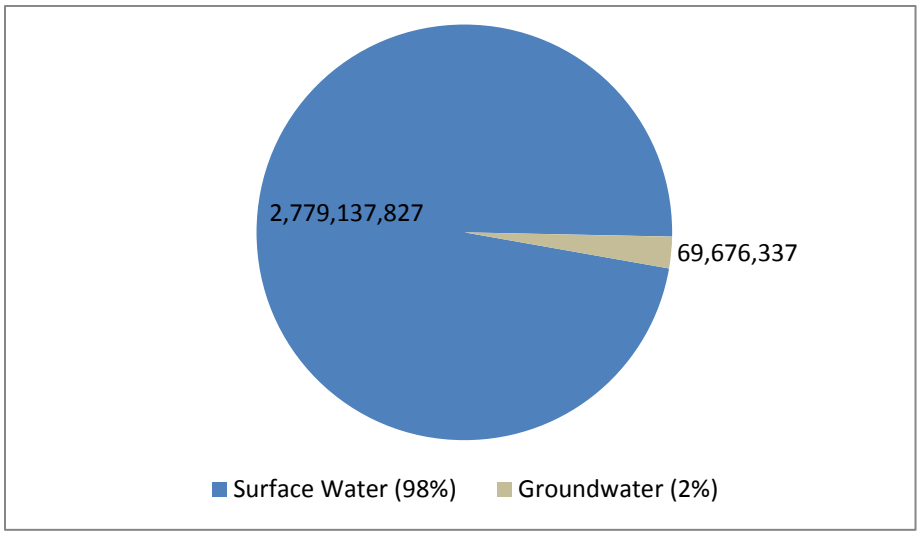
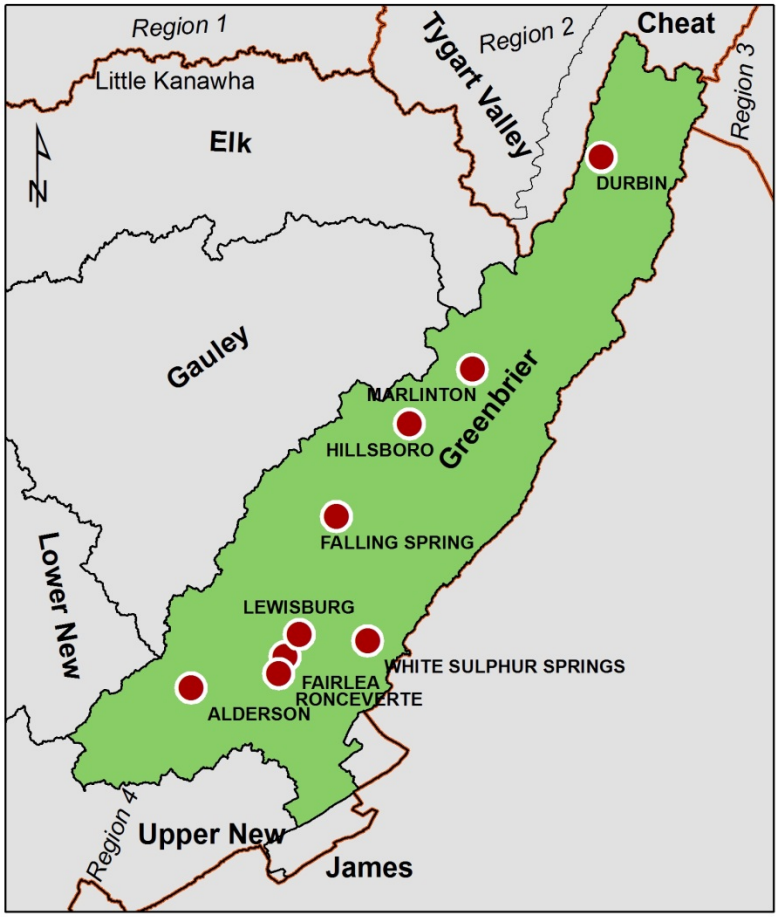
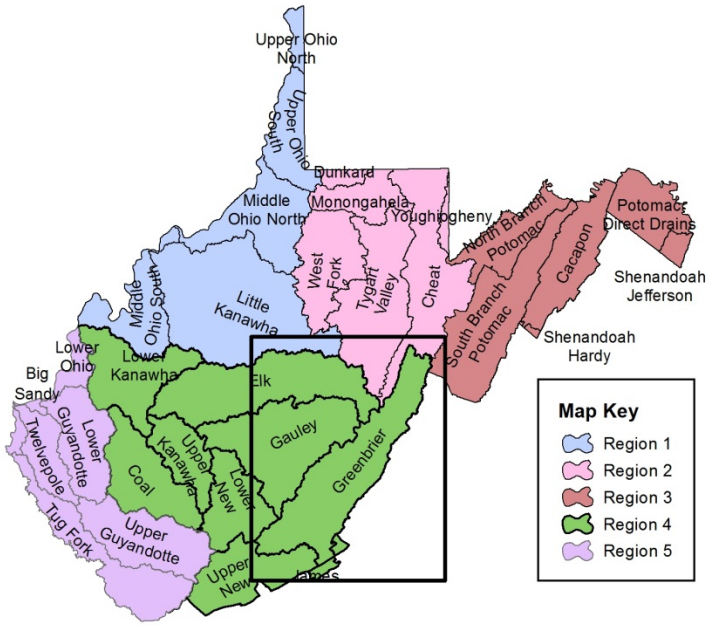


Figure 4-4 Average annual gallons of water withdrawn by LQUs from groundwater and surface water sources in the Upper New Watershed.

Interbasin transfers occur when water is permanently moved from one watershed to another. This can occur in a number of ways. However, only three possible routes of transfer are considered here; see Chapter 2 of the Plan for a discussion of possibilities and data limitations. There is one Public Water Supply facility that reportedly withdraws water from multiple watersheds. However, because discharges for Public Water Supply facilities are not recorded in the LQU database with the respective facilities there are no reported interbasin transfers occurring between the Upper New and other HUC-8 watersheds as a result of LQU operations in 2011.



Greenbrier River Watershed



Greenbrier River Watershed

Watershed Description

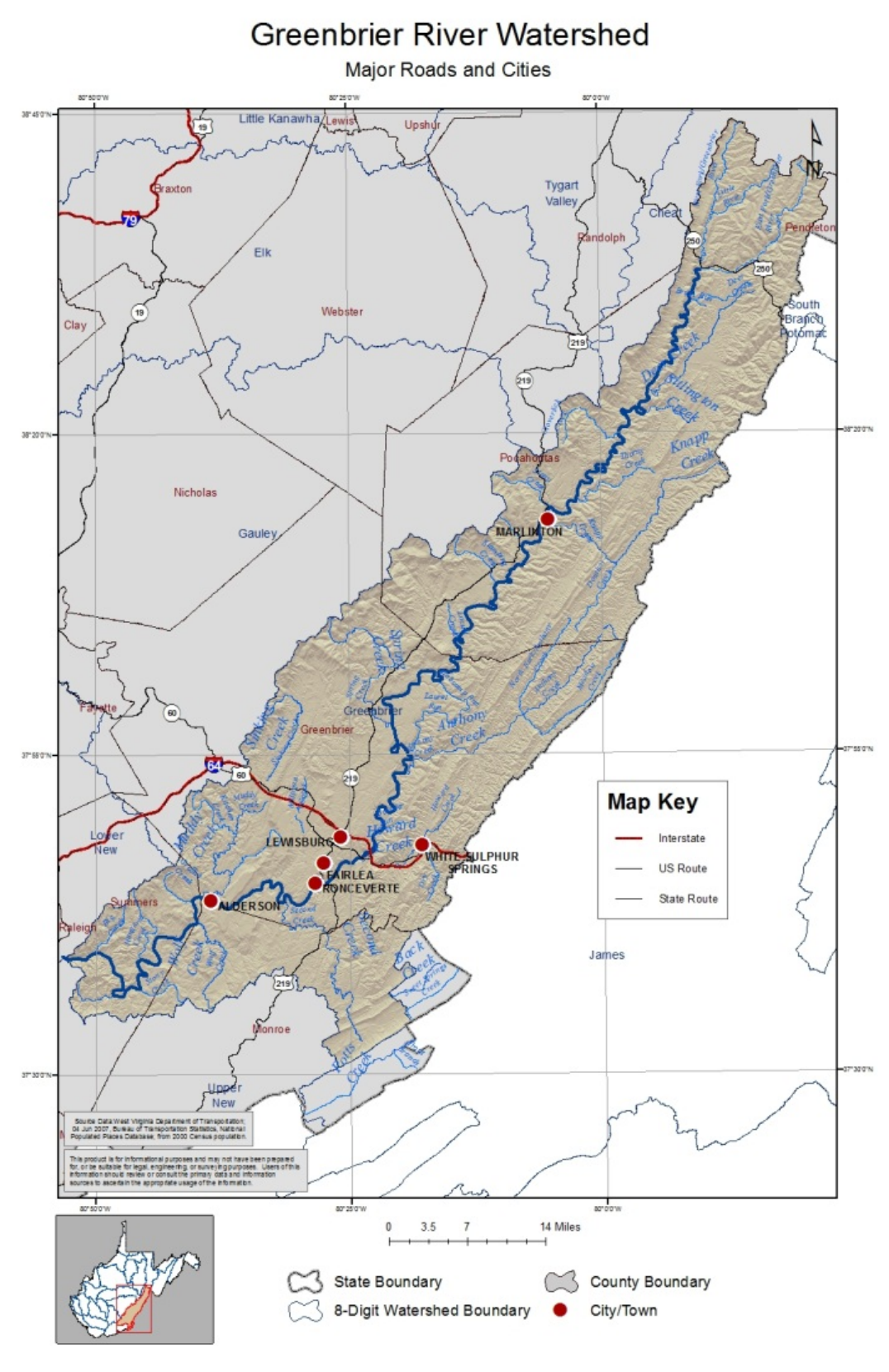
Located in southeastern West Virginia, the Greenbrier River Watershed extends from Pocahontas County in the north to the counties of Summers and Monroe in the south. Covering more than 1,646 square miles in West Virginia, the watershed contains all, or portions, of four counties (Pocahontas, Greenbrier, Summers and Monroe). Pocahontas and Greenbrier comprise 83% of the total area of the watershed.

The Greenbrier River Watershed has 3,509 miles of streams and rivers and contains the headwaters of the Greenbrier River. The Greenbrier River mainstem begins in the town of Durbin in Pocahontas County, where the East Fork and the West Fork of the Greenbrier River converge to form the Greenbrier. From Durbin, the Greenbrier flows southwesterly to its confluence with the New River in the town of Hinton, West Virginia. The major tributaries include Deer Creek, Sitlington Creek, Knapp Creek, Spring Creek, Anthony Creek, Howard Creek, Second Creek, Muddy Creek and Wolf Creek.

Additionally, the watershed encompasses all, or portions, of the following state and federal public lands: six state parks (Cass Scenic Railroad, Watoga, Droop Mountain, Beartown, Moncove Lake and Greenbrier River Trail), three state forests (Greenbrier, Calvin Price and Seneca), ten wildlife management areas (Moncove Lake, Neola, Tea Creek, Cranberry, Potomac, Beaver Dam, Rimel, Little River, Cheat and Potts Creek) and two national forests (Monongahela and Jefferson).

Demographics

The Greenbrier River Watershed has a total population of approximately 43,789. The watershed has six cities and towns with a population exceeding 1,000. The largest city within the watershed is Lewisburg with a total population of 3,830, followed by White Sulphur Springs (2,444), Fairlea (1,747), Ronceverte (1,765), Alderson (1,184) and Marlinton (1,054).


Greenbrier River Watershed
Major Roads and Cities
Little Kanawha
Lewis
Upshur
Braxton
Tygart Valley
Cheat
Randolph
Pendleton
Elk
Webster
Clay
South Branch Potomac
Pocahontas
Nicholas
Gauley
MARLINTON
Fayette
Greenbrier
Anthony Creek
Lower New
LEWISBURG
WHITE SULPHUR SPRINGS
FAIRLEA
RONCEVERTE
ALDERSON
Summers
Raleigh
James
Monroe
Upper New
Map Key
Interstate
US Route
State Route
0 3.5 7 14 Miles
State Boundary
County Boundary
8-Digit Watershed Boundary
City/Town

Geography and Geology

The Greenbrier River Watershed lies within two ecoregions. The eastern portion of the watershed occupies the Ridge and Valley Ecoregion, which is characterized by its parallel mountain ridgelines and lowland valleys. The western portion of the watershed is contained within the Central Appalachians Ecoregion, which is known for its rugged and mountainous terrain, cooler climate and biologically diverse habitat. The average elevation for the watershed is 2,630 feet above mean sea level, with the highest elevation of 4,848 feet recorded in the east at Thorny Flat, a section of Cheat Mountain, located at Snowshoe Mountain Resort. The lowest elevation, approximately 1,365 feet, is located at the confluence of the Greenbrier River and New River. The average annual temperature is 48 degrees Fahrenheit and ranges from 43 to 53 degrees. The average annual precipitation for the Greenbrier River Watershed is 42.81 inches per year.

The majority (82%) of the watershed is covered by forest area, while 12% is planted/cultivated area. Approximately 5% of the land cover is classified as developed and 1.38% is defined as impervious surface area.

The surface geology in the Greenbrier River Watershed is predominantly (81%) shale, sandstone and siltstone, while 18% is comprised of limestone. There is a small percentage (1%) of alluvium located near the town of Green Bank in Pocahontas County.

The United States Geological Survey (USGS), in conjunction with federal, state and local agencies, including the DEP, cooperatively funds the USGS stream gaging network to monitor water availability. Currently, there are six surface water gaging stations and one groundwater gaging station located within the watershed. The groundwater gaging station is a well site located in Pocahontas County, while surface water data is collected from the six stream gages located on Dry Creek (1), Marlin Run (1) and multiple sites along the Greenbrier River (4). The recorded data can be accessed at http://waterdata.usgs.gov/nwis.

LQU data

Table 4-2 contains a list of all Large Quantity User (LQU) facilities in the Greenbrier Watershed that are currently operating, their Standard Industrial Category (SIC) of use, the average percent of source water withdrawn annually, percent withdrawn from the watershed and county, as well as others if intakes are located elsewhere, and the average amount of water withdrawn by the facility based on the most recent three years of monthly data. A detailed discussion about categories of use type and comparisons of use

to statewide withdrawals and consumption is available in Chapter 2 of the Plan. Chapter 4 of the Plan includes data and discussion about future use projections. The following is a summary of data collected regarding the facilities:

- 9 Public Water Supply facilities
    - 1 is closed (Roncerverte water department, which now purchases water from Lewisburg)
- 3 Recreation facilities
    - 1 closed in 2009: CSX Hotels, Inc.
- 1 Agriculture/aquaculture facility: WVDNR – Edray Hatchery
- 1 Timber facility closed in 2009: Mullican Lumber

Table 4-2 All facilities withdrawing from Greenbrier Watershed organized by Use Category and Intake Source and Location (watershed and county). Blanks indicate that no additional withdrawals were occurring.

Facility ID	Facility Name	Use Category	Source and % of 3 Year Average		Watershed and % of 3 Year Average	County and % of 3 Year Average	3 Year Annual Average (gallons)
3569	Alderson Water Treatment Plant	Public water supply	Surface Water 100.00%		Greenbrier 100.00%	Monroe 100.00%	154,730,000
7906	Big Bend PSD	Public water supply	Surface Water 100.00%		Greenbrier 100.00%	Summers 100.00%	33,821,320
2049	City of Lewisburg Water Plant	Public water supply	Surface Water 100.00%		Greenbrier 100.00%	Greenbrier 100.00%	607,863,850
1237	City of White Sulphur Springs Water Plant	Public water supply		Groundwater 100.00%	Greenbrier 100.00%	Greenbrier 100.00%	260,740,333
7959	Denmar Correctional Center	Public water supply	Surface Water 100.00%		Greenbrier 100.00%	Pocahontas 100.00%	15,801,273
3446	Gap Mills PSD	Public water supply		Groundwater 100.00%	Greenbrier 100.00%	Monroe 100.00%	15,695,944
10064	Pocahontas County Public Service District	Public water supply		Groundwater 100.00%	Greenbrier 100.00%	Pocahontas 100.00%	44,670,981
1677	The Greenbrier	Recreation	Surface Water 100.00%		Greenbrier 100.00%	Greenbrier 100.00%	129,087,372
2787	The Greenbrier Hotel Corporation	Recreation		Groundwater 100.00%	Greenbrier 100.00%	Greenbrier 100.00%	515,365,209
3260	Town of Marlinton	Public water supply	Surface Water 100.00%		Greenbrier 100.00%	Pocahontas 100.00%	65,554,967
8163	WVDNR - Edray Hatchery	Agriculture/aquaculture	Surface Water 100.00%		Greenbrier 100.00%	Pocahontas 100.00%	414,720,000

Figures 4-5 through 4-8 summarize the breakdown of the share total withdrawals occurring among currently operating facilities, the trends in use over time for each industry group, and the amount and share of source water withdrawn by the currently operating LQUs in the watershed.

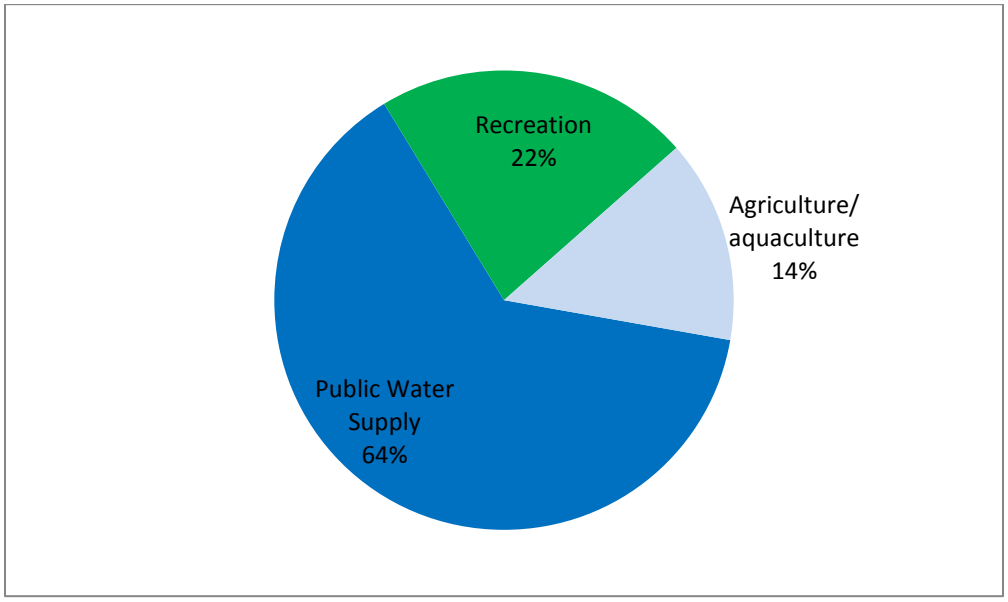
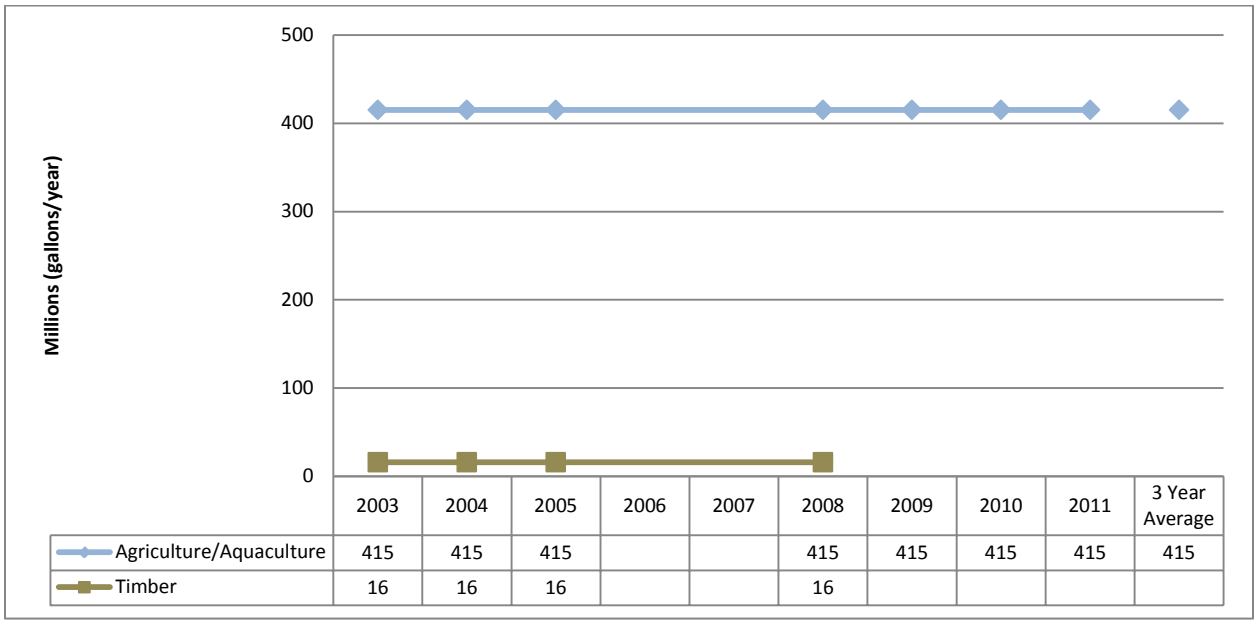
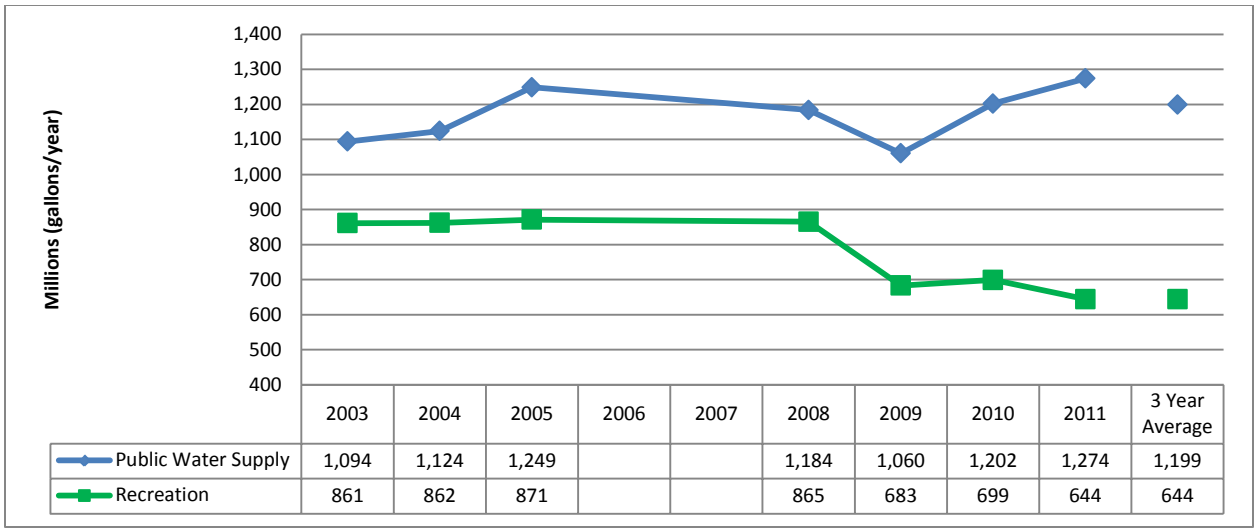


Figure 4-5 Greenbrier Watershed LQU percent of total average annual water withdrawals by sector



	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Agriculture/Aquaculture	415	415	415			415	415	415	415	415
Timber	16	16	16			16				

Figure 4-6 Greenbrier Watershed LQU water withdrawal trends for the Agriculture/Aquaculture, Recreation, and Timber SIC categories, measured in millions of gallons per year



	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Public Water Supply	1,094	1,124	1,249			1,184	1,060	1,202	1,274	1,199
Recreation	861	862	871			865	683	699	644	644

Figure 4-7 Greenbrier Watershed LQU water withdrawal trends for the Public Water Supply SIC category, measured in millions of gallons per year.

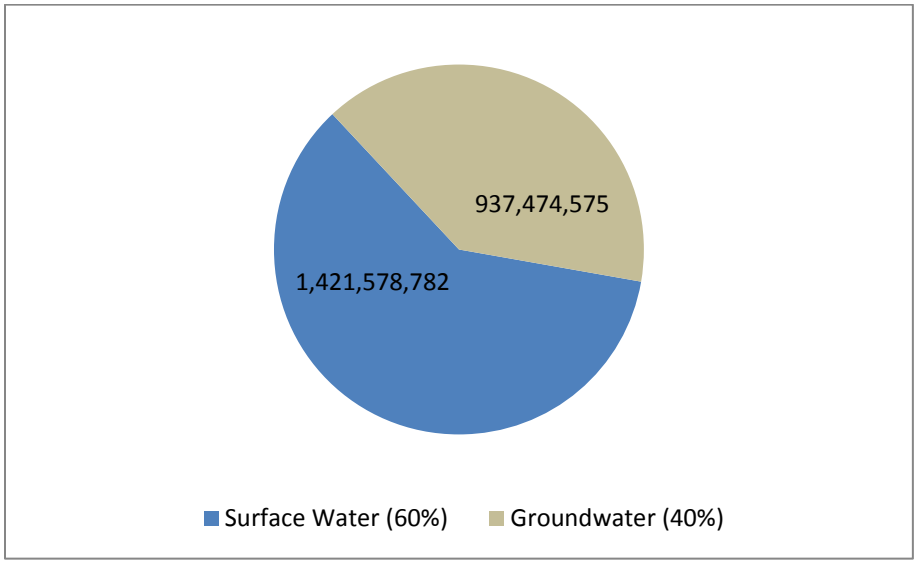
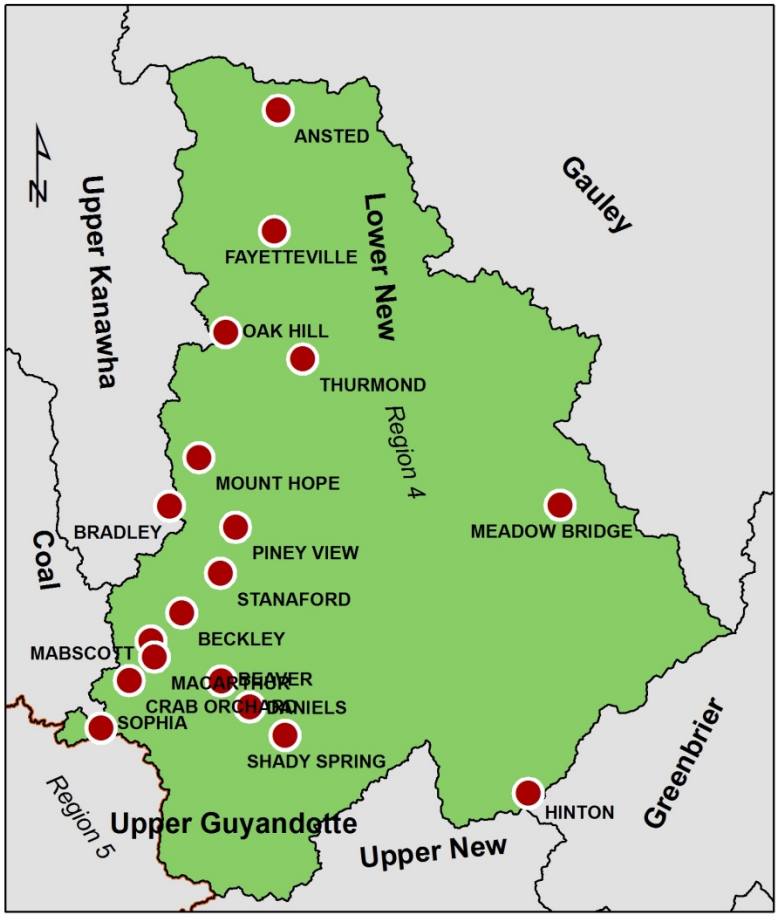
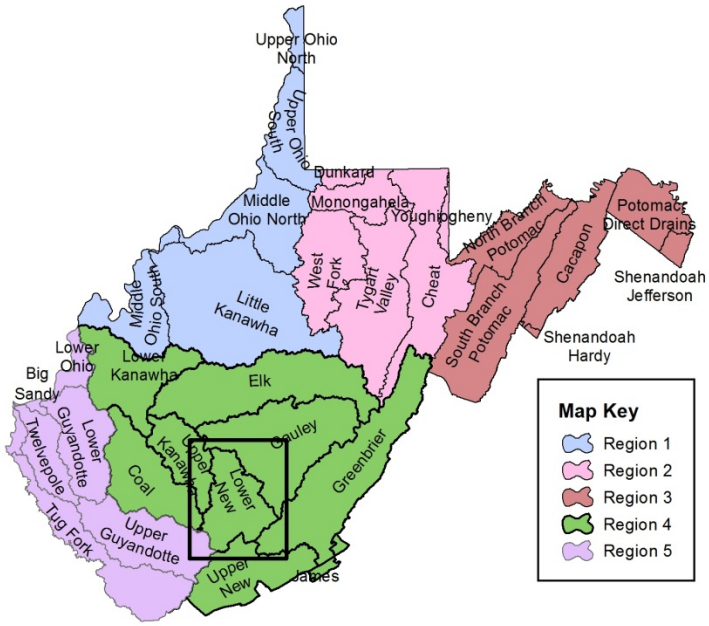


Figure 4-8 Average annual gallons of water withdrawn by LQUs from groundwater and surface water sources in the Greenbrier Watershed.

Interbasin transfers occur when water is permanently moved from one watershed to another. This can occur in a number of ways. However, only three possible routes of transfer are considered here; see Chapter 2 of the Plan for a discussion of possibilities and data limitations. There is one Public Water Supply facility that reportedly withdraws water from multiple watersheds. However, because discharges for Public Water Supply facilities are not recorded in the LQU database with the respective facilities there are no reported interbasin transfers occurring between the Greenbrier and other HUC-8 watersheds as a result of LQU operations in 2011.



Lower New River Watershed



Lower New River Watershed

Watershed Description

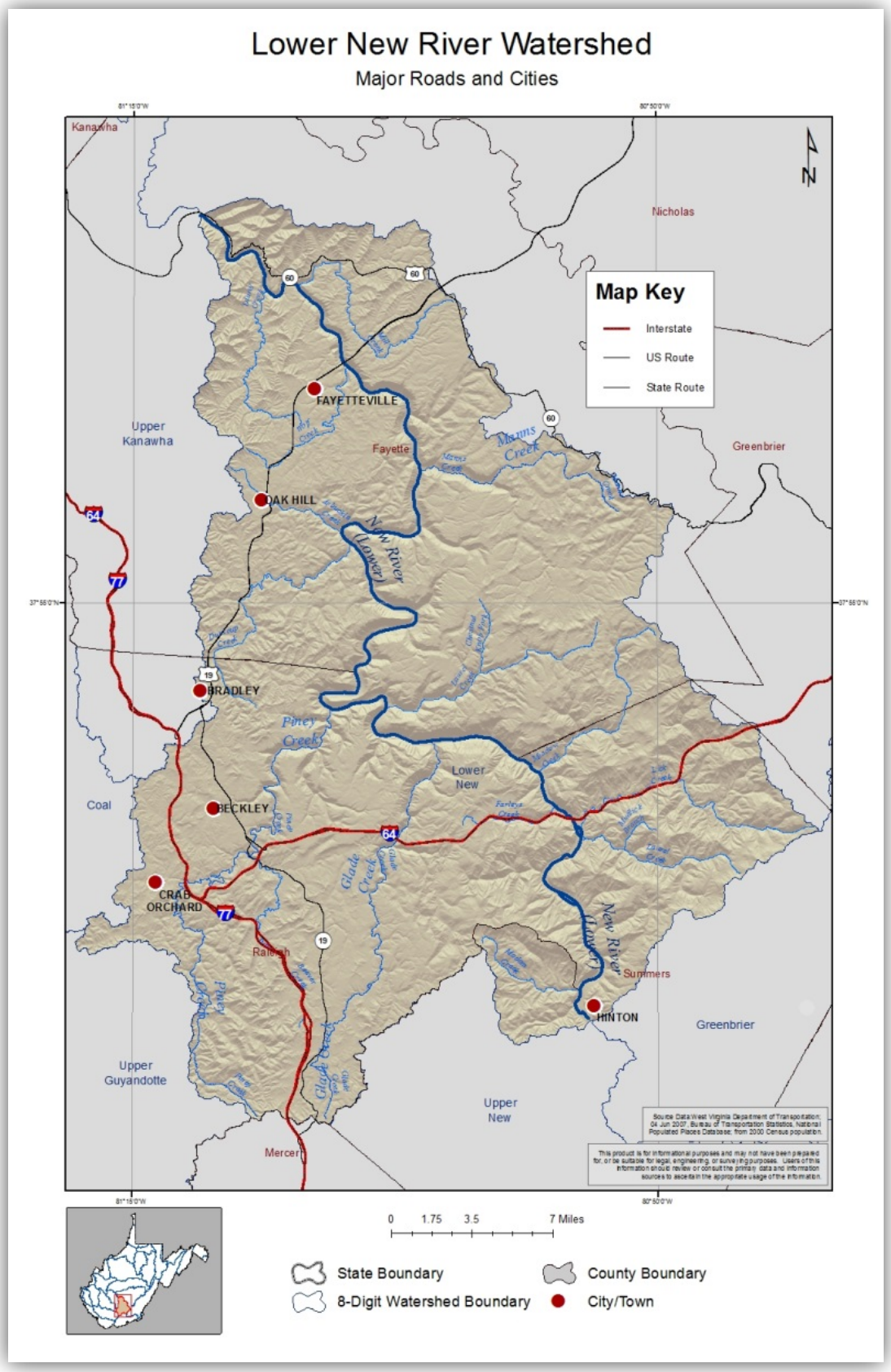
Located in southern West Virginia, the Lower New River Watershed covers approximately 691 square miles. The watershed lies within three West Virginia counties (Fayette, Raleigh and Summers). Fayette comprises 48% of the total area of the watershed.

The Lower New River Watershed has 1,612 miles of streams and rivers. The New River mainstem flows northerly from Hinton, West Virginia to its confluence with the Gauley River in Fayette County. Major tributaries for the New River include Glade Creek, Piney Creek and Manns Creek.

Additionally, the watershed encompasses all, or portions, of the following state and federal public lands: three state parks (Babcock, Hawk's Nest and Little Beaver), two wildlife management areas (Buery Mountain and Plum Orchard) and one national river (New River Gorge).

Demographics

The Lower New River Watershed has a total population of approximately 94,449. The watershed has seven cities and towns with a population exceeding 2,000. The largest city within the watershed is Beckley with a total population of 17,614, followed by Oak Hill (7,730), Shady Spring (2,998), Fayetteville (2,892), Crab Orchard (2,678), Hinton (2,676) and Bradley (2,040).


Lower New River Watershed
Major Roads and Cities
Kanawha
Nicholas
Greenbrier
Upper Kanawha
Fayette
Coal
Lower New
Upper Guyandotte
Upper New
Raleigh
Summers
Mercer
FAYETTEVILLE
OAK HILL
BRADLEY
BECKLEY
CRAB ORCHARD
HINTON
New River (Lower)
Mams Creek
Piney Creek
Glade Creek
Laurel Creek
Map Key
Interstate
US Route
State Route
0 1.75 3.5 7 Miles
State Boundary
County Boundary
8-Digit Watershed Boundary
City/Town

Geography and Geology

The Lower New River Watershed lies within the Central Appalachians Ecoregion, which is characterized by rugged and mountainous terrain, cooler climate and a biologically diverse habitat. The average elevation for the watershed is 2,289 feet above mean sea level, with the highest elevation of 3,927 feet at Keeney Knob on Keeney Mountain in Summers County. The lowest elevation, approximately 653 feet, is located in the northern portion of the watershed near the town of Gauley Bridge in Fayette County. The average annual temperature is 51 degrees Fahrenheit and ranges from 47 to 55 degrees. The average annual precipitation for the Lower New River Watershed is 43.41 inches per year.

The Lower New River Watershed is dominated by forests. Approximately 78% of the total land area consists of deciduous, evergreen and mixed growth forests. Cultivated crops and pastures comprise 8% of the total land cover, while 11% of the land cover is classified as developed. Impervious surfaces account for 6.3% of the watershed's surface area.

The surface geology in the Lower New River Watershed is predominantly (77%) sandstone with 23% of the watershed's geology, located in the southeast portion of the watershed, identified as shale and siltstone.

The United States Geological Survey (USGS), in conjunction with federal, state and local agencies, including the DEP, cooperatively funds the USGS stream gaging network to monitor water availability. Currently, there are four surface water gaging stations within the watershed. The sites are located on Piney Creek (1), New River at Hinton (1), New River at Thurmond (1) and the New River below Hawk's Nest Dam (1). The recorded data can be accessed at http://waterdata.usgs.gov/nwis.

LQU data

Table 4-3 contains a list of all Large Quantity User (LQU) facilities in the Lower New Watershed that are currently operating, their Standard Industrial Category (SIC) of use, the average percent of source water withdrawn annually, percent withdrawn from the watershed and county, as well as others if intakes are located elsewhere, and the average amount of water withdrawn by the facility based on the most recent three years of monthly data. A detailed discussion about categories of use type and comparisons of use to statewide withdrawals and consumption is available in Chapter 2 of the Plan. Chapter 4 of the Plan includes data and discussion about future use projections. The following is a summary of data collected regarding the facilities:

- 8 Public Water Supply facilities
    - 2 closed: Fayetteville in 2008 and Arbuckle in 2009
    - Beckley water withdraws the most (by an order of magnitude, but only withdraws 89% of its total water from the Lower New, the remaining 10% comes from the Upper Kanawha Watershed
- 3 Recreational facilities: Winterplace, Glade Springs (Chatham Lake and Woodhaven Golf Course)
- 1 Hydroelectric facility: Brookfield Renewable Power – Hawks Nest Hydro (the years before 2009 were recorded as part of WVA Manufacturing withdrawals)
- 1 Mining facility: ICG Beckley, LLC

Table 4-3 All facilities withdrawing from Lower New Watershed organized by Use Category and Intake Source and Location (watershed and county). Blanks indicate that no additional withdrawals were occurring.

Facility ID	Facility Name	Use Category	Source and % of 3 Year Average		Watershed and % of 3 Year Average		County and % of 3 Year Average		3 Year Annual Average (gallons)
3077	Beckley Water Company	Public water supply	Surface Water 89.45%	Groundwater 10.55%	Lower New 89.45%	Upper Kanawha 10.55%	Raleigh 100.00%		3,269,161,633
10093	Brookfield Renewable Power - Hawks Nest Hydro	Hydroelectric	Surface Water 100.00%		Lower New 100.00%		Fayette 100.00%		1,479,558,325,833
5064	Coal City Water Plant	Public water supply		Groundwater 100.00%	Lower New 100.00%		Raleigh 100.00%		88,621,000
4068	Danese Public Service District	Public water supply		Groundwater 100.00%	Lower New 100.00%		Fayette 100.00%		78,059,847
4222	Glade Springs Village P.O.A. - Chatham Lake	Recreation	Surface Water 100.00%		Lower New 100.00%		Raleigh 100.00%		15,421,811
10090	Glade Springs Village P.O.A. - Woodhaven Golf Cour	Recreation	Surface Water 100.00%		Lower New 100.00%		Raleigh 100.00%		11,314,407
10084	ICG Beckley, LLC	Mining		Groundwater 100.00%	Lower New 100.00%		Raleigh 100.00%		176,114,250
2863	Mt Hope Water Treatment Plant	Public water supply		Groundwater 100.00%	Lower New 100.00%		Fayette 100.00%		96,580,500
2842	Town of Meadow Bridge Water Dept.	Public water supply		Groundwater 100.00%	Lower New 100.00%		Fayette 100.00%		23,734,517
2524	West Virginia American Water - New River District	Public water supply	Surface Water 100.00%		Lower New 100.00%		Fayette 100.00%		1,157,897,667
3224	Winterplace Ski Resort	Recreation	Surface Water 97.28%	Groundwater 2.72%	Lower New 100.00%		Raleigh 100.00%		147,267,333

Figures 4-9 through 4-13 summarize the breakdown of the share total withdrawals occurring among currently operating facilities, the trends in use over time for each industry group, and the amount and share of source water withdrawn by the currently operating LQUs in the watershed.

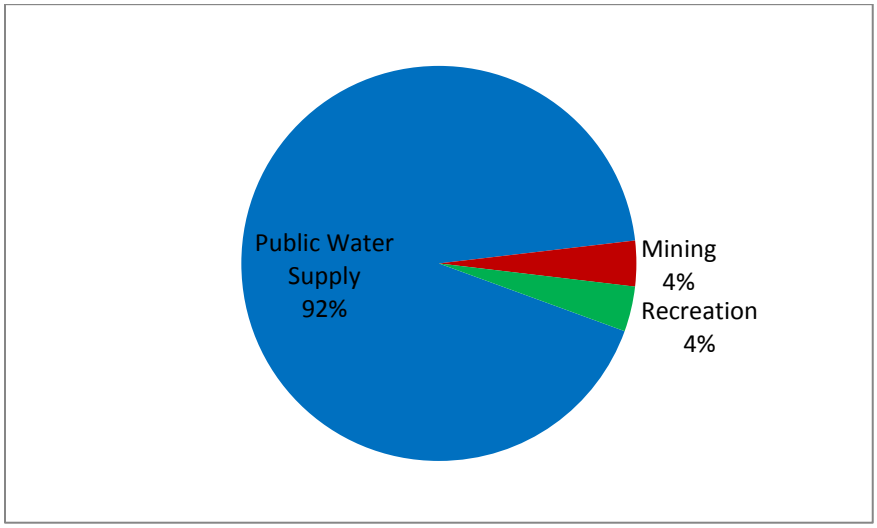
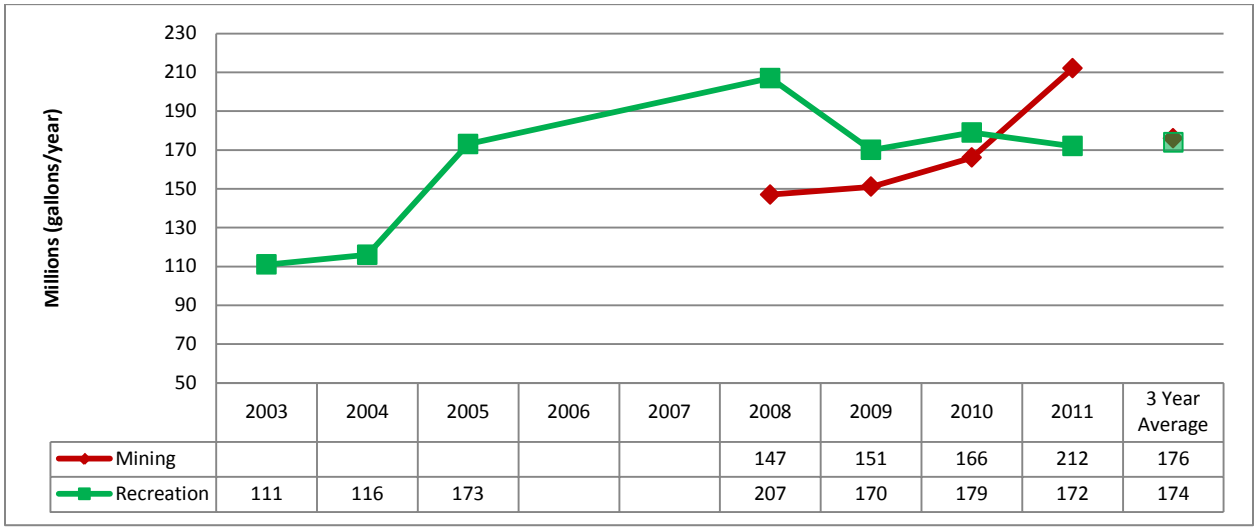


Figure 4-9 Lower New Watershed LQU percent of total average annual water withdrawals by sector (excluding Hydroelectric).



	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Mining						147	151	166	212	176
Recreation	111	116	173			207	170	179	172	174

Figure 4-10 Lower New Watershed LQU water withdrawal trends for the Mining and Recreation SIC categories, measured in millions of gallons per year.

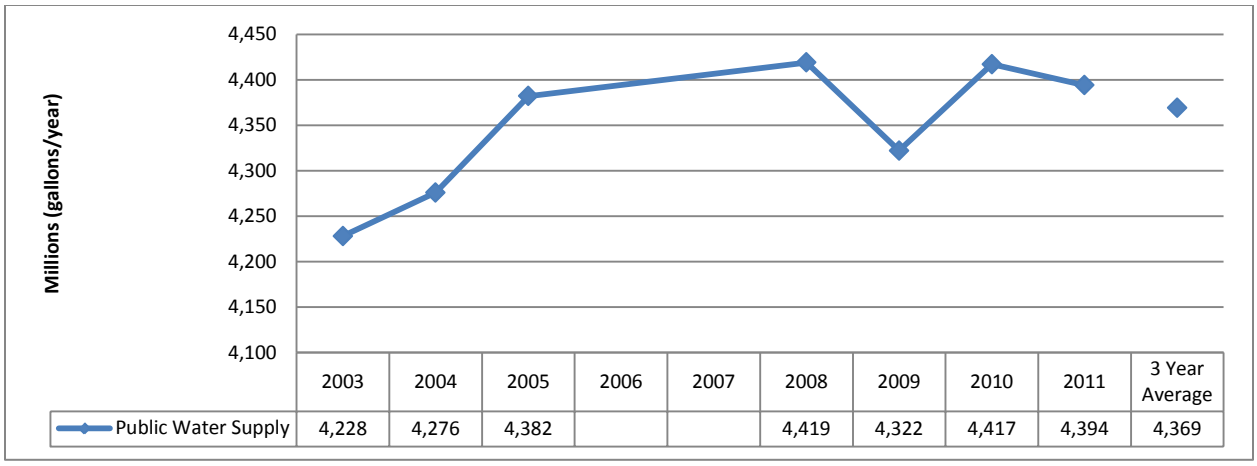


Figure 4-11 Lower New Watershed LQU water withdrawal trends for the Public Water Supply SIC category, measured in millions of gallons per year.

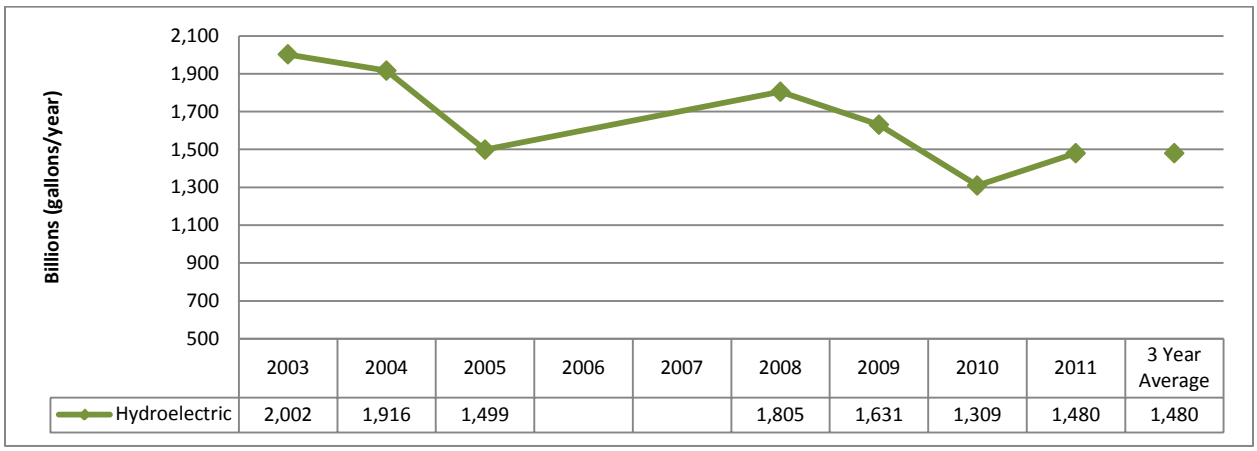


Figure 4-12 Lower New Watershed LQU water withdrawal trends for the Hydroelectric SIC category, measured in billions of gallons per year.

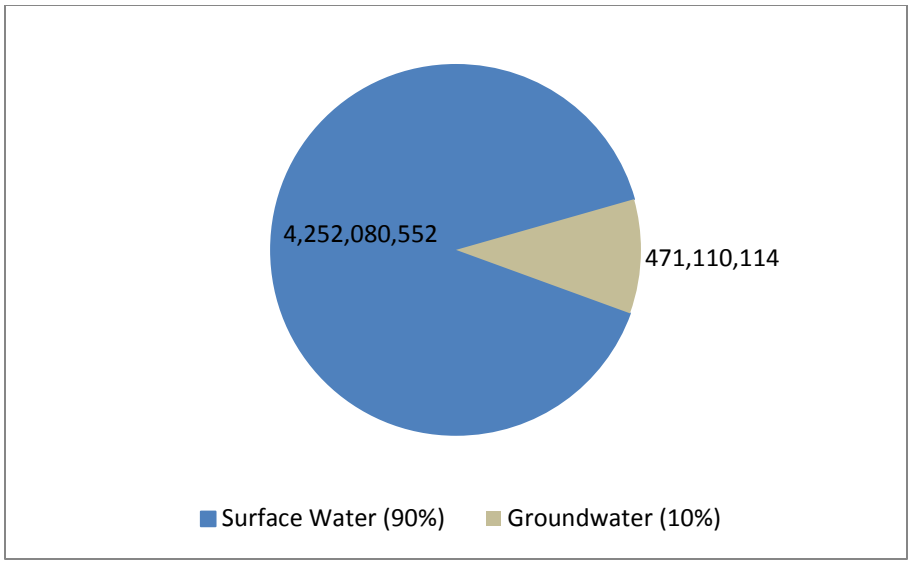
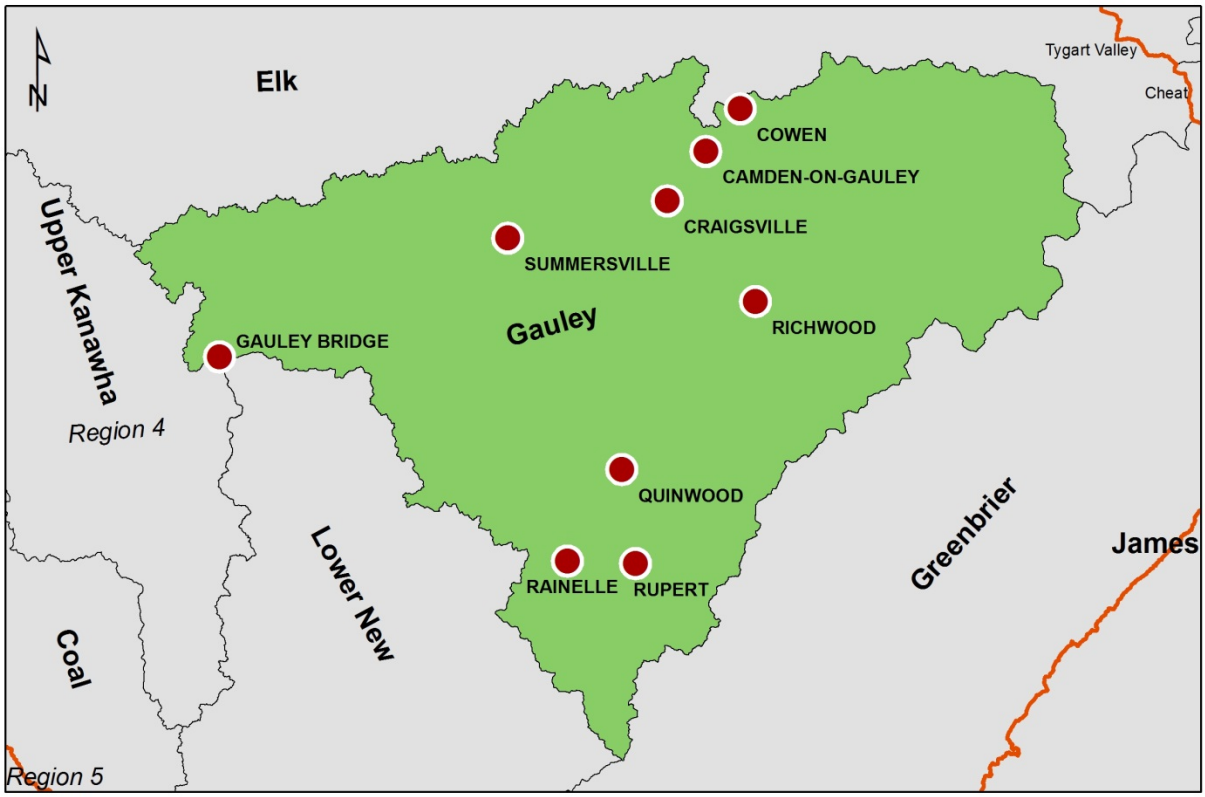
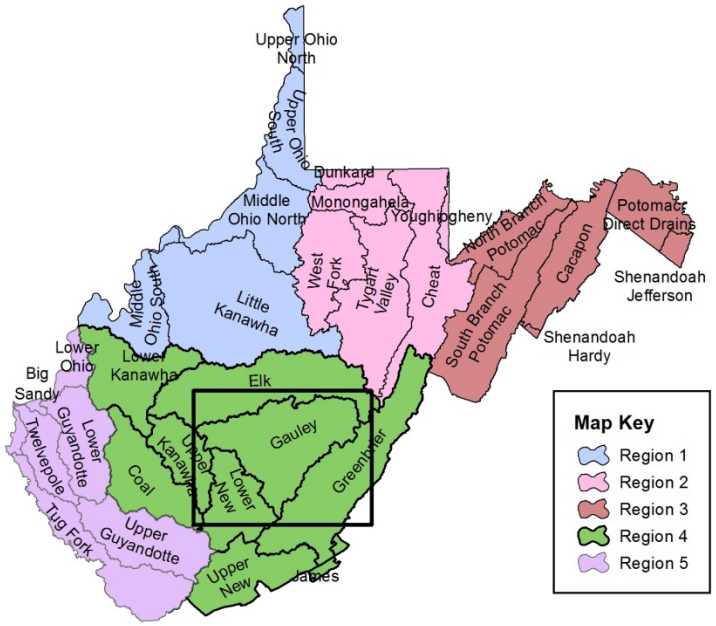


Figure 4-13 Average annual gallons of water withdrawn by LQUs from groundwater and surface water sources in the Lower New Watershed (excluding Hydroelectric).

Interbasin transfers occur when water is permanently moved from one watershed to another. This can occur in a number of ways. However, only three possible routes of transfer are considered here; see Chapter 2 of the Plan for a discussion of possibilities and data limitations. There is one Public Water Supply facility that reportedly withdraws water from multiple watersheds. However, because discharges for Public Water Supply facilities are not recorded in the LQU database with the respective facilities, there are no reported interbasin transfers occurring between the Lower New and other HUC-8 watersheds as a result of LQU operations in 2011.

Gauley River Watershed





Gauley River Watershed

Watershed Description

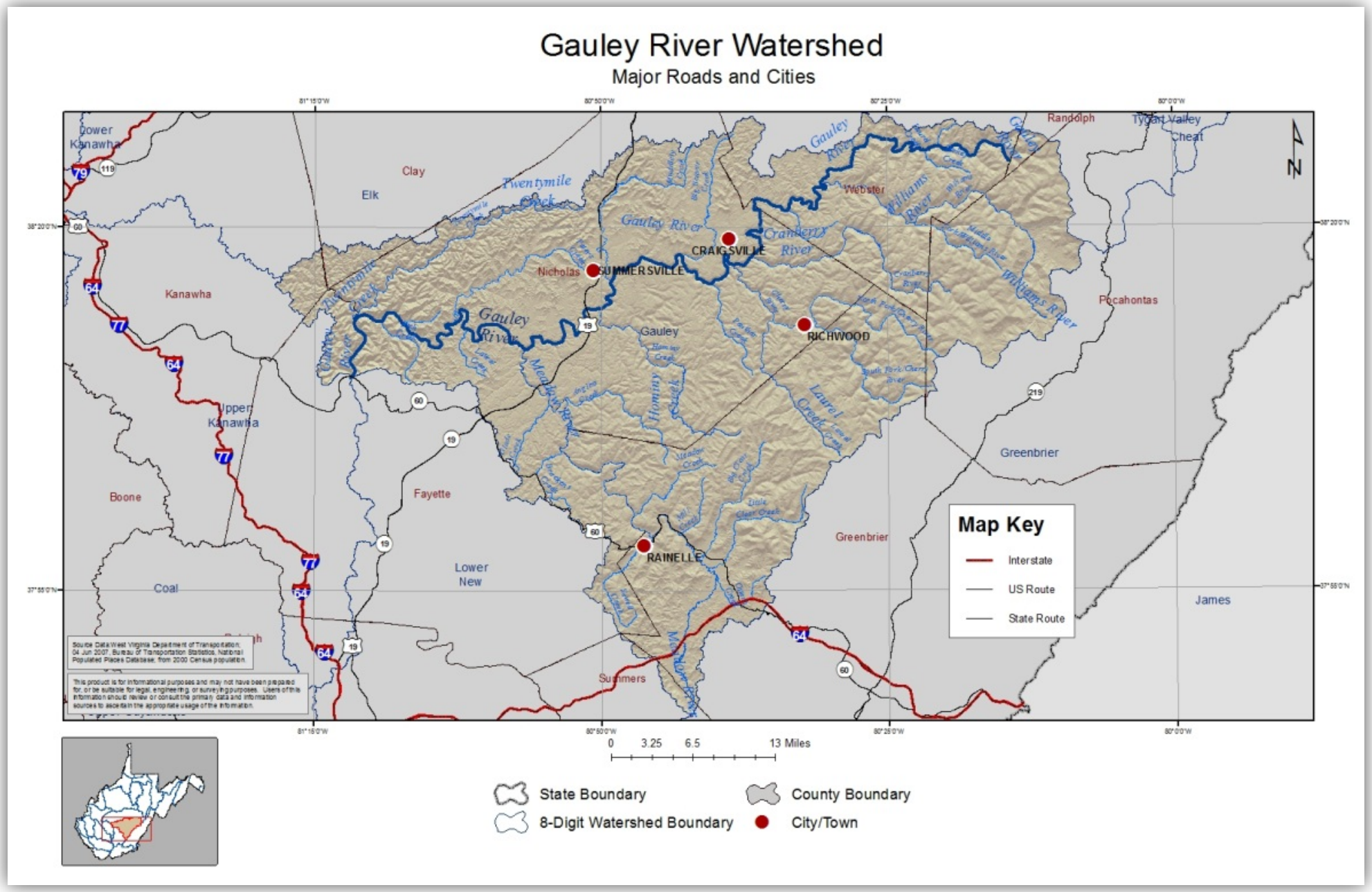
Located in southern West Virginia, the Gauley River Watershed covers approximately 1,419 square miles. Included within the watershed are portions of nine West Virginia counties (Randolph, Kanawha, Summers, Clay, Pocahontas, Fayette, Webster, Greenbrier and Nicholas). Nicholas County comprises 88% of the total area of the watershed.

The Gauley River Watershed has 3,063 miles of streams and rivers. The headwaters of the Gauley River are on Gauley Mountain in Pocahontas County. The Gauley River mainstem flows westerly through the northern portion of the watershed to its confluence with the New River at the Town of Gauley Bridge. Major tributaries include Twentymile Creek, Williams River, Cranberry River, Cherry River and Meadow River. The Gauley River Watershed also encompasses Summersville Lake, which is located just south of the town of Summersville in Nicholas County in the western portion of the watershed. It is the largest lake in the state and boasts 2,700 acres of surface area and more than 60 miles of shoreline during summer pool. The Summersville Dam maintains a minimum flow release of 100 cubic feet per second.

Additionally, the watershed encompasses all, or portions, of the following state and federal public lands: one state park (Carnifex Ferry Battlefield), six wildlife management areas (Handley, Meadow River, Big Ditch, Summersville, Cranberry and Tea Creek), one national recreation area (Gauley River) and one national forest (Monongahela).

Demographics

The Gauley River Watershed has a total population of approximately 42,000. The watershed has four cities and towns with a population exceeding 1,000. The largest town within the watershed is Summersville with a total population of 3,572, followed by Craigsville (2,213), Richwood (2,051) and Rainelle (1,505).


Gauley River Watershed
Major Roads and Cities
Lower Kanawha
Clay
Elk
Twentymile Creek
Randolph
Tygart Valley
Cheat
Webster
Gauley River
Cranberry River
Williams River
CRAIGSVILLE
SUMMERSVILLE
Nicholas
Kanawha
Pocahontas
Gauley
RICHWOOD
Upper Kanawha
Greenbrier
Boone
Fayette
Lower New
Coal
RAINELLE
Summers
James
Map Key
Interstate
US Route
State Route
0 3.25 6.5 13 Miles
State Boundary
County Boundary
8-Digit Watershed Boundary
City/Town

Geography and Geology

The Gauley River Watershed lies within the Central Appalachians Ecoregion, which is characterized by rugged and mountainous terrain, cooler climate and a biologically diverse habitat. The average elevation for the watershed is 2,624 feet above mean sea level, with the highest elevation, 4,703 feet, located in the east on Red Spruce Knob in Pocahontas County. The lowest elevation, 653 feet, is located in the west at the confluence of the New River and Gauley River in Fayette County. This variation in elevation has an influence on annual precipitation and temperature values. The average annual temperature is 49 degrees Fahrenheit and ranges from 43 to 55 degrees. The average annual precipitation for the Gauley River Watershed is 50.62 inches per year.

The majority (88%) of the Gauley River Watershed is covered by deciduous, mixed and evergreen forests, while only 4.5% of the land cover is classified as developed. The remaining land cover consists of grasslands, pastures, barren land, wetlands, crops, shrubs and open water. Only 1.25% of the entire watershed is covered by impervious surfaces.

Geologically, the Gauley River Watershed consists predominantly (98%) of sandstone and shale, while containing a small percentage of alluvium.

The United States Geological Survey (USGS), in conjunction with federal, state and local agencies, including the DEP, cooperatively funds the USGS stream gaging network to monitor water availability. Currently, there are 10 surface water gaging stations and one groundwater gaging station located within the watershed. The groundwater gaging station is a well site located in Webster County, while surface water data is collected from the 10 stream gages located on Laurel Creek (1), Peters Creek (1), Cranberry River (1), Williams River (1) and multiple sites along the Gauley River (4) and Meadow River (2). The recorded data can be accessed at http://waterdata.usgs.gov/nwis.

LQU data

Table 4-4 contains a list of all Large Quantity User (LQU) facilities in the Gauley Watershed that are currently operating, their Standard Industrial Category (SIC) of use, the average percent of source water withdrawn annually, percent withdrawn from the watershed and county, as well as others if intakes are located elsewhere, and the average amount of water withdrawn by the facility based on the most recent three years of monthly data. A detailed discussion about categories of use type and comparisons of use to statewide withdrawals and consumption is available in Chapter 2 of the Plan. Chapter 4 of the Plan

includes data and discussion about future use projections. The following is a summary of data collected regarding the facilities:

- 9 Public Water Supply facilities
- 8 Mining facilities
    - 1 closed in 2009: Terry Eagle Prep plant
    - ICG Eastern gets 93% of its water from the Gauley and the remaining 7% from the Elk
- 1 Hydroelectric facility: Summersville Hydroelectric

Table 4-4 All facilities withdrawing from Gauley Watershed organized by Use Category and Intake Source and Location (watershed and county). Blanks indicate that no additional withdrawals were occurring.

Facility ID	Facility Name	Use Category	Source and % of 3 Year Average		Watershed and % of 3 Year Average		County and % of 3 Year Average		3 Year Annual Average (gallons)
10095	Alex Energy - Jerry Fork Eagle Deep Mine	Mining	Surface Water 100.00%		Gauley 100.00%		Nicholas 100.00%		5,641,000
5013	Alex Energy - Surface Mines	Mining	Surface Water 74.56%	Groundwater 25.44%	Gauley 100.00%		Nicholas 100.00%		128,247,341
10035	Cowen PSD	Public water supply	Surface Water 100.00%		Gauley 100.00%		Webster 100.00%		118,313,467
4158	Craigsville PSD	Public water supply	Surface Water 100.00%		Gauley 100.00%		Nicholas 100.00%		205,629,500
4753	Fola Coal Co - Fola Prep Plant facilities	Mining		Groundwater 100.00%	Gauley 100.00%		Nicholas 100.00%		152,928,000
4803	Green Valley Coal - Grassy Creek #1 Deep Mine	Mining	Surface Water 100.00%		Gauley 100.00%		Nicholas 100.00%		19,200,000
4822	Green Valley Coal Company - Quinwood Prep Plant	Mining	Surface Water 100.00%		Gauley 100.00%		Nicholas 100.00%		47,517,333
10041	Greenbrier County PSD #2	Public water supply		Groundwater 100.00%	Gauley 100.00%		Greenbrier 100.00%		58,550,937
3034	ICG Eastern - Birch River Operation	Mining	Surface Water 100.00%		Elk 9.12%	Gauley 90.88%	Webster 100.00%		118,152,753
10028	Nettie-Leivasy PSD	Public water supply	Surface Water 100.00%		Gauley 100.00%		Nicholas 100.00%		97,607,000
7851	Power Mountain Coal Processing	Mining	Surface Water 38.71%	Groundwater 61.29%	Gauley 100.00%		Nicholas 100.00%		92,007,670
10043	Rainelle Water Department	Public water supply		Groundwater 100.00%	Gauley 100.00%		Greenbrier 100.00%		92,690,967
1653	Richwood Water Department	Public water supply	Surface Water 100.00%		Gauley 100.00%		Nicholas 100.00%		123,479,914
5038	Rupert Water Department	Public water supply		Groundwater 100.00%	Gauley 100.00%		Greenbrier 100.00%		43,500,733
10102	Summersville Hydroelectric Facility	Hydroelectric	Surface Water 100.00%		Gauley 100.00%		Nicholas 100.00%		326,095,879,431
10029	Summersville Municipal Water	Public water supply	Surface Water 100.00%		Gauley 100.00%		Nicholas 100.00%		256,935,000
10030	Wilderness PSD	Public water supply	Surface Water 100.00%		Gauley 100.00%		Nicholas 100.00%		114,127,633

Figures 4-14 through 4-17 summarize the breakdown of the share total withdrawals occurring among currently operating facilities, the trends in use over time for each industry group, and the amount and share of source water withdrawn by the currently operating LQUs in the watershed.

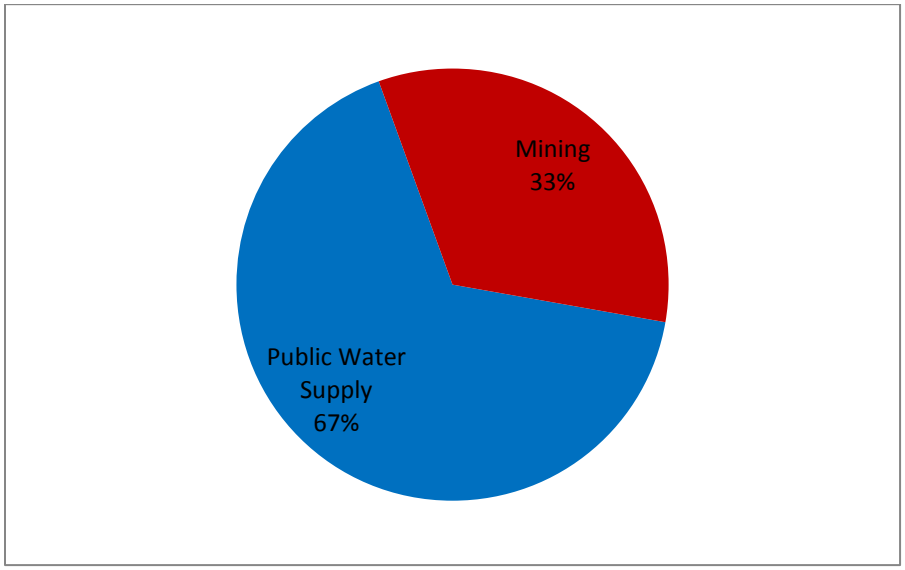
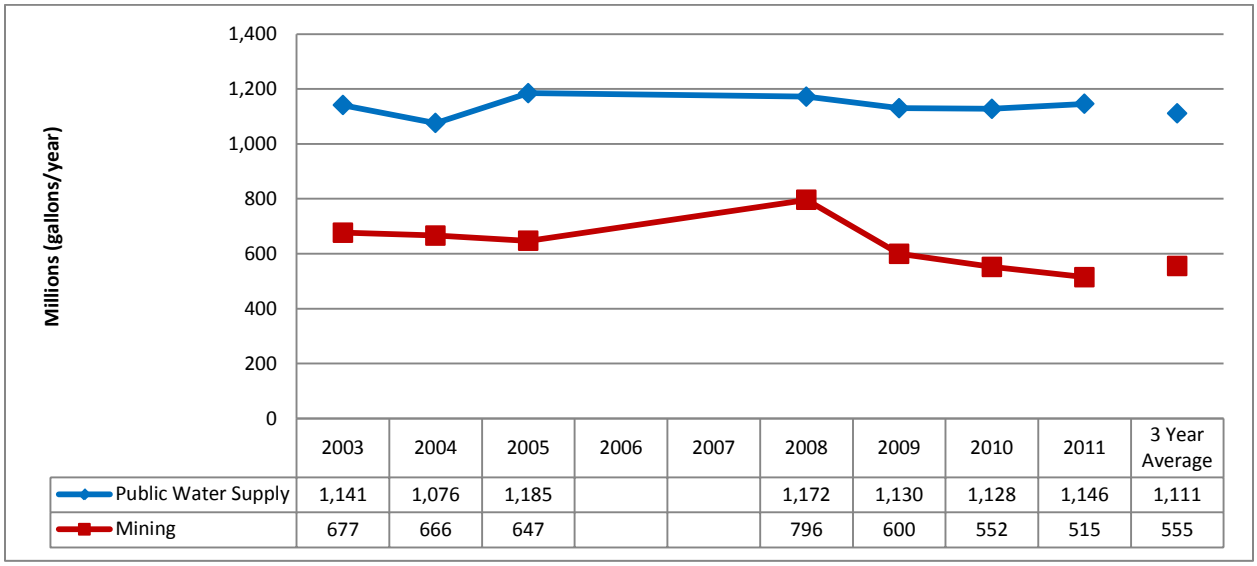


Figure 4-14 Gauley Watershed LQU percent of total average annual water withdrawals by sector (excluding Hydroelectric).



	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Public Water Supply	1,141	1,076	1,185			1,172	1,130	1,128	1,146	1,111
Mining	677	666	647			796	600	552	515	555

Figure 4-15 Gauley Watershed LQU water withdrawal trends for the Public Water Supply and Mining SIC categories, measured in millions of gallons per year.

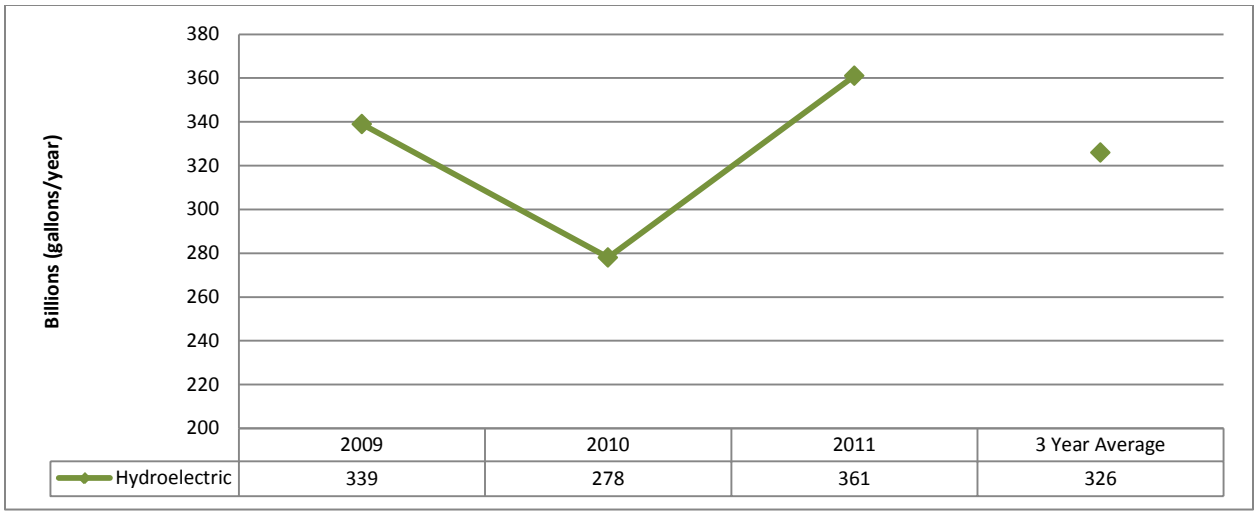


Figure 4-16 Gauley Watershed LQU water withdrawal trends for the Hydroelectric SIC category, measured in billions of gallons per year.

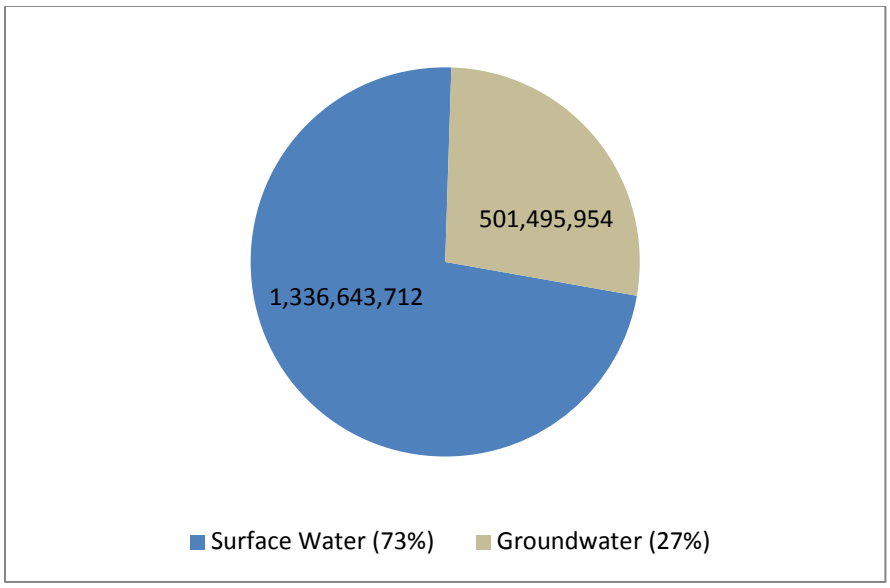
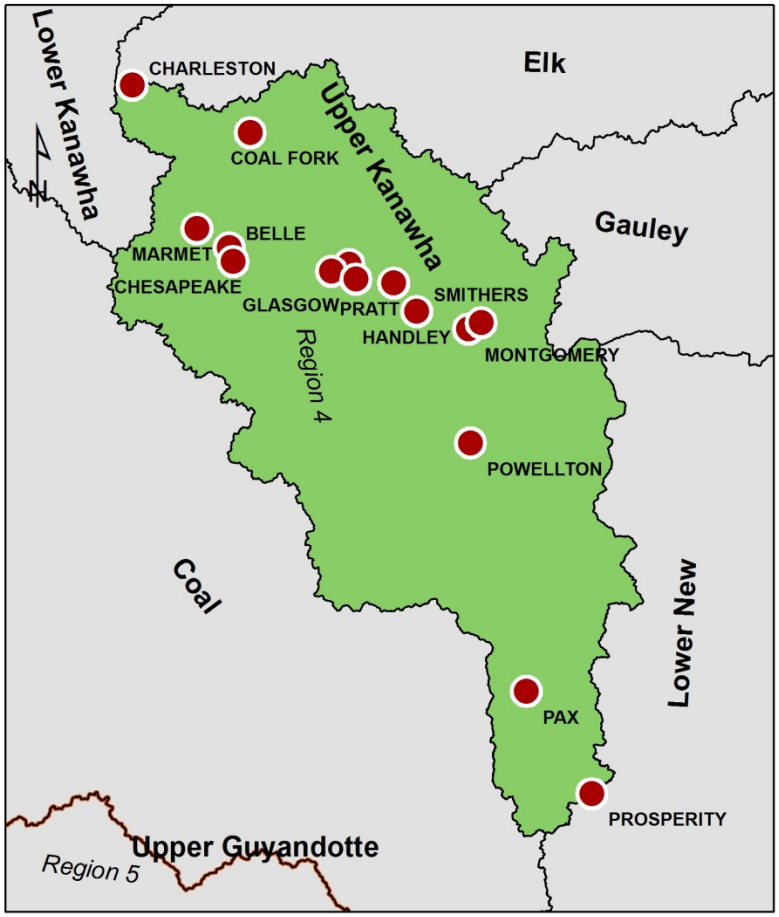


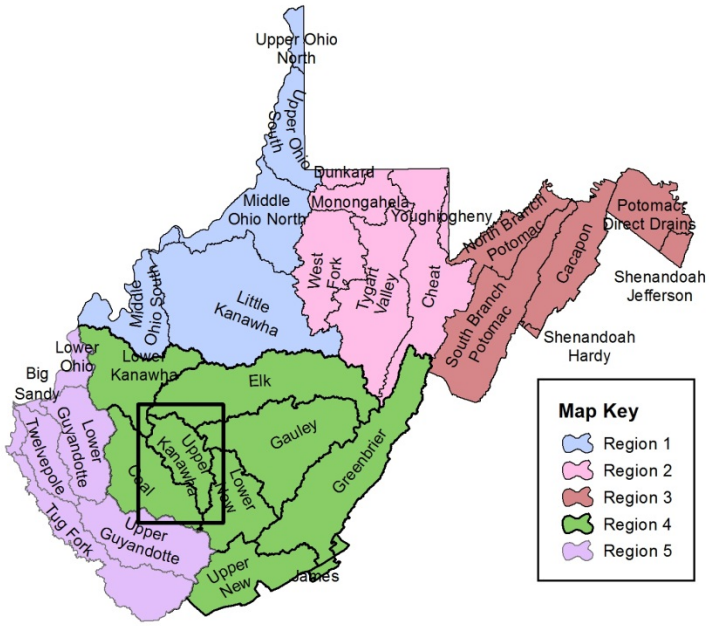
Figure 4-17 Average annual gallons of water withdrawn by LQUs from groundwater and surface water sources in the Gauley Watershed (excluding Hydroelectric).

Interbasin transfers occur when water is permanently moved from one watershed to another. This can occur in a number of ways. However, only three possible routes of transfer are considered here; see Chapter 2 of the Plan for a discussion of possibilities and data limitations. The following is a detailed list of interbasin transfers occurring between the Gauley and other HUC-8 watersheds as a result of LQU operations in 2011:

- Withdrawals vs. Stream Discharges
    - Green Valley Coal – Grassy Creek #1 Deep Mine withdrawals a three-year average of approximately 19 million gallons of water from the surface waters of the Gauley Watershed for use in coal extraction and related activities. Approximately 7 million gallons are reportedly discharged into a surface water source of the Elk Watershed.
    - ICG Eastern – Birch River Operation withdraws a three-year average of approximately 107 million gallon from impoundment, surface water sources located in the Gauley Watershed and approximately 11 million gallons from a surface impoundment in the Elk Watershed. Additionally, an approximate annual average of 596 thousand gallons of water is purchased from the Gauley Watershed via Cowen PSD. The water is reportedly used for preparation plant make up water and dust suppression. A three-year average of approximately 27 million gallons of that water has been reportedly discharged via land application to suppress dust on haul roads most highly concentrated in the Gauley Watershed. Stream discharges to the Gauley Watershed have not occurred since 2008.
- Withdrawals vs. POTW discharges
    - None reported
- Purchased water vs. Stream/POTW Discharges
    - None reported



Upper Kanawha River Watershed



Upper Kanawha River Watershed

Watershed Description

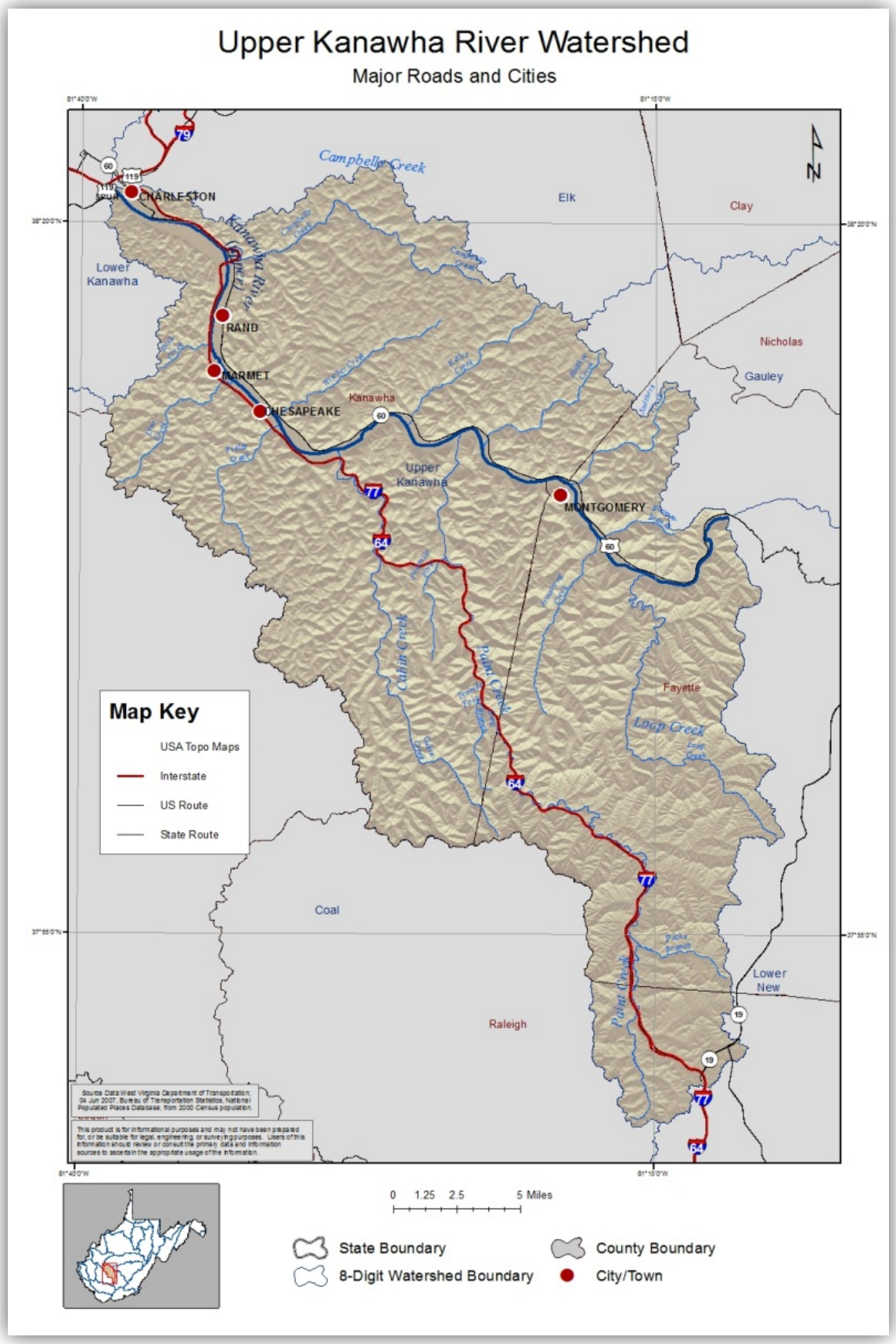
Located in south-central West Virginia, the Upper Kanawha River Watershed extends from Fayette County in the east to the Capital City of Charleston in the northwest. Covering approximately 519 square miles, the watershed contains portions of three counties (Kanawha, Fayette and Raleigh). Kanawha and Fayette counties comprise 95% of the total area of the watershed.

The Upper Kanawha River Watershed has 1,244 miles of streams and rivers and contains the headwaters of the Kanawha River. The Kanawha River mainstem is formed near the Town of Gauley Bridge from the convergence of the New River and Gauley River. From Gauley Bridge, the Kanawha flows westerly through the northern portion of the watershed to its confluence with the Elk River in Charleston. Major tributaries include Campbell's Creek, Witcher Creek, Kelly's Creek, Hughes Creek, Smithers Creek, Loop Creek, Armstrong Creek, Paint Creek, Cabin Creek, Slaughter Creek, Fields Creek and Lens Creek.

Additionally, the watershed encompasses all, or portions, of the following state and federal public lands: Plum Orchard Wildlife Management Area and Kanawha State Forest.

Demographics

The Upper Kanawha River Watershed has a total population of approximately 62,451. The watershed has five cities and towns with a population exceeding 1,500. The largest city within the watershed is Charleston with a total population of 51,400, followed by Montgomery (1,638), Rand (1,631), Chesapeake (1,554) and Marmet (1,503).


Upper Kanawha River Watershed
Major Roads and Cities
CHARLESTON
RAND
MARMET
CHESAPEAKE
MONTGOMERY
Campbells Creek
Kanawha River
Elk
Clay
Nicholas
Gauley
Lower Kanawha
Kanawha
Upper Kanawha
Fayette
Coal
Raleigh
Lower New
Cabin Creek
Paint Creek
Loop Creek
Map Key
USA Topo Maps
Interstate
US Route
State Route
0 1.25 2.5 5 Miles
State Boundary
8-Digit Watershed Boundary
County Boundary
City/Town

Geography and Geology

The Upper Kanawha River Watershed lies within two ecoregions. More than 99% of the watershed occupies the Central Appalachians Ecoregion, which is characterized by rugged and mountainous terrain, cooler climate and a biologically diverse habitat. The City of Charleston in the northeastern portion of the watershed is contained within the Western Allegheny Plateau Ecoregion and is comprised of tall rounded hills with narrow valleys, mixed oak forests and agricultural lands. The average elevation for the watershed is 1,448 feet above mean sea level, with the highest elevation, 3,132 feet, located in the southwest on Paint Mountain which forms the border between Fayette County and Raleigh County. The lowest elevation, 561 feet, is located in the northwest at the confluence of the Kanawha River and Elk River in Charleston. The average annual temperature is 54 degrees Fahrenheit and ranges from 49 to 55 degrees. The average annual precipitation for the Upper Kanawha River Watershed is 44.16 inches per year.

The majority (85%) of the Upper Kanawha River Watershed is covered by deciduous, mixed and evergreen forests, while 7.6% of the land cover is classified as developed. The remaining land cover consists of grasslands, pastures, barren land, wetlands, crops, shrubs and open water. 3.8% of the entire watershed is covered by impervious surfaces.

Geologically, the Upper Kanawha River Watershed consists predominantly (97%) of sandstone and shale, while containing a small percentage alluvium located in and around the Kanawha River Valley.

The United States Geological Survey (USGS), in conjunction with federal, state and local agencies, including the DEP, cooperatively funds the USGS stream gaging network to monitor water availability. Currently, there is one surface water gaging station located within the watershed. Surface water data is collected from the stream gage located on the Kanawha River at Kanawha Falls. The recorded data can be accessed at http://waterdata.usgs.gov/nwis.

LQU data

Table 4-5 contains a list of all Large Quantity User (LQU) facilities in the Upper Kanawha Watershed that are currently operating, their Standard Industrial Category (SIC) of use, the average percent of source water withdrawn annually, percent withdrawn from the watershed and county, as well as others if intakes are located elsewhere, and the average amount of water withdrawn by the facility based on the most recent three years of monthly data. A detailed discussion about categories of use type and comparisons of use to statewide withdrawals and consumption is available in Chapter 2 of the Plan.

Chapter 4 of the Plan includes data and discussion about future use projections. The following is a summary of data collected regarding the facilities:

- 12 Mining facilities
    - 1 closed in 2010: Mammoth Coal, Shadrick Stockton Mine
    - 3 did not start reporting as LQU until 2009: Mammoth Coal (Laurel Hollow Coalburg, Slab Camp Stockton and Alloy Powellton)
    - Catenary Coal –Samples Mine Complex gets 52% of its water from the Upper Kanawha and the remaining 48% from the Coal Watershed.
- 9 Public water supply facilities
    - 1 closed in 2011: Deep Water PSD
    - Beckley Water Company withdraws 10% of its total water from the Upper Kanawha but still contributes the greatest average withdrawals for public supply
- 2 Hydroelectric facilities: London and Marmet
- 1 Chemical facility: DuPont Belle
- 1 Industrial facility: WVA manufacturing
- 1 Thermoelectric (coal) facility: Appalachian Power, Kanawha River plant

Table 4-5 All facilities withdrawing from Upper Kanawha Watershed organized by Use Category and Intake Source and Location (watershed and county). Blanks indicate that no additional withdrawals were occurring.

Facility ID	Facility Name	Use Category	Source and % of 3 Year Average		Watershed and % of 3 Year Average		County and % of 3 Year Average		3 Year Annual Average (gallons)
3804	Appalachian Power - Kanawha River Plant	Thermoelectric (coal)	Surface Water 100.00%		Upper Kanawha 100.00%		Kanawha 100.00%		87,314,848,603
10009	Armstrong PSD	Public water supply	Surface Water 100.00%		Upper Kanawha 100.00%		Fayette 100.00%		83,785,791
3077	Beckley Water Company	Public water supply	Surface Water 89.45%	Groundwater 10.55%	Lower New 89.45%	Upper Kanawha 10.55%	Raleigh 100.00%		3,269,161,633
4685	Catenary Coal Company - Samples Mine Complex	Mining	Surface Water 100.00%		Coal 48.06%	Upper Kanawha 51.94%	Boone 48.06%	Kanawha 51.94%	102,356,004
8195	Cedar Grove Water Works	Public water supply	Surface Water 100.00%		Upper Kanawha 100.00%		Kanawha 100.00%		215,774,333
1180	DuPont Belle Plant	Chemical	Surface Water 100.00%		Upper Kanawha 100.00%		Kanawha 100.00%		37,317,600,000
2990	Jacks Branch River Terminal	Mining	Surface Water 100.00%		Upper Kanawha 100.00%		Kanawha 100.00%		18,351,943
3052	Kanawha Falls PSD	Public water supply	Surface Water 100.00%		Upper Kanawha 100.00%		Fayette 100.00%		257,671,433
2988	Kanawha River Terminals - Quincy Dock	Mining	Surface Water 100.00%		Upper Kanawha 100.00%		Kanawha 100.00%		45,467,855
3378	Kingston Resources, Inc.	Mining	Surface Water 99.64%	Groundwater 0.36%	Upper Kanawha 100.00%		Fayette 100.00%		232,323,840
10096	London Hydroelectric Project	Hydroelectric	Surface Water 100.00%		Upper Kanawha 100.00%		Kanawha 100.00%		1,214,105,592,765
7977	Mammoth Coal Co - #2 Gas Mine	Mining	Surface Water 100.00%		Upper Kanawha 100.00%		Kanawha 100.00%		9,088,720
10111	Mammoth Coal Co - Alloy Powellton	Mining	Surface Water 100.00%		Upper Kanawha 66.67%		Fayette 100.00%		13,748,940
10109	Mammoth Coal Co - Laurel Hollow Coalburg	Mining	Surface Water 100.00%		Upper Kanawha 100.00%		Kanawha 100.00%		5,902,848
4208	Mammoth Coal Co - Mammoth Processing	Mining	Surface Water 100.00%		Upper Kanawha 100.00%		Kanawha 100.00%		1,917,368,960
10110	Mammoth Coal Co - Slab Camp Stockton	Mining	Surface Water 100.00%		Upper Kanawha 100.00%		Kanawha 100.00%		18,240,768
10098	Marmet Hydroelectric Project	Hydroelectric	Surface Water 100.00%		Upper Kanawha 100.00%		Kanawha 100.00%		1,230,245,785,037
10105	Midland Trail Energy - Blue Creek Complex	Mining	Surface Water 100.00%		Upper Kanawha 100.00%		Kanawha 100.00%		93,645,797
4865	Midland Trail Energy - Campbells Creek Complex	Mining	Surface Water 100.00%		Upper Kanawha 100.00%		Kanawha 100.00%		178,940,037
2998	Page- Kincaid Public Service District	Public water supply		Groundwater 100.00%	Upper Kanawha 100.00%		Fayette 100.00%		111,807,667
2651	Pratt Water Works	Public water supply	Surface Water 100.00%		Upper Kanawha 100.00%		Kanawha 100.00%		68,031,649
1470	West Virginia American Water - Montgomery	Public water supply	Surface Water 100.00%		Upper Kanawha 100.00%		Fayette 100.00%		169,862,667
1944	WVA Manufacturing	Industrial	Surface Water 100.00%		Upper Kanawha 100.00%		Fayette 100.00%		2,208,933,333
1489	WVPA - Morton	Public water supply		Groundwater 100.00%	Upper Kanawha 100.00%		Kanawha 100.00%		6,310,533

Figures 4-18 through 4-22 summarize the breakdown of the share total withdrawals occurring among currently operating facilities, the trends in use over time for each industry group, and the amount and share of source water withdrawn by the currently operating LQUs in the watershed.

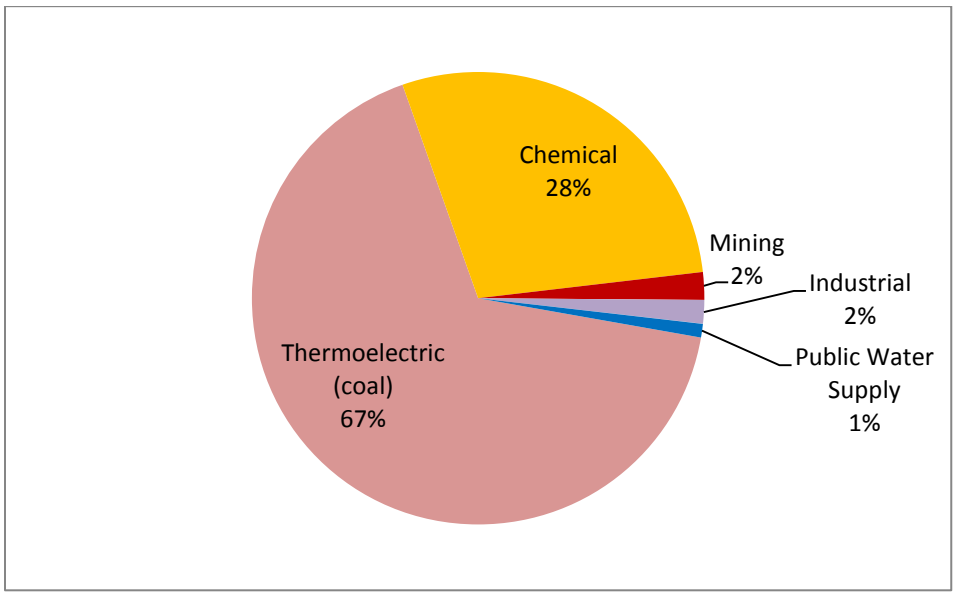
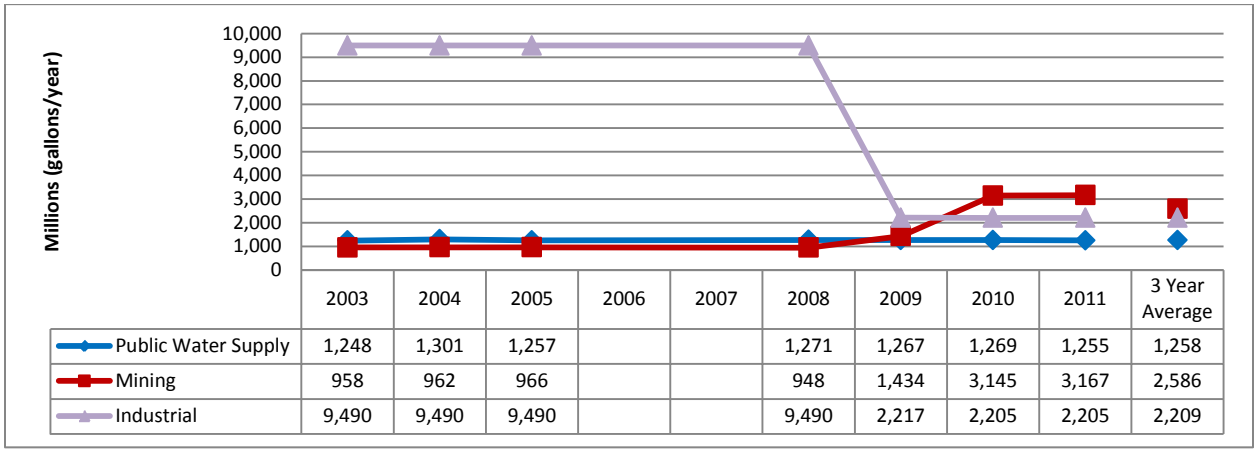


Figure 4-18 Upper Kanawha Watershed LQU percent of total average annual water withdrawals by sector (excluding Hydroelectric).



	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Public Water Supply	1,248	1,301	1,257			1,271	1,267	1,269	1,255	1,258
Mining	958	962	966			948	1,434	3,145	3,167	2,586
Industrial	9,490	9,490	9,490			9,490	2,217	2,205	2,205	2,209

Figure 4-19 Upper Kanawha Watershed LQU water withdrawal trends for the Public Water Supply, Mining, and Industrial SIC categories, measured in millions of gallons per year.

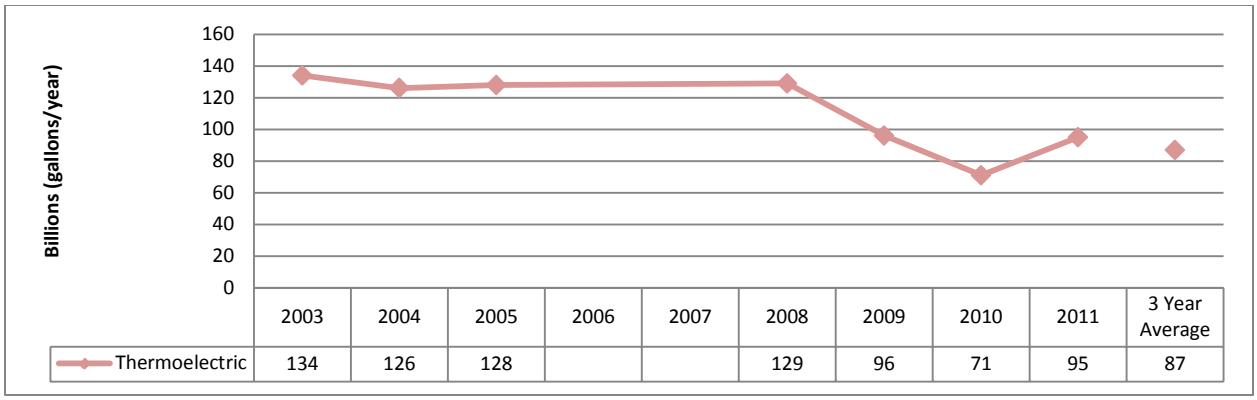


Figure 4-20 Upper Kanawha Watershed LQU water withdrawal trends for the Thermoelectric SIC category, measured in billions of gallons per year.

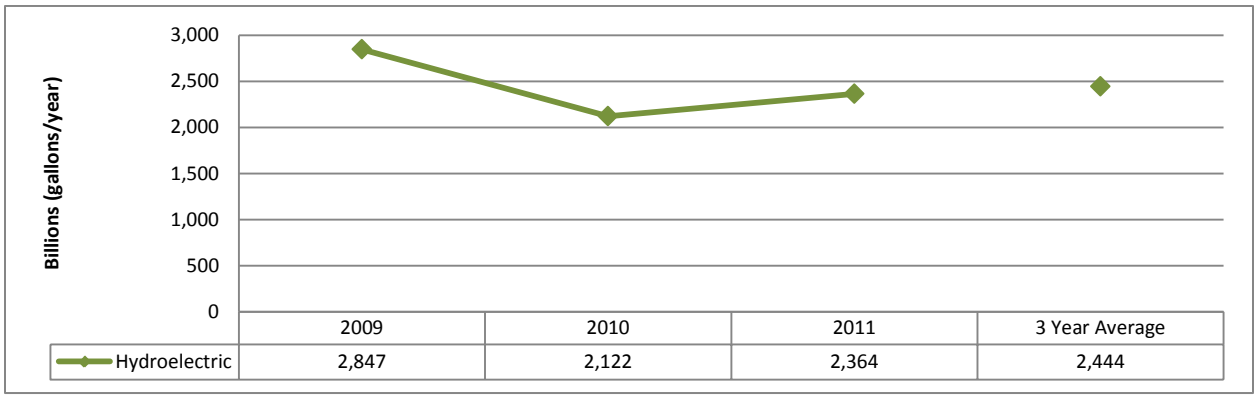


Figure 4-21 Upper Kanawha Watershed LQU water withdrawal trends for Hydroelectric SIC category, measured in billions of gallons per year.

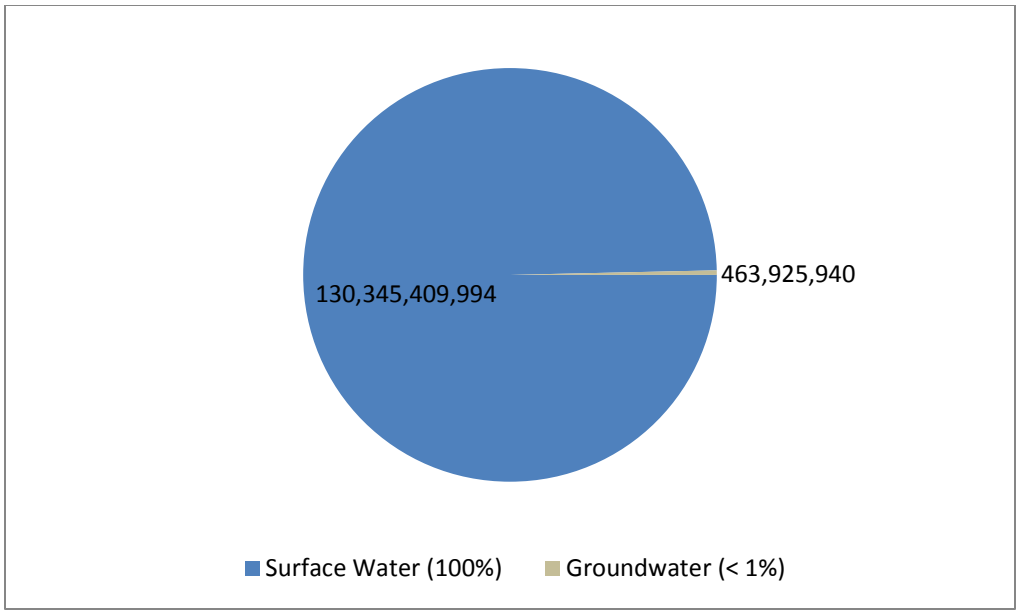


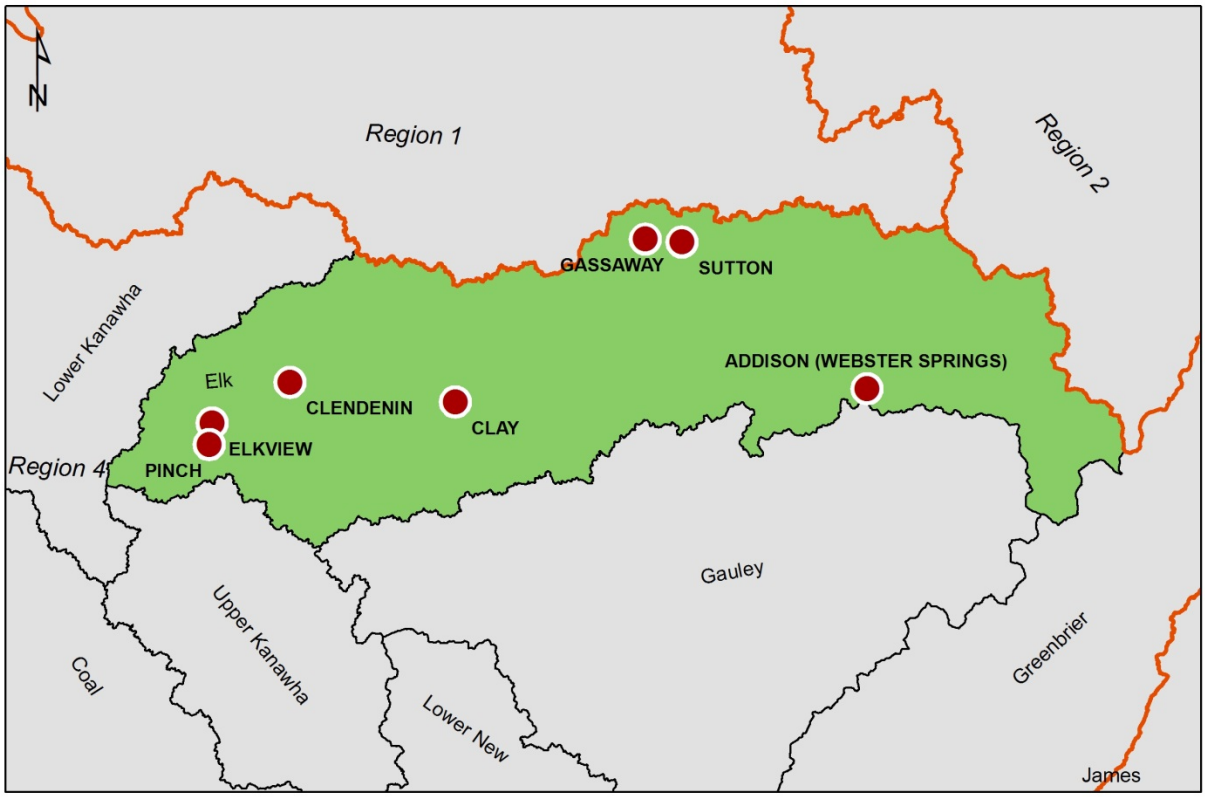
Figure 4-22 Average annual gallons of water withdrawn by LQUs from groundwater and surface water sources in the Upper Kanawha Watershed.

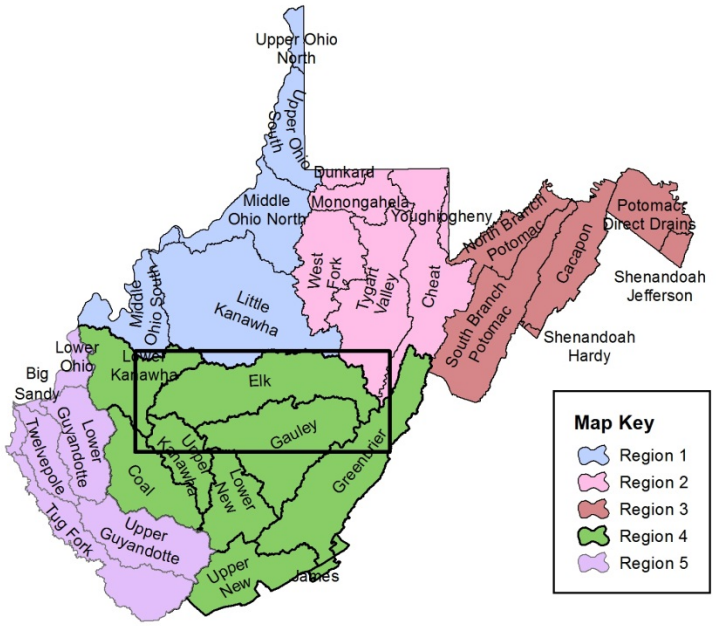
Interbasin transfers occur when water is permanently moved from one watershed to another. This can occur in a number of ways. However, only three possible routes of transfer are considered here; see Chapter 2 of the Plan for a discussion of possibilities and data limitations. The following is a detailed list of interbasin transfers occurring between the Upper Kanawha and other HUC-8 watersheds as a result of LQU operations in 2011:

- Withdrawals vs. Stream Discharges
    - Catenary Coal Company – Samples Mine Complex withdraws a three-year average of approximately 53 million gallons of water from a surface water source in the Upper Kanawha and approximately 49 million gallons of surface water from the Coal Watershed. The water is used as process water, dust control, truck wash and for domestic purposes. Reportedly, 49 million gallons are discharged into the surface water of the Coal Watershed, and 53 million gallons are discharged into surface water sources of the Upper Kanawha Watershed. Although haul water and truck wash is a reported use, no values for gallons discharged for this purpose have been provided.
- Withdrawals vs. POTW discharges
    - None reported

- Purchased water vs. Stream/POTW Discharges
    - Catenary Coal Company – Samples Mine Complex purchases an approximate annual average of 238 thousand gallons of water from the Upper Kanawha Watershed via West Virginia American Water. The water is used as process water, dust control, truck wash and for domestic purposes. Reportedly, 49 million gallons are discharged into the surface water of the Coal Watershed, and 53 million gallons are discharged into surface water sources of the Upper Kanawha Watershed. Although haul water and truck wash is a reported use, no values for gallons discharged for this purpose have been provided.

Elk River Watershed





Elk River Watershed

Watershed Description

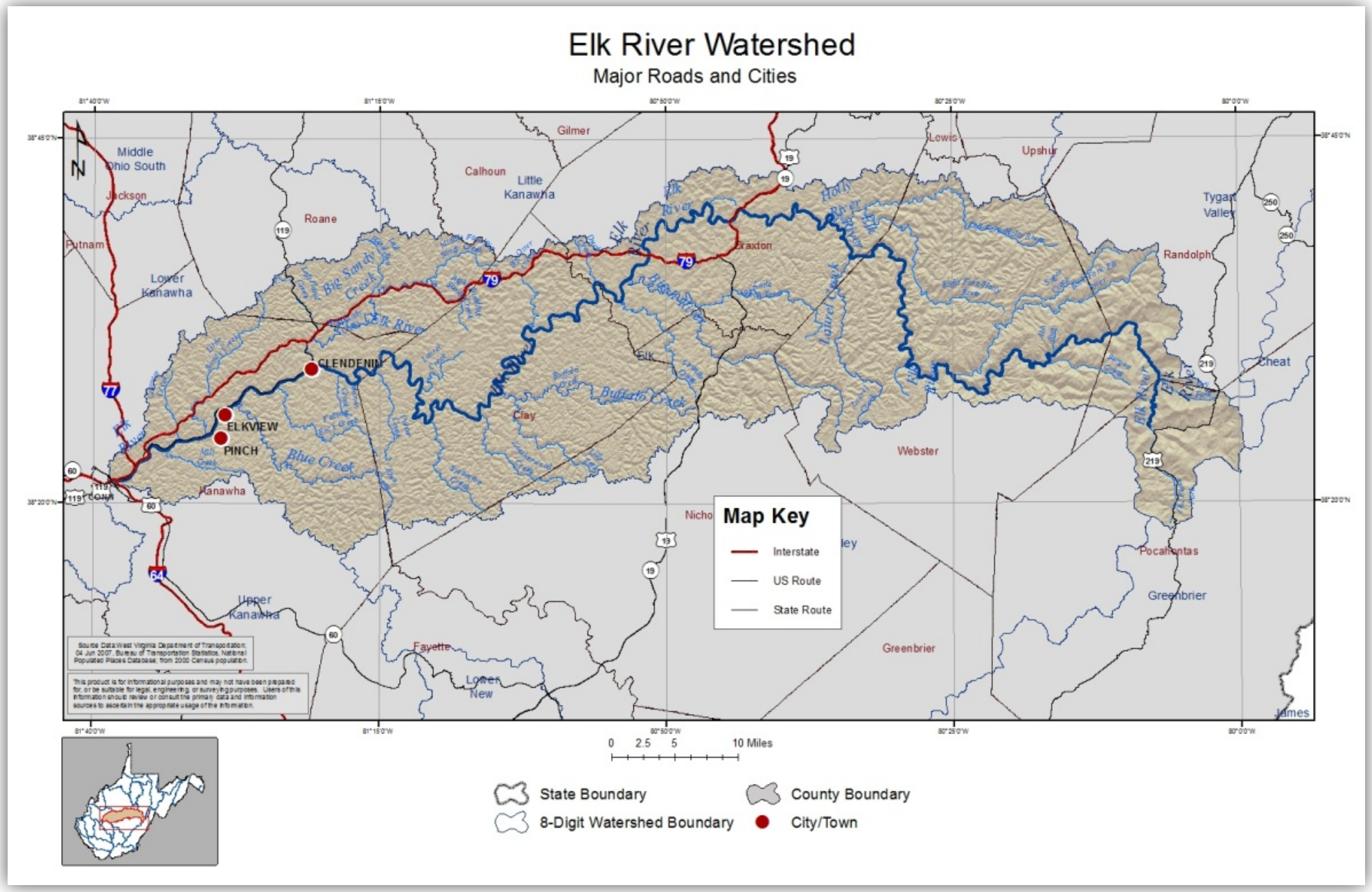
Located in central West Virginia, the Elk River Watershed extends from Snowshoe Mountain Resort in the east to the Capital City of Charleston in the west. Covering more than 1,532 square miles, the watershed contains portions of eight West Virginia counties (Pocahontas, Randolph, Roane, Nicholas, Braxton, Kanawha, Clay and Webster). Webster, Clay, Kanawha and Braxton counties comprise 77% of the total area of the watershed.

The Elk River Watershed has 3,213 miles of streams and rivers and contains the headwaters of the Elk River at the town of Slaty Fork in Pocahontas County. From Slaty Fork, the Elk River flows westerly to its confluence with the Kanawha River in Charleston. The Elk's major tributaries include Laurel Creek, Holly River, Birch River, Buffalo Creek, Big Sandy Creek and Blue Creek. The Elk River Watershed also encompasses Sutton Lake, which is located on the Elk River in the northern portion of the watershed near the town of Sutton in Braxton County. The lake, which was completed in 1961, has 1,520 acres of surface area and the Sutton Dam maintains a minimum flow release of 75 cubic feet per second.

Additionally, the watershed encompasses all, or portions, of the following state and federal public lands: one state park (Holly River), one state forest (Kumbrabow), seven wildlife management areas (Morris Creek, Elk River, Tea Creek, Cranberry, Slaty Fork, Big Ditch and Wallback) and one national forest (Monongahela).

Demographics

The Elk River Watershed has a total population of approximately 58,216. The watershed has three towns with a population exceeding 1,000. The largest town within the watershed is Pinch with a total population of 3,262, followed by Clendenin (1,227) and Elkview (1,222).


Elk River Watershed
Major Roads and Cities
Middle Ohio South
Jackson
Putnam
Lower Kanawha
Roane
Calhoun
Little Kanawha
Gilmer
Lewis
Upshur
Tygart Valley
Randolph
Braxton
Clay
Webster
Cheat
Pocahontas
Greenbrier
Nicholas
Fayette
Upper Kanawha
Lower New
James
Kanawha
CLENDENIN
ELKVIEW
PINCH
COON
Big Sandy Creek
Blue Creek
Buffalo Creek
Laurel Creek
Map Key
Interstate
US Route
State Route
0 2.5 5 10 Miles
State Boundary
County Boundary
8-Digit Watershed Boundary
City/Town

Geography and Geology

The southern portion of the watershed lies within the Central Appalachians Ecoregion, which is characterized by rugged and mountainous terrain, cooler climate and a biologically diverse habitat. Meanwhile, the northern portion of the watershed occupies the Western Allegheny Plateau Ecoregion, which consists of rounded hills with mixed oak and mesophytic forests. The average elevation for the watershed is 1,634 feet above mean sea level, with the highest elevation of 4,848 feet recorded in the east at Thorny Flat, a section of Cheat Mountain, located at Snowshoe Mountain Resort. The lowest elevation, 566 feet, is recorded at the confluence of the Elk and Kanawha Rivers in Charleston. The average annual temperature is 51 degrees Fahrenheit and ranges from 43 to 55 degrees. The average annual precipitation for the Elk River Watershed is 48.84 inches per year.

More than 90% of the watershed is covered by forests, while 5.3% is classified as developed. The remaining land cover consists of grasslands, pastures, barren land, wetlands, crops, shrubs and open water. Only 1.05% of the entire watershed is covered by impervious surfaces.

The surface geology in the Elk River Watershed is predominantly (99%) sandstone, shale and siltstone with a small percentage of limestone.

The United States Geological Survey (USGS), in conjunction with federal, state and local agencies, including the DEP, cooperatively funds the USGS stream gaging network to monitor water availability. Currently, there are seven surface water gaging stations located throughout the watershed. Surface water data is collected from the gages located on the Birch River (1), an unnamed tributary to Elk Twomile Creek (1) and multiple sites along the Elk River (5). The recorded data can be accessed at http://waterdata.usgs.gov/nwis.

LQU data

Table 4-6 contains a list of all Large Quantity User (LQU) facilities in the Elk Watershed that are currently operating, their Standard Industrial Category (SIC) of use, the average percent of source water withdrawn annually, percent withdrawn from the watershed and county, as well as others if intakes are located elsewhere, and the average amount of water withdrawn by the facility based on the most recent three years of monthly data. A detailed discussion about categories of use type and comparisons of use to statewide withdrawals and consumption is available in Chapter 2 of the Plan. Chapter 4 of the Plan includes data and discussion about future use projections. The following is a summary of data collected regarding the facilities:

- 10 Public Water Supply facilities
    - 1 closed in 2007: Clendenin Water Works
    - 3 are run by West Virginia American Water (Gassaway, Kanawha Valley and Webster Springs)
    - Cheat mountain water company gets 27% of its water from the Elk Watershed, the rest comes from the Cheat Watershed
- 2 mining facilities: Brooks Run and ICG Eastern
    - ICG Eastern – Birch River operation gets 7% of its total water from the Elk Watershed, the rest comes from the Gauley Watershed.
- 1 Recreation facility: Snowshoe
    - Snowshoe gets 1% of its water from the Elk, the rest comes from the Cheat Watershed

Table 4-6 All facilities withdrawing from Elk Watershed organized by Use Category and Intake Source and Location (watershed and county). Blanks indicate that no additional withdrawals were occurring.

Facility ID	Facility Name	Use Category	Source and % of 3 Year Average		Watershed and % of 3 Year Average		County and % of 3 Year Average		3 Year Annual Average (gallons)
3631	Brooks Run Mining - Erbacon Plant	Mining	Surface Water 100.00%		Elk 100.00%		Webster 100.00%		162,329,000
5082	Cheat Mountain Water Company	Public water supply		Groundwater 100.00%	Cheat 74.58%	Elk 25.42%	Pocahontas 100.00%		10,911,345
10006	Clay Municipal Water	Public water supply	Surface Water 100.00%		Elk 100.00%		Clay 100.00%		137,203,667
10007	Clay-Roane PSD (Procious District)	Public water supply	Surface Water 100.00%		Elk 100.00%		Clay 100.00%		29,506,367
10004	Flatwoods Canoe Run PSD	Public water supply	Surface Water 100.00%		Elk 100.00%		Braxton 100.00%		208,389,667
3034	ICG Eastern - Birch River Operation	Mining	Surface Water 100.00%		Elk 9.12%	Gauley 90.88%	Webster 100.00%		118,152,753
4639	Snowshoe Mountain	Recreation	Surface Water >99.99%	Groundwater <0.01%	Cheat 98.26%	Elk 1.74%	Pocahontas 100.00%		459,501,260
10005	Sugar Creek PSD	Public water supply	Surface Water 100.00%		Elk 100.00%		Braxton 100.00%		29,183,000
2113	West Virginia American Water - Gassaway	Public water supply	Surface Water 100.00%		Elk 100.00%		Braxton 100.00%		104,552,667
1193	West Virginia American Water - Kanawha Valley	Public water supply	Surface Water 100.00%		Elk 100.00%		Kanawha 100.00%		11,364,700,000
1471	West Virginia American Water - Webster Springs	Public water supply	Surface Water 100.00%		Elk 100.00%		Webster 100.00%		47,538,000

Figures 4-23 through 4-26 summarize the breakdown of the share total withdrawals occurring among currently operating facilities, the trends in use over time for each industry group, and the amount and share of source water withdrawn by the currently operating LQUs in the watershed.

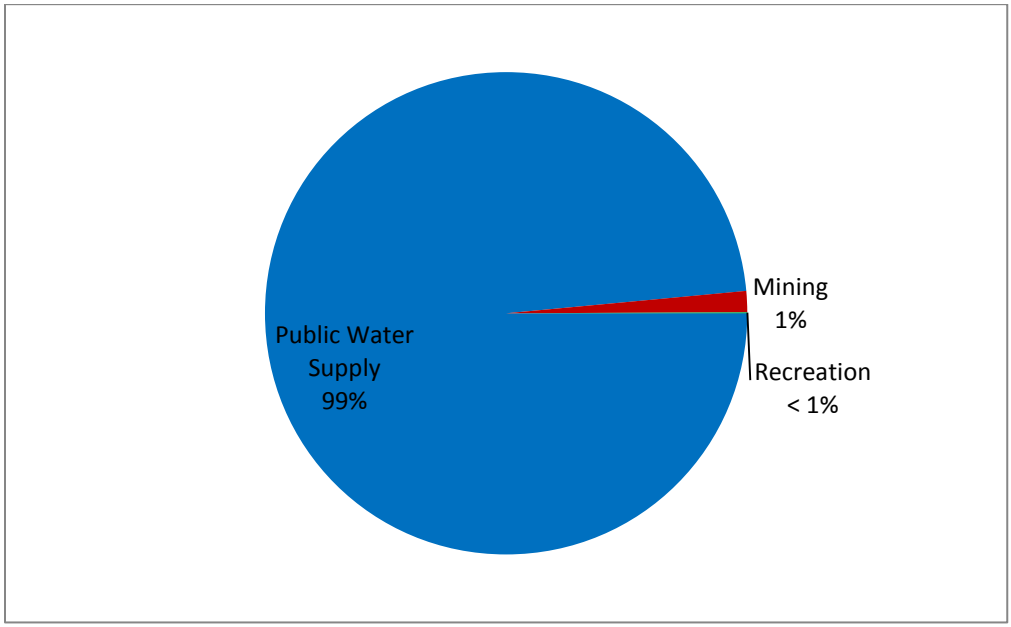
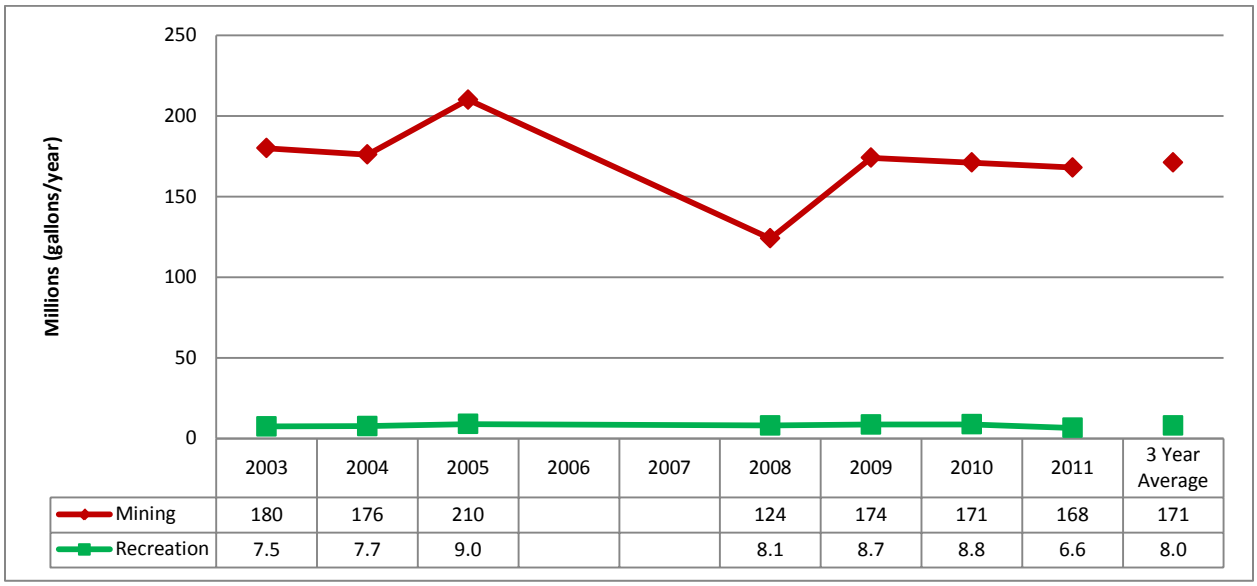


Figure 4-23 Elk Watershed LQU percent of total average annual water withdrawals by sector (excluding Frac Water*).



	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Mining	180	176	210			124	174	171	168	171
Recreation	7.5	7.7	9.0			8.1	8.7	8.8	6.6	8.0

Figure 4-24 Elk Watershed LQU water withdrawal trends for the Recreation and Mining SIC categories, measured in millions of gallons per year.

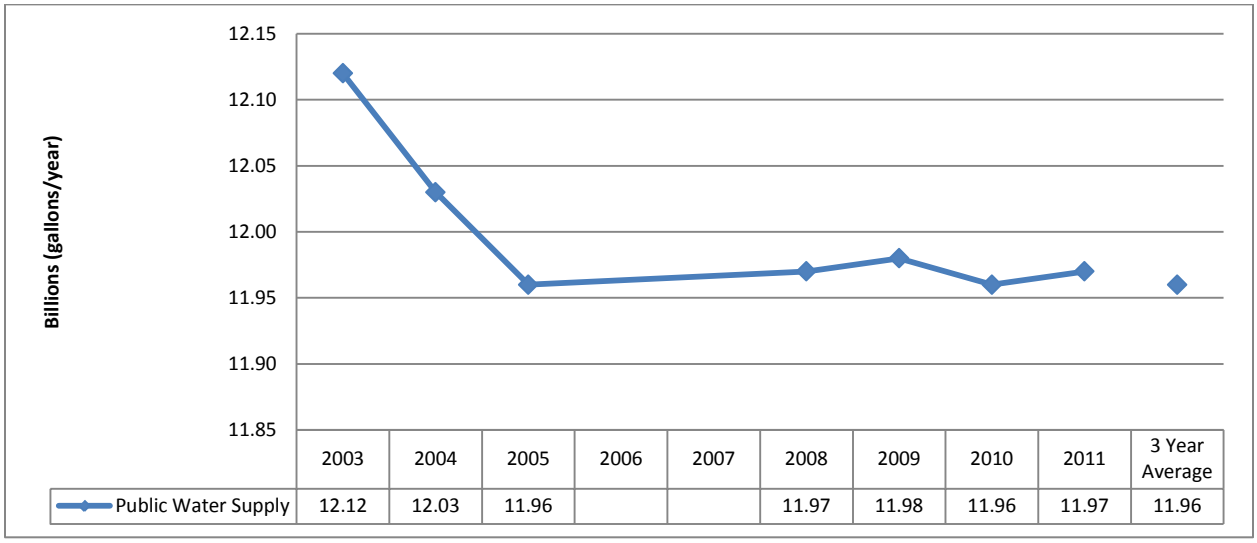


Figure 4-25 Elk Watershed LQU water withdrawal trends for the Public Water Supply SIC category, measured in billions of gallons per year.

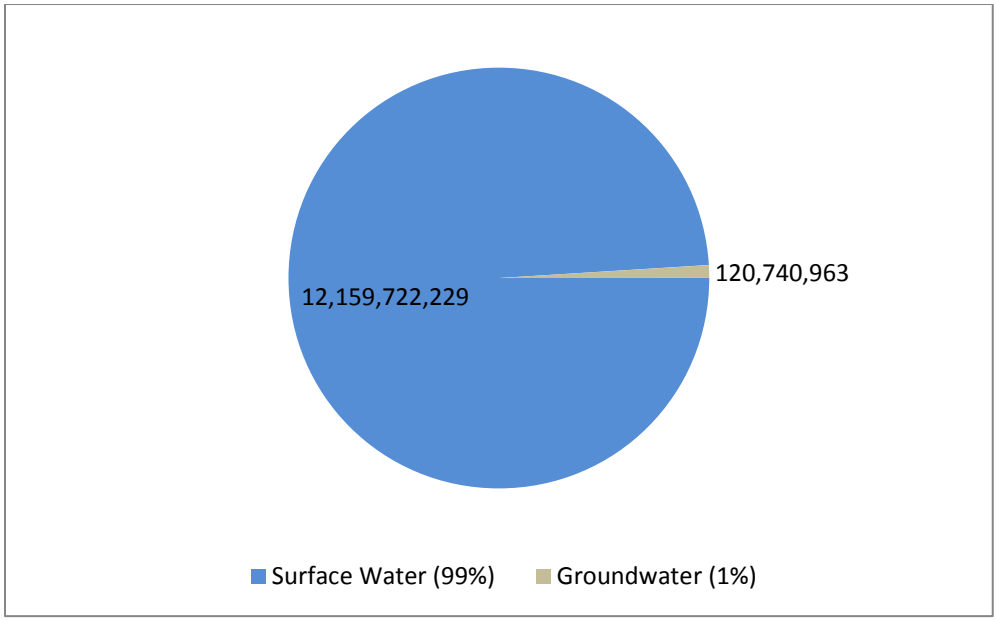


Figure 4-26 Average annual gallons of water withdrawn by LQUs from groundwater and surface water sources in the Elk Watershed.

Interbasin transfers occur when water is permanently moved from one watershed to another. This can occur in a number of ways. However, only three possible routes of transfer are considered here; see Chapter 2 of the Plan for a discussion of possibilities and data limitations. The following is a detailed list of interbasin transfers occurring between the Elk and other HUC-8 watersheds as a result of LQU operations in 2011:

- Withdrawals vs. Stream Discharges
    - Green Valley Coal – Grassy Creek #1 Deep Mine withdraws a three-year average of approximately 19 million gallons of water from the surface waters of the Gauley Watershed for use in coal extraction and related activities. Approximately 7 million gallons are reportedly discharged into a surface water source of the Elk Watershed.
    - ICG Eastern – Birch River Operation withdraws a three-year average of approximately 107 million gallon from impoundment, surface water sources located in the Gauley Watershed and approximately 11 million gallons from a surface impoundment in the Elk Watershed. Additionally, an approximate annual average of 596 thousand gallons of water is purchased from the Gauley Watershed via Cowen PSD. The water is reportedly used for preparation plant make up water and dust suppression. A three-year average of approximately 27 million gallons of that water has been reportedly discharged via land application to suppress dust on haul roads most highly concentrated in the Gauley Watershed. Stream discharges to the Gauley Watershed have not occurred since 2008.
    - Snowshoe Mountain withdraws a three-year average of approximately 8 million gallons of water from a surface water source in the Elk Watershed and approximately 452 million gallons from surface water sources in the Cheat Watershed. Approximately 393.6 million gallons of water is used annually for snowmaking at the Snowshoe and Silver Creek ski slopes in the Cheat Watershed and approximately 8 million gallons is used for irrigation of the Raven Golf Course located in the Elk Watershed.
- Withdrawals vs. POTW discharges
    - Snowshoe Mountain withdraws a three-year average of approximately 8 million gallons of water from a surface water source in the Elk Watershed and approximately 452 million gallons from surface water sources in the Cheat Watershed. Some of the water is used as potable supply at various locations. A three-year average of approximately 8.5 million gallons is discharged into the Cheat Watershed via POTW discharge to the Black Run WWTP.
- Purchased water vs. Stream/POTW Discharges
    - Bayer CropScience – Institute Plant purchases a three-year average of water from the West Virginia American Water Company in the Elk Watershed approximately equal to 232.7 million gallons per year. The water is reportedly used as cooling water, zeolite treated process water, boiler feed water and for emergency fire water. The only form of discharge reported is stream discharge at eight locations that fall under a single NPDES

permit number. All water discharged from the facility at these locations enters the Lower Kanawha Watershed at a three-year average rate of 42.2 billion gallons per year.

- Mingo Logan Coal Company – Mountain Laurel Complex purchases an approximate annual average of 12.9 million gallons of water from the Elk Watershed via West Virginia American Water. The water is used at multiple facilities in the process of mining coal including the preparation plant and longwall miner. A three-year average of approximately 345 million gallons of water a year is discharged into the Upper Guyandotte Watershed. There are no reported discharges into the Elk watershed.

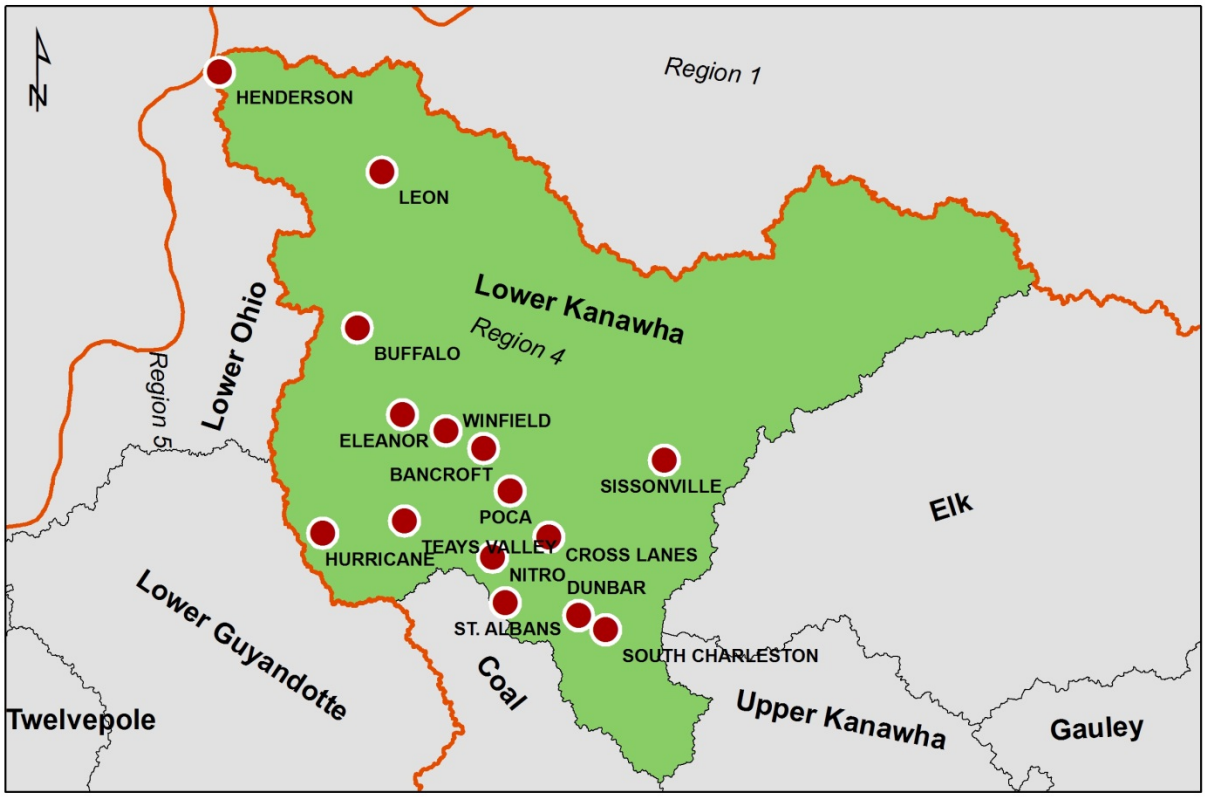
Marcellus Shale

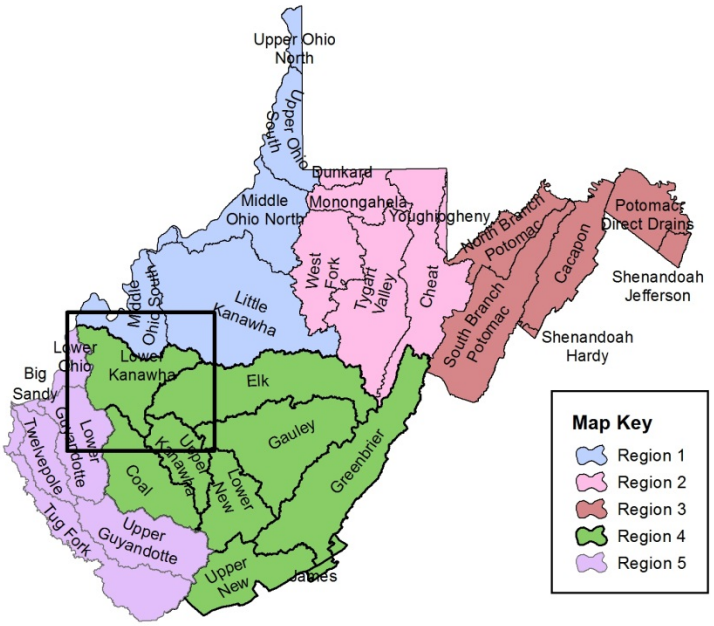
Since the DEP started tracking water use data associated with hydraulic fracturing operations in 2009, approximately four million gallons of water have been withdrawn from Elk River Watershed. In this watershed, all of the water withdrawn has originated from streams or rivers. The most frequently cited stream and river source from this region is the Elk River.

Water Source	2009	2010	2011	Grand Total
Stream/River	0	0	3,780,000	3,780,000
Grand Total	**0**	**0**	**3,780,000**	**3,780,000**

Table 4-7 Water use for hydraulic fracturing in the Elk River Watershed from 2009-2011 in gallons.

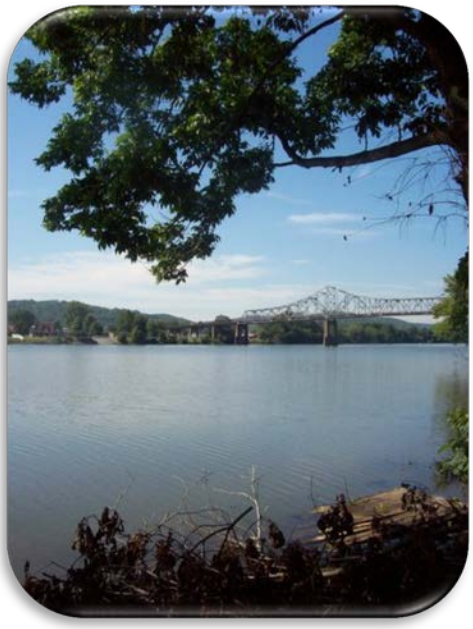
Lower Kanawha River Watershed





Lower Kanawha River Watershed

Watershed Description



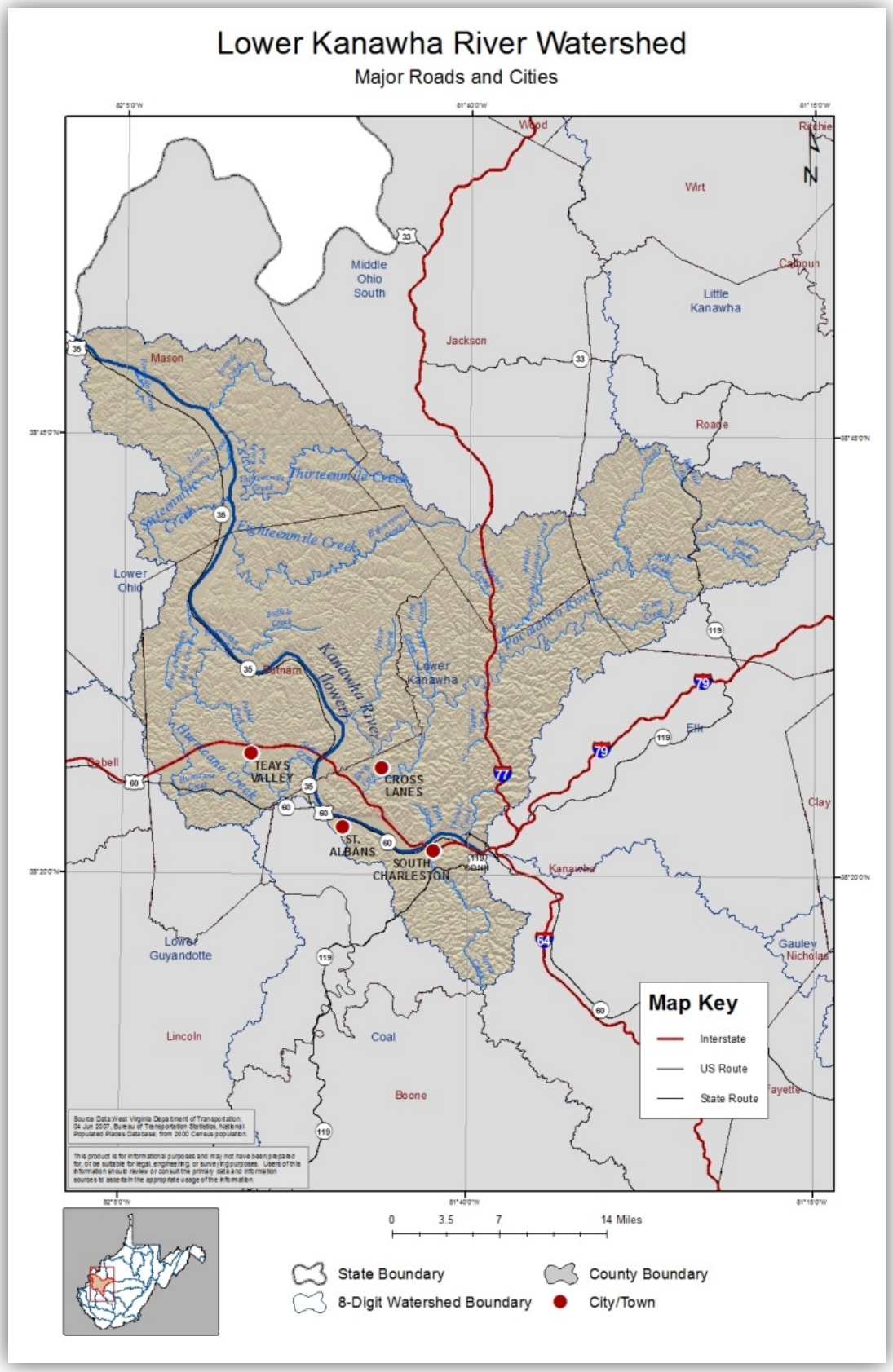
Located in west-central West Virginia, the Lower Kanawha River Watershed extends northwest from the City of Charleston to the Ohio River near Henderson, West Virginia. Covering approximately 924 square miles, the watershed contains portions of six counties (Cabell, Jackson, Roane, Mason, Kanawha and Putnam). Kanawha, Mason and Putnam counties comprise 78% of the total area of the watershed.

The Lower Kanawha River Watershed has 1,965 miles of streams and rivers and contains the lower portion of the Kanawha River. The Kanawha River flows northwesterly through the watershed from the City of Charleston to its confluence with the Ohio River. Major tributaries include Pocatalico River, Hurricane Creek and Eighteenmile Creek.

Additionally, the watershed encompasses all, or portions, of the following state and federal public lands: one state forest (Kanawha State Forest), one state park (Tu-Endie-Wei) and three wildlife management areas (Woodrum Lake, Amherst/Plymouth and Chief Cornstalk).

Demographics

The Lower Kanawha River Watershed has a total population of approximately 162,287. The watershed has four cities with populations greater than 9,000. The largest city within the watershed is South Charleston with a total population of 13,450, followed by Teays Valley (13,175), St. Albans (11,044) and Cross Lanes (9,995).


Lower Kanawha River Watershed
Major Roads and Cities
Wood
Ritchie
Wirt
Middle Ohio South
Little Kanawha
Calhoun
Jackson
Mason
Roane
Thirteenmile Creek
Eighteenmile Creek
Lower Ohio
Kanawha River
Putnam
Lower Kanawha
Elk
Cabell
TEAYS VALLEY
CROSS LANES
ST. ALBANS
SOUTH CHARLESTON
Clay
Kanawha
Lower Guyandotte
Gauley
Nicholas
Lincoln
Coal
Boone
Map Key
Interstate
US Route
State Route
0 3.5 7 14 Miles
State Boundary
County Boundary
8-Digit Watershed Boundary
City/Town

Geography and Geology

The Lower Kanawha River Watershed lies within two ecoregions. More than 96% of the watershed occupies the Western Allegheny Plateau Ecoregion, which is comprised of rounded hills with wide fertile valleys, mixed oak forests and agricultural lands. The southwest region of the watershed lies within the Central Appalachians Ecoregion and is characterized by rugged and mountainous terrain, cooler climate and a biologically diverse habitat. The average elevation for the watershed is 807 feet above mean sea level, with the highest elevation, 1587 feet, located in the southeast on a ridge near Hoffman Hollow in the Kanawha State Forest. The lowest elevation, 550 feet, is located in the northwest at the confluence of the Kanawha River and Ohio River in Mason County.

The average annual temperature is 54 degrees Fahrenheit and ranges from 53 to 55 degrees. The average annual precipitation for the Lower Kanawha River Watershed is 41.62 inches per year.

The majority (77%) of the Lower Kanawha River Watershed is covered by deciduous, mixed and evergreen forests, while 11% of the land cover is classified as developed. The remaining land cover consists of grasslands, pastures, barren land, wetlands, crops, shrubs and open water. 4.75% of the entire watershed is covered by impervious surfaces.

Geologically, the Lower Kanawha River Watershed consists predominantly (92%) of sandstone and shale, while containing a small percentage (8%) of alluvium along the Kanawha River.

The United States Geological Survey (USGS), in conjunction with federal, state and local agencies, including the DEP, cooperatively funds the USGS stream gaging network to monitor water availability. Currently, there are three surface water gaging stations and one groundwater gaging station located within the watershed. The groundwater gaging station is a well site located within the Kanawha State Forest, while surface water data is collected from the stream gages located on Hurricane Creek (1) and multiple locations on the Kanawha River (2). The recorded data can be accessed at http://waterdata.usgs.gov/nwis.

LQU data

Table 4-8 contains a list of all Large Quantity User (LQU) facilities in the Lower Kanawha Watershed that are currently operating, their Standard Industrial Category (SIC) of use, the average percent of source water withdrawn annually, percent withdrawn from the watershed and county, as well as others if intakes are located elsewhere, and the average amount of water withdrawn by the facility based on the

most recent three years of monthly data. A detailed discussion about categories of use type and comparisons of use to statewide withdrawals and consumption is available in Chapter 2 of the Plan. Chapter 4 of the Plan includes data and discussion about future use projections. The following is a summary of data collected regarding the facilities:

- 4 Chemical facilities
    - 1 closed in 2003: FMC Corporation Steam plant
    - Union Carbide south Charleston and Bayer CropScience – Institute Plant withdraws the most water
- 3 Public Water Suppliers
    - Putnam being the largest
- 1 Recreation facility: Edgewood Country Club
- 1 Thermoelectric (coal) facility: John E. Amos Plant
- 1 Hydroelectric facility: Winfield Hydroelectric Project.

Table 4-8 All facilities withdrawing from Lower Kanawha Watershed organized by Use Category and Intake Source and Location (watershed and county). Blanks indicate that no additional withdrawals were occurring.

Facility ID	Facility Name	Use Category	Source and % of 3 Year Average	Watershed and % of 3 Year Average	County and % of 3 Year Average	3 Year Annual Average (gallons)
2082	Bayer CropScience - Institute Plant	Chemical	Surface Water 100.00%	Lower Kanawha 100.00%	Kanawha 100.00%	40,648,925,000
2419	Clearon Corporation	Chemical	Surface Water 100.00%	Lower Kanawha 100.00%	Kanawha 100.00%	261,917,280
1185	Edgewood Country Club - Golf Facility	Recreation	Surface Water 100.00%	Lower Kanawha 100.00%	Kanawha 100.00%	12,350,000
1871	Hurricane Water Company	Public water supply	Surface Water 100.00%	Lower Kanawha 100.00%	Putnam 100.00%	232,325,000
3803	John E Amos Plant	Thermoelectric (coal)	Surface Water 100.00%	Lower Kanawha 100.00%	Putnam 100.00%	14,411,032,933
2271	Putnam Public Service District	Public water supply	Surface Water 100.00%	Lower Kanawha 100.00%	Putnam 100.00%	597,101,333
1620	Union Carbide South Charleston Facility	Chemical	Surface Water 100.00%	Lower Kanawha 100.00%	Roane 100.00%	22,207,680,000
3126	Walton PSD	Public water supply	Surface Water 100.00%	Lower Kanawha 100.00%	Kanawha 100.00%	47,306,890
10104	Winfield Hydroelectric Project	Hydroelectric	Surface Water 100.00%	Lower Kanawha 100.00%	Putnam 100.00%	1,552,169,273,905

Figures 4-27 through 4-30 summarize the breakdown of the share total withdrawals occurring among currently operating facilities, the trends in use over time for each industry group for currently operating LQUs in the watershed. 100% of the water withdrawn from the Lower Kanawha Watershed by registered LQUs in the state is from surface water sources.

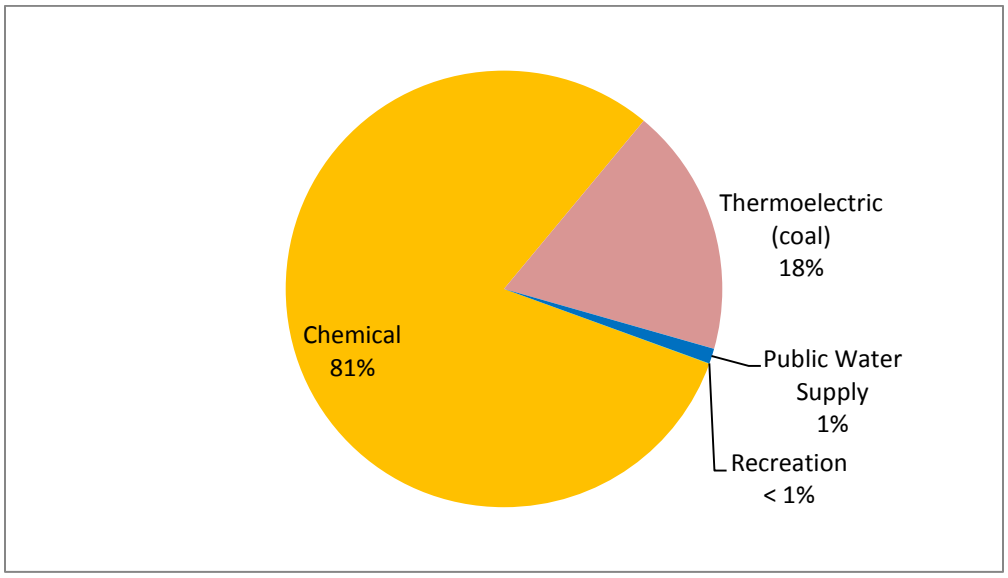
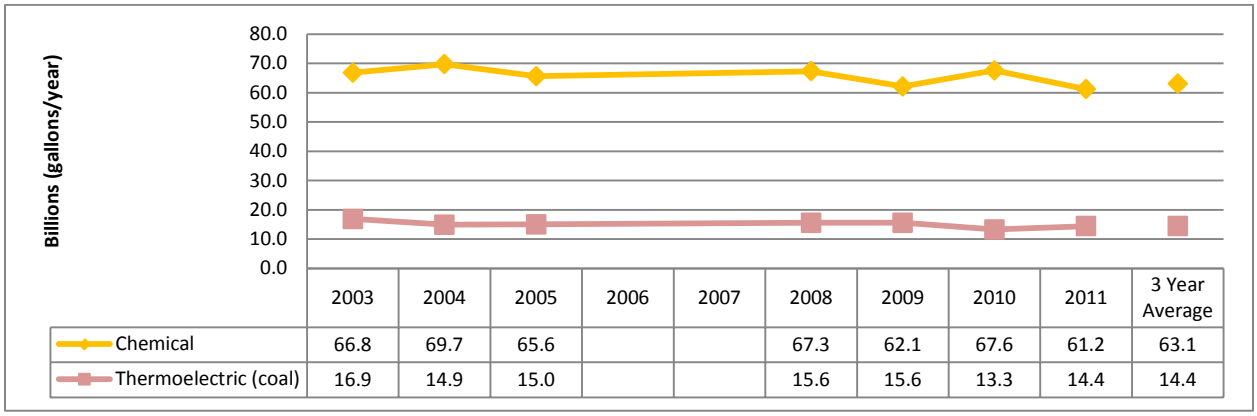
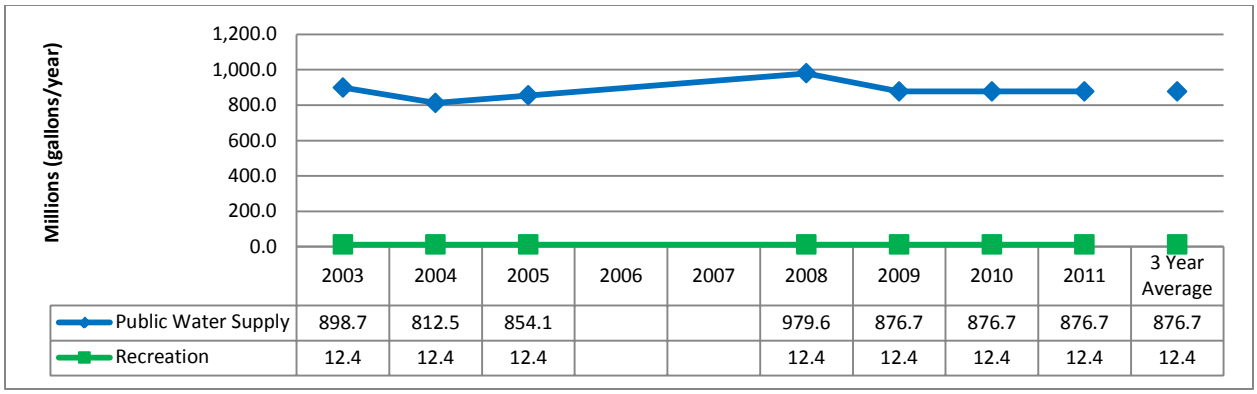


Figure 4-27 Lower Kanawha Watershed LQU percent of total average annual water withdrawals by sector (excluding hydroelectric).



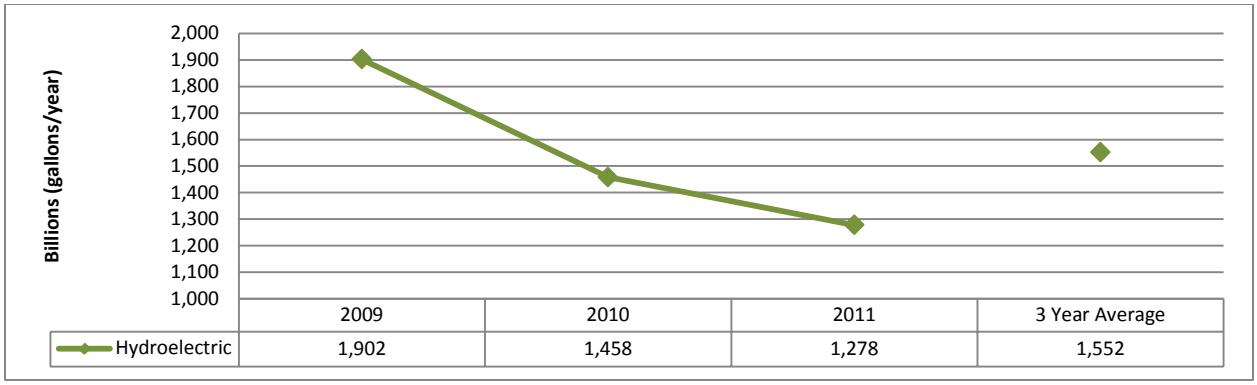
	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Chemical	66.8	69.7	65.6			67.3	62.1	67.6	61.2	63.1
Thermoelectric (coal)	16.9	14.9	15.0			15.6	15.6	13.3	14.4	14.4

Figure 4-28 Lower Kanawha Watershed LQU water withdrawal trends for the Chemical and Thermoelectric (coal) SIC categories, measured in billions of gallons per year.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Public Water Supply	898.7	812.5	854.1			979.6	876.7	876.7	876.7	876.7
Recreation	12.4	12.4	12.4			12.4	12.4	12.4	12.4	12.4

Figure 4-29 Lower Kanawha Watershed LQU water withdrawal trends for the Public Water Supply and Recreation SIC categories, measured in millions of gallons per year.



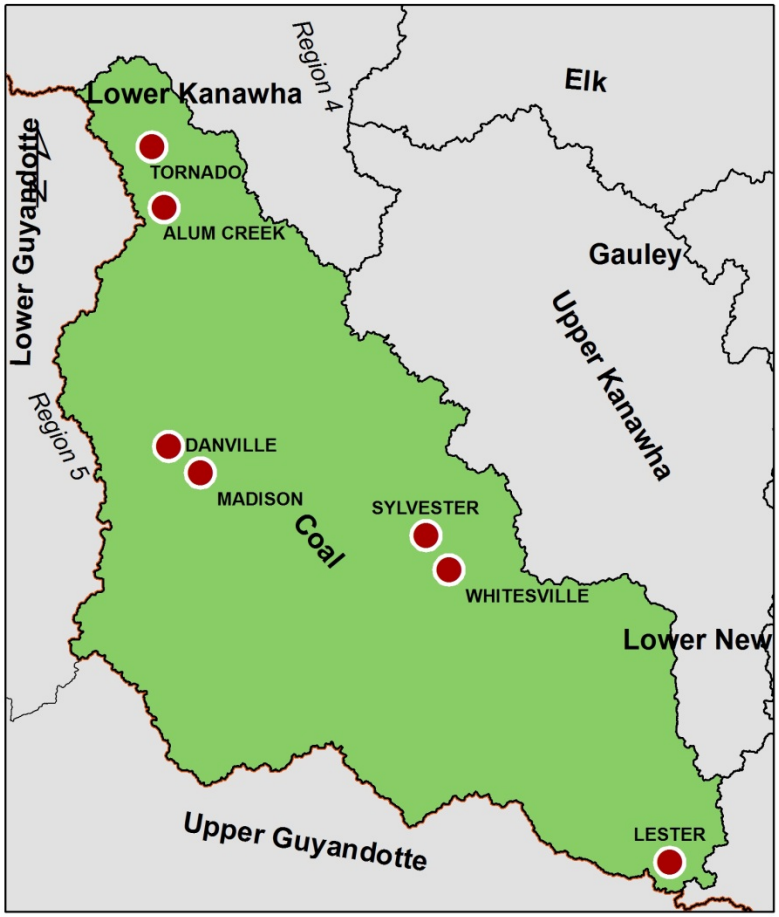
	2009	2010	2011	3 Year Average
Hydroelectric	1,902	1,458	1,278	1,552

Figure 4-30 Lower Kanawha Watershed LQU water withdrawal trends for the Hydroelectric SIC category, measured in billions of gallons per year.

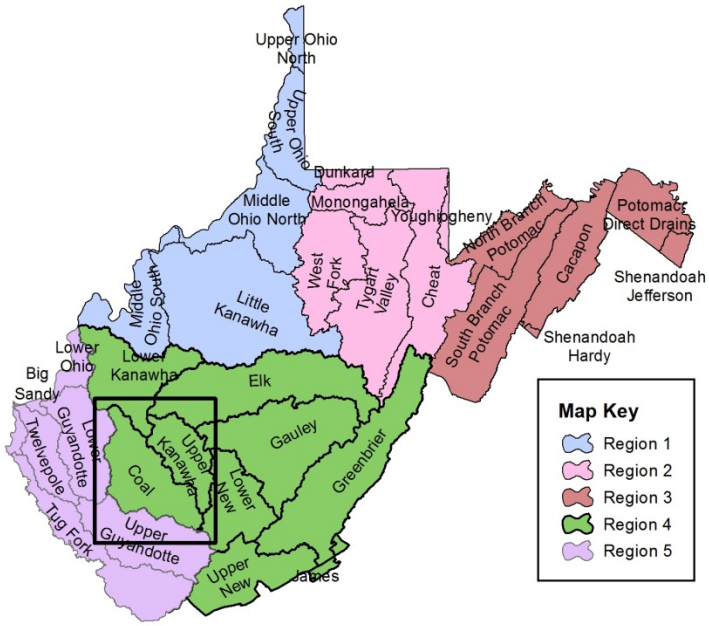
Interbasin transfers occur when water is permanently moved from one watershed to another. This can occur in a number of ways. However, only three possible routes of transfer are considered here; see Chapter 2 of the Plan for a discussion of possibilities and data limitations. The following is a detailed list of interbasin transfers occurring between the Lower Kanawha and other HUC-8 watersheds as a result of LQU operations in 2011:

- Withdrawals vs. Stream Discharges
    - None reported
- Withdrawals vs. POTW discharges
    - None reported
- Purchased water vs. Stream/POTW Discharges

- Bayer CropScience – Institute Plant purchases a three-year average of water from the West Virginia American Water Company in the Elk Watershed approximately equal to 232.7 million gallons per year. The water is reportedly used as cooling water, zeolite treated process water, boiler feed water and for emergency fire water. The only form of discharge reported is stream discharge at eight locations that fall under a single NPDES permit number. All water discharged from the facility at these locations enters the Lower Kanawha Watershed at a three-year average rate of 42.2 billion gallons per year.



Coal River Watershed



Coal River Watershed

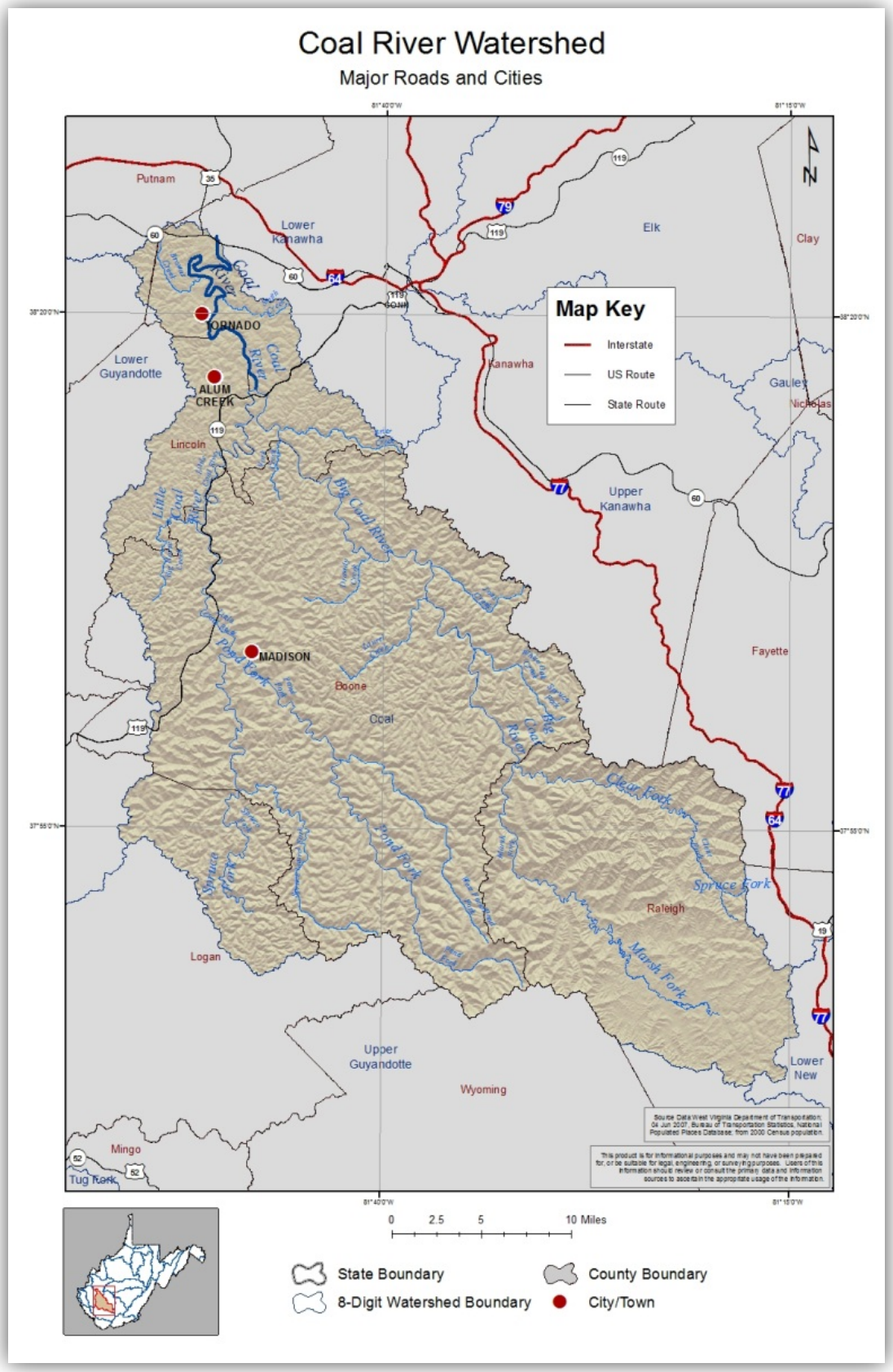
Watershed Description

Located in south-central West Virginia, the Coal River Watershed extends from Raleigh County in the southeast to the city of Saint Albans, West Virginia in the northwest. Covering approximately 892 square miles, the watershed contains portions of six counties (Putnam, Kanawha, Lincoln, Boone, Logan and Raleigh). Boone and Raleigh counties comprise 79% of the total area of the watershed.

The Coal River Watershed has 2,232 miles of streams and rivers and contains the Coal River. The Coal River mainstem is formed near the town of Alum Creek from the convergence of the Little Coal River and the Big Coal River. From Alum Creek, the Coal flows northerly through the northern portion of the watershed to its confluence with the Kanawha River in Saint Albans. Major tributaries include Marsh Fork, Clear Fork, Pond Fork, Spruce Fork, Little Coal River and Big Coal River. Additionally, the watershed encompasses a portion of the Kanawha State Forest in Kanawha County.

Demographics

The Coal River Watershed has a total population of approximately 57,265. The watershed has three cities and towns with a population exceeding 1,000. The largest city within the watershed is Tornado with a total population of 3,701, followed by Madison (3,076) and Alum Creek (1,749).


Coal River Watershed
Major Roads and Cities
Map Key
Interstate
US Route
State Route
Putnam
Lower Kanawha
Elk
Clay
Lower Guyandotte
Kanawha
Gauley
Nicholas
Lincoln
Upper Kanawha
Fayette
Boone
Coal
Raleigh
Logan
Upper Guyandotte
Wyoming
Lower New
Mingo
Tug Fork
TORNADO
ALUM CREEK
MADISON
Coal River
Big Coal River
Little Coal River
Pond Fork
Clear Fork
Spruce Fork
Marsh Fork
0 2.5 5 10 Miles
State Boundary
County Boundary
8-Digit Watershed Boundary
City/Town

Geography and Geology

The Coal River Watershed lies within two ecoregions. More than 90% of the watershed occupies the Central Appalachians Ecoregion, which is characterized by rugged and mountainous terrain, cooler climate and a biologically diverse habitat. The northern portion of the watershed is contained within the Western Allegheny Plateau Ecoregion and is comprised of tall rounded hills with narrow valleys, mixed oak forests and agricultural lands. The average elevation for the watershed is 1,487 feet above mean sea level, with the highest elevation, 3,196 feet, located in the southeast on Ivy Knob which is on the border of Raleigh County and Wyoming County. The lowest elevation, 564 feet, is located in the northwest at the confluence of the Kanawha River and Coal River in Saint Albans.

The average annual temperature is 53 degrees Fahrenheit and ranges from 49 to 55 degrees. The average annual precipitation for the Coal River Watershed is 45.68 inches per year.

The majority (83%) of the Coal River Watershed is covered by deciduous, mixed and evergreen forests, while 4.7% of the land cover is classified as developed. The remaining land cover consists of grasslands, pastures, barren land, wetlands, crops, shrubs and open water. Only 2.3% of the entire watershed is covered by impervious surfaces.

Geologically, the Coal River Watershed consists predominantly (99%) of sandstone and shale, while containing a small percentage alluvium located in and around the Coal River Valley.

The United States Geological Survey (USGS), in conjunction with federal, state and local agencies, including the DEP, cooperatively funds the USGS stream gaging network to monitor water availability. Currently, there are three surface water gaging stations located within the watershed. Surface water data is collected from the stream gages located on Clear Fork at Whitesville (1), the Big Coal River at Ashford (1) and the Coal River at Tornado (1). The recorded data can be accessed at http://waterdata.usgs.gov/nwis.

LQU data

Table 4-9 contains a list of all Large Quantity User (LQU) facilities in the Coal Watershed that are currently operating, their Standard Industrial Category (SIC) of use, the average percent of source water withdrawn annually, percent withdrawn from the watershed and county, as well as others if intakes are located elsewhere, and the average amount of water withdrawn by the facility based on the most recent three years of monthly data. A detailed discussion about categories of use type and comparisons of use

to statewide withdrawals and consumption is available in Chapter 2 of the Plan. Chapter 4 of the Plan includes data and discussion about future use projections. The following is a summary of data collected regarding the facilities:

- 23 mining companies two of which have closed since data collection began. One closed in 2008 (Contract services) and one in 2009 (Endurance Coal Company). Hobet mining – Hobet 21 mine gets 81% of its water from the Coal Watershed and the rest from the Lower Guyandotte. Mingo Logan Coal Company – Mountain Laurel complex gets >99% of its water from the Coal Watershed but does get a small amount from the Upper Guyandotte as well.
- 4 Public water supply LQUs, one of which closed in 2007 (Sharples water treatment)

Table 4-9 All facilities withdrawing from Coal Watershed organized by Use Category and Intake Source and Location (watershed and county). Blanks indicate that no additional withdrawals were occurring.

Facility ID	Facility Name	Use Category	Source and % of 3 Year Average		Watershed and % of 3 Year Average		County and % of 3 Year Average		3 Year Annual Average (gallons)
4388	Apogee Coal Company - Guyan Surface Mine	Mining	Surface Water 100.00%		Coal 100.00%		Logan 100.00%		56,924,588
10003	Boone Raleigh PSD	Public water supply	Surface Water 100.00%		Coal 100.00%		Boone 100.00%		56,110,053
4413	Coal River Processing	Mining	Surface Water 100.00%		Coal 100.00%		Boone 100.00%		89,106,667
4520	Eastern Assoc - Harris Operating Unit - Pond Fork	Mining		Groundwater 100.00%	Coal 100.00%		Boone 100.00%		77,288,760
3722	Eastern Associated Coal - Jasper Workman	Mining	Surface Water 100.00%		Coal 100.00%		Boone 100.00%		14,848,000
3764	Eastern Associated Coal Corp - Wells Complex	Mining	Surface Water 85.96%	Groundwater 14.04%	Coal 100.00%		Boone 100.00%		20,277,231
3421	Elk Run Coal Company	Mining	Surface Water 100.00%		Coal 100.00%		Boone 100.00%		187,224,924
3348	Goals Coal Company, Inc.	Mining	Surface Water 100.00%		Coal 100.00%		Raleigh 100.00%		453,927,332
4896	Independence Coal Co - Liberty Processing	Mining	Surface Water 100.00%		Coal 100.00%		Boone 100.00%		78,811,004
10108	Jack's Branch Coal Co - Admiral Processing	Mining	Surface Water 100.00%		Coal 100.00%		Boone 100.00%		119,819,000
3419	Marfork Coal Company, Inc.	Mining	Surface Water 100.00%		Coal 100.00%		Raleigh 100.00%		1,245,669,792
10087	Mingo Logan Coal Company - Left Fork No. 2 Surface	Mining	Surface Water 100.00%		Coal 100.00%		Raleigh 100.00%		5,176,000
10086	Mingo Logan Coal Company - Spruce No. 1 Mine	Mining	Surface Water 100.00%		Coal 100.00%		Logan 100.00%		7,320,000
4904	Omar Mining Co - Chesterfield Prep Plant	Mining	Surface Water 100.00%		Coal 100.00%		Boone 100.00%		57,408,000
3321	Performance Coal Company	Mining	Surface Water 100.00%		Coal 100.00%		Raleigh 100.00%		151,263,660
4056	Pine Ridge Coal Company	Mining	Surface Water 73.62%	Groundwater 26.38%	Coal 100.00%		Boone 100.00%		291,137,280
7607	Pioneer Fuel - Ewing Fork Surface Mine	Mining	Surface Water 100.00%		Coal 100.00%		Raleigh 100.00%		26,160,000
3453	Progress Coal - Twilight MTR Surface Mine	Mining	Surface Water 100.00%		Coal 100.00%		Raleigh 100.00%		44,610,067
3785	Rivers Edge Mining - Rivers Edge Mine	Mining	Surface Water 100.00%		Coal 100.00%		Boone 100.00%		11,073,226
10017	Lincoln Public Service District	Public water supply	Surface Water 100.00%		Coal 100.00%		Kanawha 100.00%		145,930,000
10016	St Albans Water	Public water supply	Surface Water 100.00%		Coal 100.00%		Kanawha 100.00%		486,227,000
7522	Sycamore Water Plant	Public water supply		Groundwater 100.00%	Coal 100.00%		Raleigh 100.00%		19,285,913
4685	Catenary Coal Company - Samples Mine Complex	Mining	Surface Water 100.00%		Coal 48.06%	Upper Kanawha 51.94%	Boone 48.06%	Kanawha 51.94%	102,356,004
4454	Hobet Mining - Hobet 21 Mine	Mining	Surface Water 100.00%		Coal 81.36%	Lower Guyandotte 18.64%	Boone 94.92%	Lincoln 5.08%	914,308,971

Figures 4-31 through 4-33 summarize the breakdown of the share total withdrawals occurring among currently operating facilities, the trends in use over time for each industry group, and the amount and share of source water withdrawn by the currently operating LQUs in the watershed.

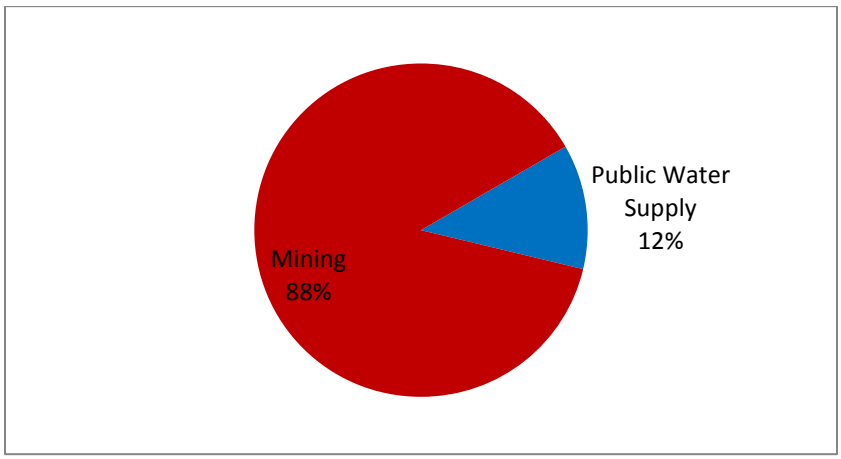
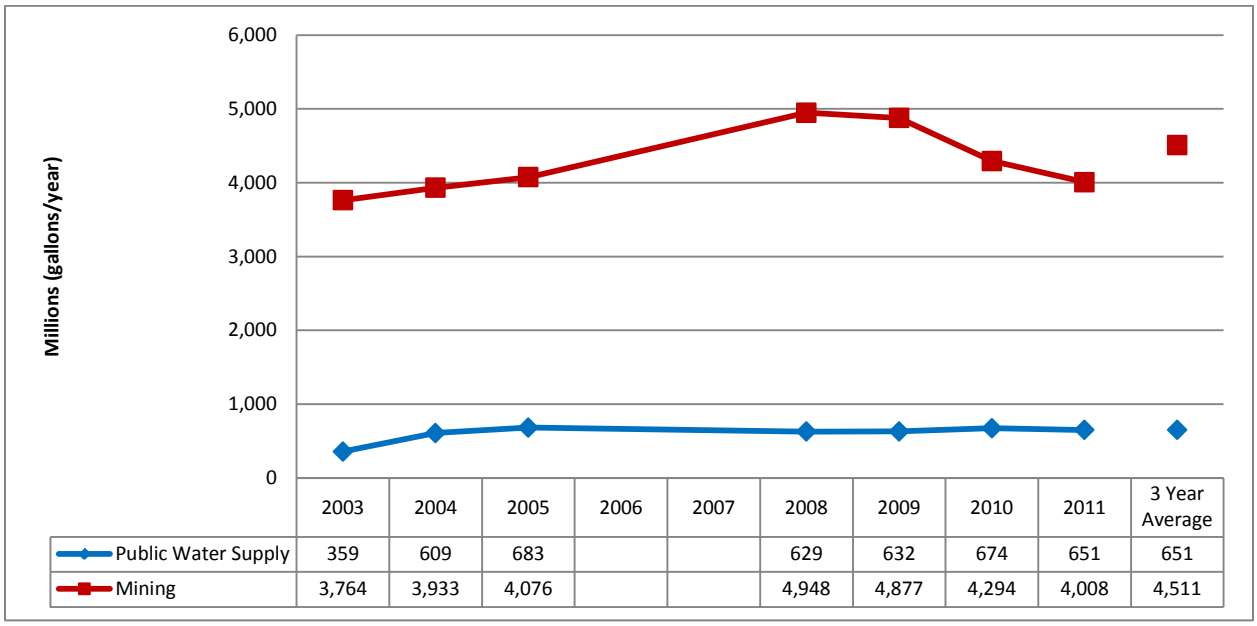


Figure 4-31 Coal Watershed LQU percent of total average annual water withdrawals by sector.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Public Water Supply	359	609	683			629	632	674	651	651
Mining	3,764	3,933	4,076			4,948	4,877	4,294	4,008	4,511

Figure 4-32 Coal Watershed LQU water withdrawal trends for the Public Water Supply and Mining SIC categories, measured in millions of gallons per year.

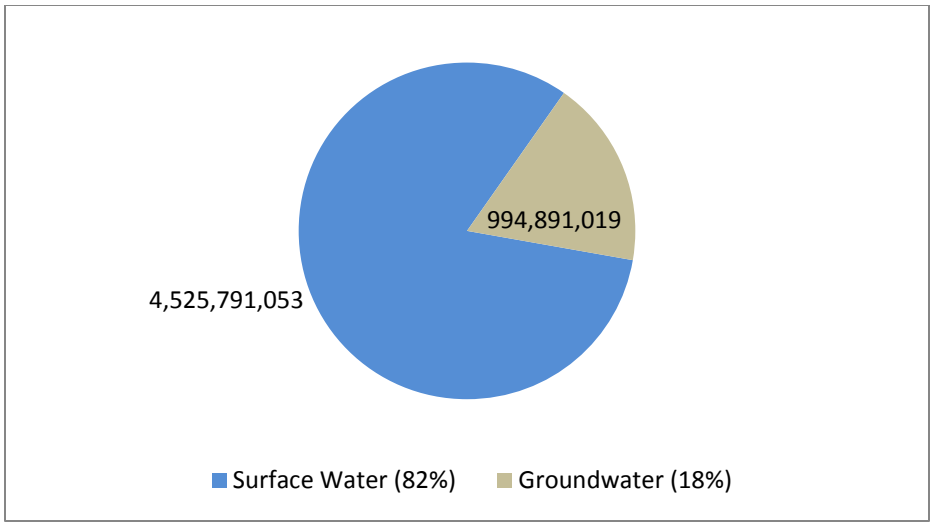


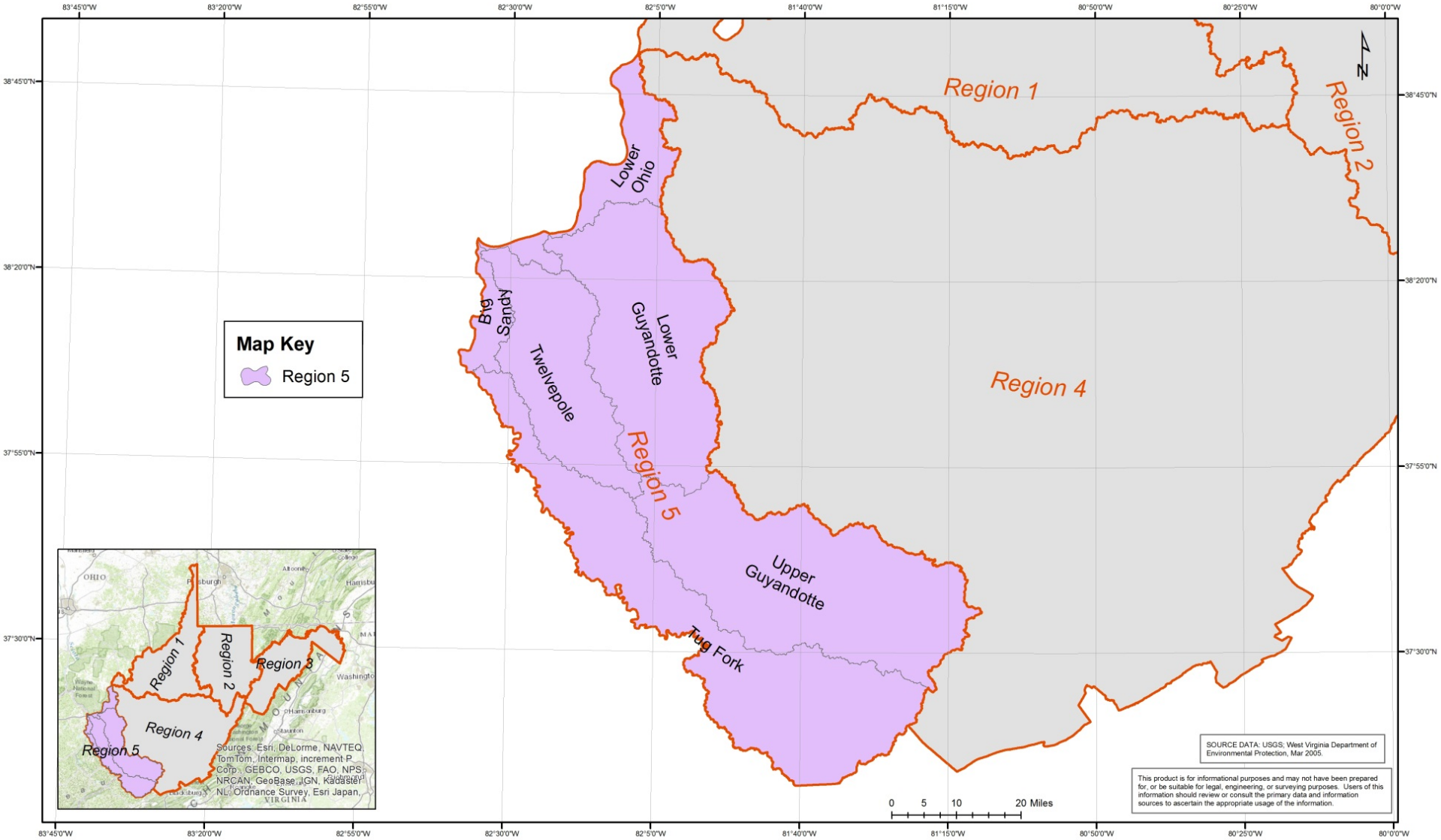
Figure 4-33 Average annual gallons of water withdrawn by LQUs from groundwater and surface water sources in the Coal Watershed.

Interbasin transfers occur when water is permanently moved from one watershed to another. This can occur in a number of ways. However, only three possible routes of transfer are considered here; see Chapter 2 of the Plan for a discussion of possibilities and data limitations. The following is a detailed list of interbasin transfers occurring between the Coal and other HUC-8 watersheds as a result of LQU operations in 2011:

- Withdrawals vs. Stream Discharges
    - Catenary Coal Company – Samples Mine Complex withdraws a three-year average of approximately 53 million gallons of water from a surface water source in the Upper Kanawha and approximately 49 million gallons of surface water from the Coal Watershed. The water is used as process water, dust control, truck wash and for domestic purposes. Reportedly, 49 million gallons are discharged into the surface water of the Coal Watershed, and 53 million gallons are discharged into surface water sources of the Upper Kanawha Watershed. Although haul water and truck wash is a reported use, no values for gallons discharged for this purpose have been provided.
    - Hobet Mining – Hobet 21 Mine withdraws a three-year average of approximately 170 million gallons of surface water from the Lower Guyandotte Watershed and 744 million gallons from surface sources in the Coal Watershed for use in the mining and processing of coal including spraying haul roads to suppress fugitive dust. The three-year average discharge to surface sources in the Coal Watershed is reported to be approximately 215 million gallons of water annually.
- Withdrawals vs. POTW discharges
    - None reported

- Purchased water vs. Stream/POTW Discharges
    - Catenary Coal Company – Samples Mine Complex purchases an approximate annual average of 238 thousand gallons of water from the Upper Kanawha Watershed via West Virginia American Water. The water is used as process water, dust control, truck wash and for domestic purposes. Reportedly, 49 million gallons are discharged into the surface water of the Coal Watershed, and 53 million gallons are discharged into surface water sources of the Upper Kanawha Watershed. Although haul water and truck wash is a reported use, no values for gallons discharged for this purpose have been provided.

Region 5


Region 1
Region 2
Region 4
Region 5
Lower Ohio
Big Sandy
Twelvepole
Lower Guyandotte
Upper Guyandotte
Tug Fork
Map Key
Region 5
Region 1
Region 2
Region 3
Region 4
Region 5
Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster, NL, Ordnance Survey, Esri Japan,
0 5 10 20 Miles
SOURCE DATA: USGS; West Virginia Department of Environmental Protection, Mar 2005.
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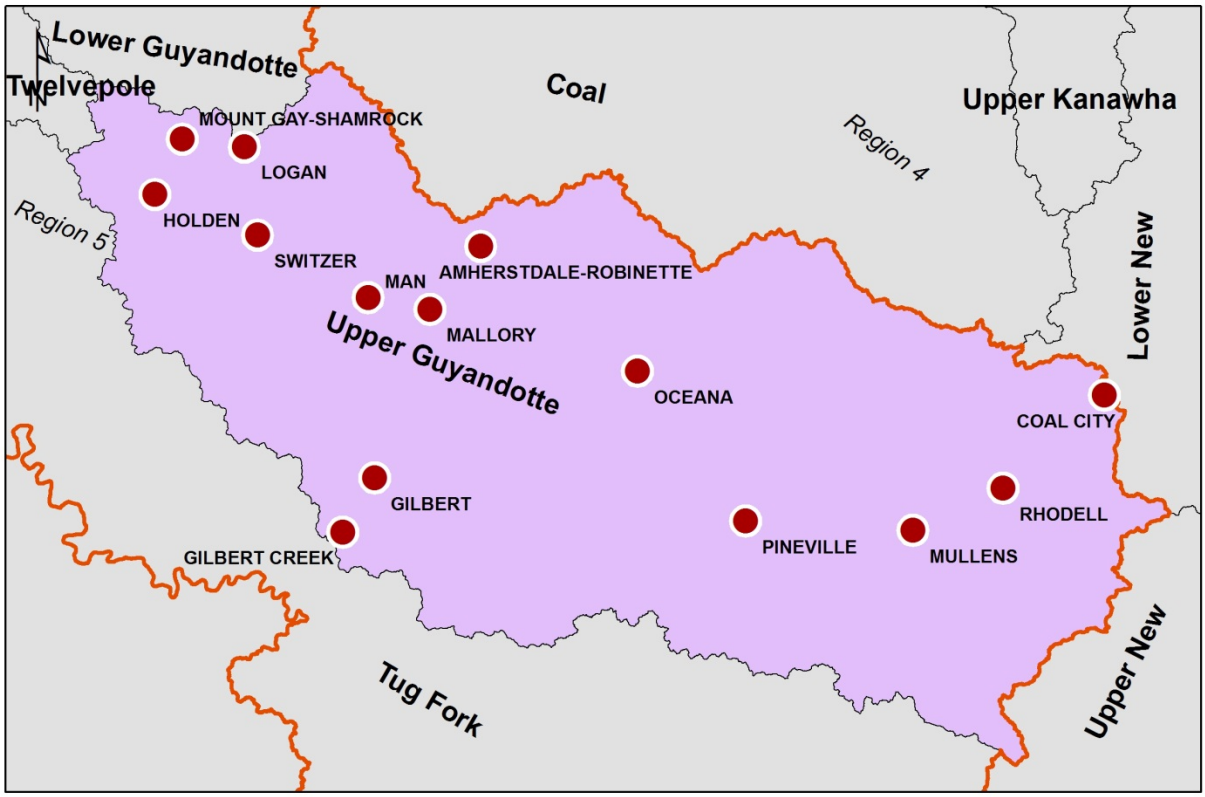
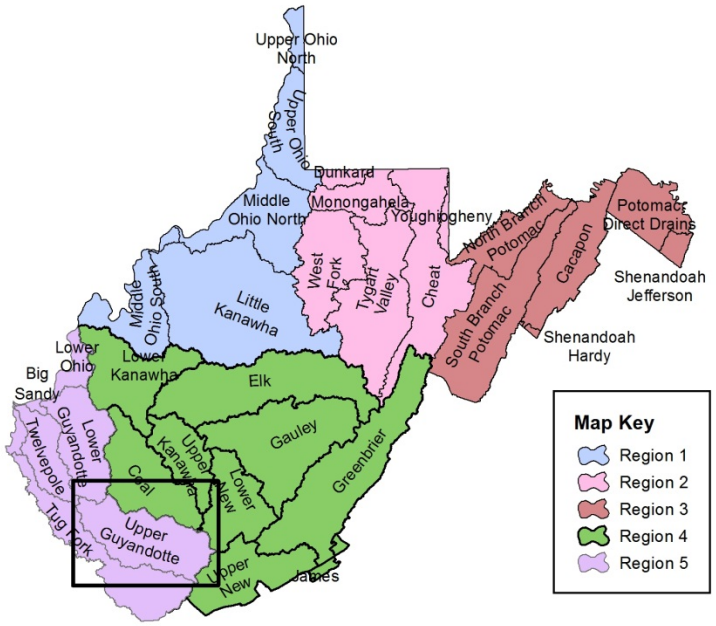
Upper Guyandotte River Watershed





Region 5

Upper Guyandotte River Watershed

Watershed Description

Located in the coalfields of southwestern West Virginia, the Upper Guyandotte River Watershed extends northwesterly from Wyoming County to central Logan County. Encompassing 940 square miles, the watershed contains all, or portions, of four West Virginia counties (Wyoming, Logan, Raleigh and Mingo). Wyoming and Logan counties comprise 83% of the total area of the watershed.

The Upper Guyandotte River Watershed has 2,200 miles of streams and rivers and contains the headwaters of the Guyandotte River. Formed at the confluence of Devils Fork and Tommy Creek in western Raleigh County, the Guyandotte River flows northwesterly through the watershed to the city of Logan. The major tributaries include Pinnacle Creek, Clear Fork, Buffalo Creek and Island Creek. The Upper Guyandotte River Watershed also encompasses R.D. Bailey Lake, which is located on the Guyandotte River near the town of Justice on the Wyoming-Mingo County border. The lake, which was dedicated in 1980, has 630 acres of surface area during summer pool. The R.D. Bailey Dam maintains a minimum flow release of 45 cubic feet per second.

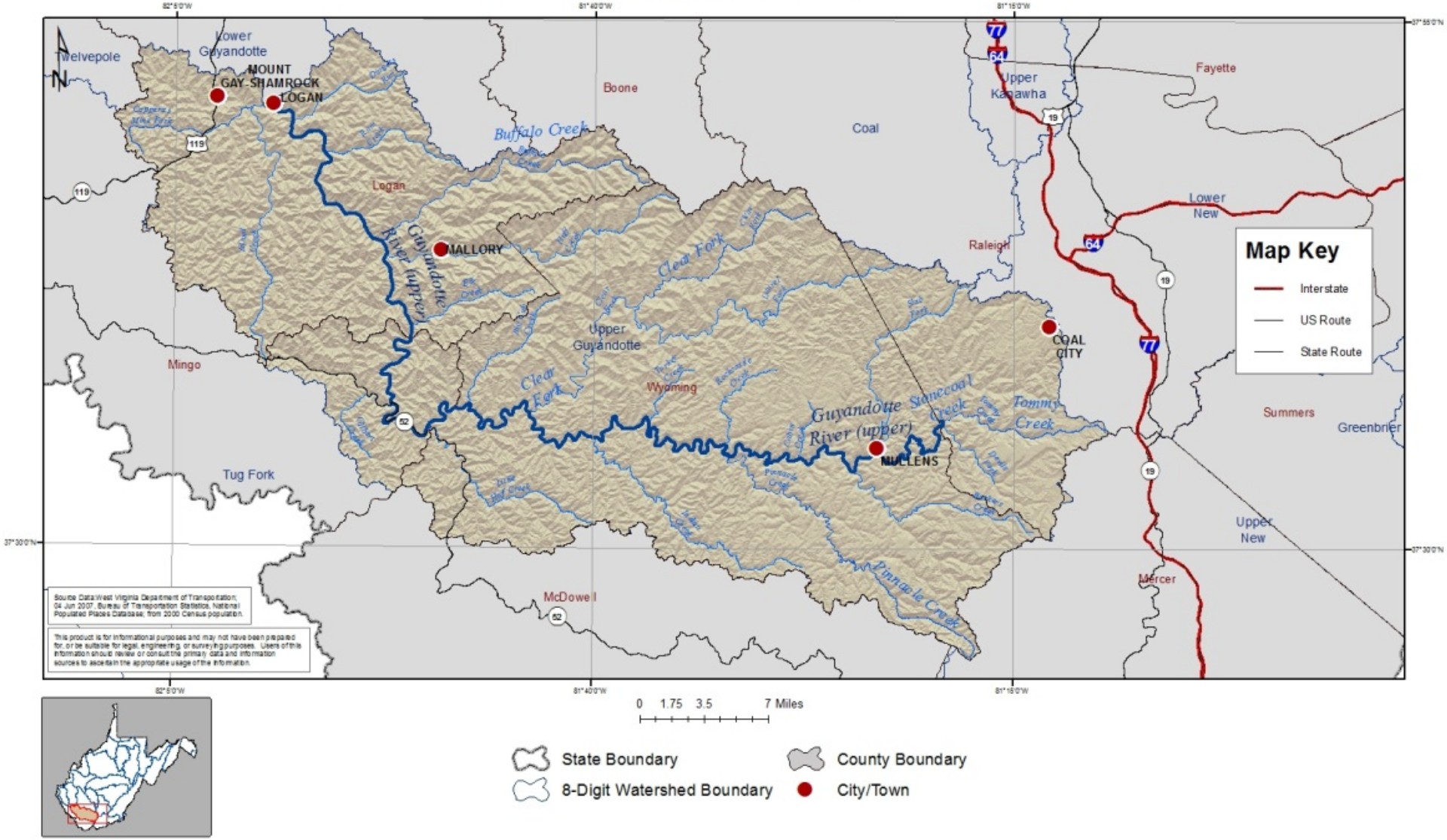
Additionally, the watershed encompasses all, or portions, of the following state public lands: two state parks (Chief Logan and Twin Falls) and three wildlife management areas (Elk Creek, Horse Creek and R.D. Bailey Lake).

Demographics

The Upper Guyandotte River Watershed has a total population of approximately 51,783. The watershed has five cities/towns with a population exceeding 1,500. The largest city within the watershed is Coal City in Raleigh County with a total population of 1,812, followed by Logan (1,779), Mount Gay-Shamrock (1,779), Mallory (1,654) and Mullens (1,559).

Upper Guyandotte River Watershed

Major Roads and Cities



Geography and Geology

The watershed lies entirely within the Central Appalachians Ecoregion, which is characterized by rugged and mountainous terrain, cooler climate, and a biologically diverse habitat. The average elevation for the watershed is 1,825 feet above mean sea level, with the highest elevation of 3,553 feet recorded in the north on the summit of Ivy Knob in Wyoming County. The lowest elevation, 661 feet, is recorded in the City of Logan. The average annual temperature is 53 degrees Fahrenheit and ranges from 49 to 55 degrees. The average annual precipitation for the Upper Guyandotte River Watershed is 45.65 inches per year.

More than 84% of the watershed is covered by forests, while 6% is classified as developed. The remaining land cover consists of grasslands, pastures, barren land, wetlands, crops, shrubs and open water. Only 2.5% of the entire watershed is covered by impervious surfaces.

The surface geology in the Upper Guyandotte River Watershed is comprised entirely of sandstone.

The United States Geological Survey (USGS), in conjunction with federal, state and local agencies, including the DEP, cooperatively funds the USGS stream gaging network to monitor water availability. Currently, there are four surface water gaging stations and one groundwater gaging station located within the watershed. The groundwater gaging station is a well site located in Wyoming County, while surface water data is collected from the stream gages located on Clear Fork (1) and multiple sites along the Guyandotte River (3). The recorded data can be accessed at http://waterdata.usgs.gov/nwis.

LQU data

Table 5-1 contains a list of all Large Quantity User (LQU) facilities in the Upper Guyandotte Watershed that are currently operating, their Standard Industrial Category (SIC) of use, the average percent of source water withdrawn annually, percent withdrawn from the watershed and county, as well as others if intakes are located elsewhere, and the average amount of water withdrawn by the facility based on the most recent three years of monthly data. A detailed discussion about categories of use type and comparisons of use to statewide withdrawals and consumption is available in Chapter 2 of the Plan. Chapter 4 of the Plan includes data and discussion about future use projections. The following is a summary of data collected regarding the facilities:

- 23 Public Water Suppliers
    - 12 are closed: 1 in 2005, 2 in 2006, 4 in 2007, 3 in 2008, 1 in 2009 and 1 in 2010
    - The City of Logan Water Department withdraws the most water, averaging 506 million gallons annually
- 20 Mining facilities
    - 4 Closed: Simmons Fork Surface mine 2004, Keystone No. 2 Prep plant 2005 and Road Fork Development – Superior Surface 2009 and Paynter Branch Mining – Paynter Branch Surface Mine 2011
    - Pinnacle, Apogee Co – Ruffner & Winifrede Mine – Fanco Pit, Aracoma Coal – Alma mine use the most annually, averaging between 220 million and 300 million gallons a year each.
    - Arch Coal withdraws 37% from Upper Guyandotte and the remainder from Tug Fork
    - Cobra Natural Resources – Mountaineer Mine and Plant withdraws 99% from Upper Guyandotte, and the remainder from Tug Fork
    - Mingo Logan Coal Company –Mountain Laurel Complex withdrawals <1% of their water from the Upper Guyandotte, getting the majority from the Coal Watershed.
- 1 Agriculture/aquaculture facility: Rockhouse Springs, LLC, closed in 2008
    - The same amount of water was reportedly withdrawn each year

Table 5-1 All facilities withdrawing from Upper Guyandotte Watershed organized by Use Category and Intake Source and Location (watershed and county). Blanks indicate that no additional withdrawals were occurring.

Facility ID	Facility Name	Use Category	Source and % of 3 Year Average		Watershed and % of 3 Year Average		County and % of 3 Year Average		3 Year Annual Average (gallons)
3772	Apogee Coal Company - Fanco Loadout and Beltline	Mining		Groundwater 100.00%	Upper Guyandotte 100.00%		Logan 100.00%		17,454,000
3721	Apogee Coal Co-Ruffner & Winifrede Mine-Fanco Plt	Mining	Surface Water 100.00%		Upper Guyandotte 100.00%		Logan 100.00%		299,865,600
4544	Aracoma Coal - Alma Mine	Mining		Groundwater 100.00%	Upper Guyandotte 100.00%		Logan 100.00%		261,504,000
4527	Aracoma Coal - Hernshaw Mine	Mining		Groundwater 100.00%	Upper Guyandotte 100.00%		Logan 100.00%		25,488,000
4161	Arch Coal - Coal-Mac, Inc.	Mining	Surface Water 7.85%	Groundwater 92.15%	Tug Fork 45.69%	Upper Guyandotte 54.31%	Mingo 45.69%	Logan 54.31%	97,403,267
4343	Bandmill Coal Corp - Bandmill Preparation Plant	Mining	Surface Water 100.00%		Upper Guyandotte 100.00%		Logan 100.00%		21,352,000
3911	Bandmill Coal Corp - Bandmill Surface	Mining	Surface Water 100.00%		Upper Guyandotte 100.00%		Logan 100.00%		10,726,667
4757	Brenton PSD	Public water supply		Groundwater 100.00%	Upper Guyandotte 100.00%		Wyoming 100.00%		17,075,200
1720	Buffalo Creek PSD	Public water supply		Groundwater 100.00%	Upper Guyandotte 100.00%		Logan 100.00%		124,299,329
2762	City of Logan Water Department	Public water supply	Surface Water 100.00%		Upper Guyandotte 100.00%		Logan 100.00%		505,653,620
4564	Cobra Natural Resources- Mountaineer Mine & Plant	Mining		Groundwater 100.00%	Tug Fork 1.18%	Upper Guyandotte 98.82%	Mingo 100.00%		158,548,357
10073	Covel Water Works	Public water supply		Groundwater 100.00%	Upper Guyandotte 100.00%		Wyoming 100.00%		7,089,167
10024	Gilbert Water Works	Public water supply	Surface Water 100.00%		Upper Guyandotte 100.00%		Mingo 100.00%		44,495,463
3662	Greenville Water Treatment Plant	Public water supply	Surface Water 100.00%		Upper Guyandotte 100.00%		Logan 100.00%		127,557,897
8059	Hampden Coal Company Prep Plant	Mining	Surface Water 100.00%		Upper Guyandotte 100.00%		Mingo 100.00%		116,361,600
4149	Highland Mining Co - Highland Surface	Mining	Surface Water 100.00%		Upper Guyandotte 100.00%		Logan 100.00%		5,081,667
4591	Keplar Pocahontas No. 51 Prep Plant	Mining	Surface Water 48.67%	Groundwater 51.33%	Upper Guyandotte 100.00%		Wyoming 100.00%		116,109,200
10091	Mingo Logan Coal Company - Mountain Laurel Complex	Mining	Surface Water 0.01%	Groundwater 99.99%	Coal 99.99%	Upper Guyandotte 0.01%	Logan 99.99%	Wyoming 0.01%	780,356,925
5097	Pineville Municipal Water Works	Public water supply	Surface Water 100.00%		Upper Guyandotte 100.00%		Wyoming 100.00%		114,309,680
1174	Pinnacle Mining Company, LLC	Mining		Groundwater 100.00%	Upper Guyandotte 100.00%		Wyoming 100.00%		223,880,001
3547	Pioneer Fuel Corp - Pioneer Load-out Facility	Mining	Surface Water 100.00%		Upper Guyandotte 100.00%		Wyoming 100.00%		11,424,000
8312	Pocahontas Coal Co. - East Gulf Preparation Plant	Mining	Surface Water 100.00%		Upper Guyandotte 100.00%		Raleigh 100.00%		78,962,390
2601	Ravencliff-McGraws-Saulsville PSD	Public water supply		Groundwater 100.00%	Upper Guyandotte 100.00%		Wyoming 100.00%		114,396,335
10068	Rhodell Water Works	Public water supply		Groundwater 100.00%	Upper Guyandotte 100.00%		Raleigh 100.00%		17,377,807

Facility ID	Facility Name	Use Category	Source and % of 3 Year Average		Watershed and % of 3 Year Average		County and % of 3 Year Average		3 Year Annual Average (gallons)
3941	Rum Creek Coal Sales - Anna Branch Surface	Mining		Groundwater 100.00%	Upper Guyandotte 100.00%		Logan 100.00%		8,096,667
3697	Stephenson Water Treatment Plant	Public water supply	Surface Water 100.00%		Upper Guyandotte 100.00%		Wyoming 100.00%		99,722,733
2197	Town of Man Water Works	Public water supply	Surface Water 100.00%		Upper Guyandotte 100.00%		Logan 100.00%		46,089,001
10037	Town of Oceana	Public water supply	Surface Water 100.00%		Upper Guyandotte 100.00%		Wyoming 100.00%		203,631,000

Figures 5-1 through 5-3 summarize the breakdown of the share total withdrawals occurring among currently operating facilities, the trends in use over time for each industry group, and the amount and share of source water withdrawn by the currently operating LQUs in the watershed.

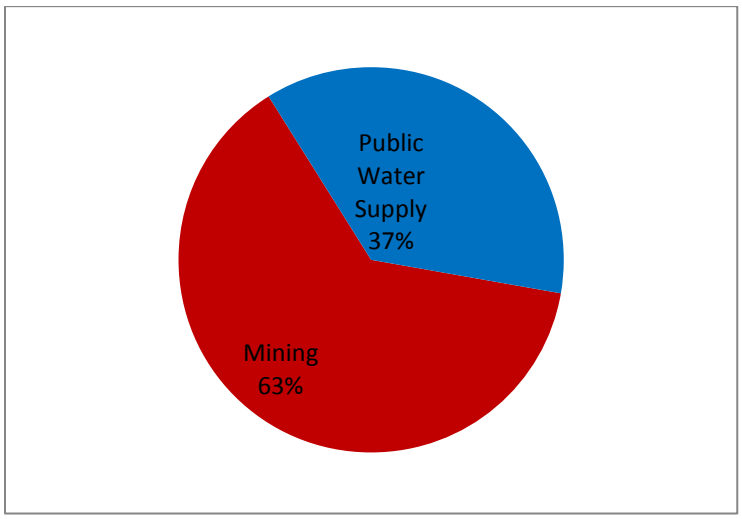
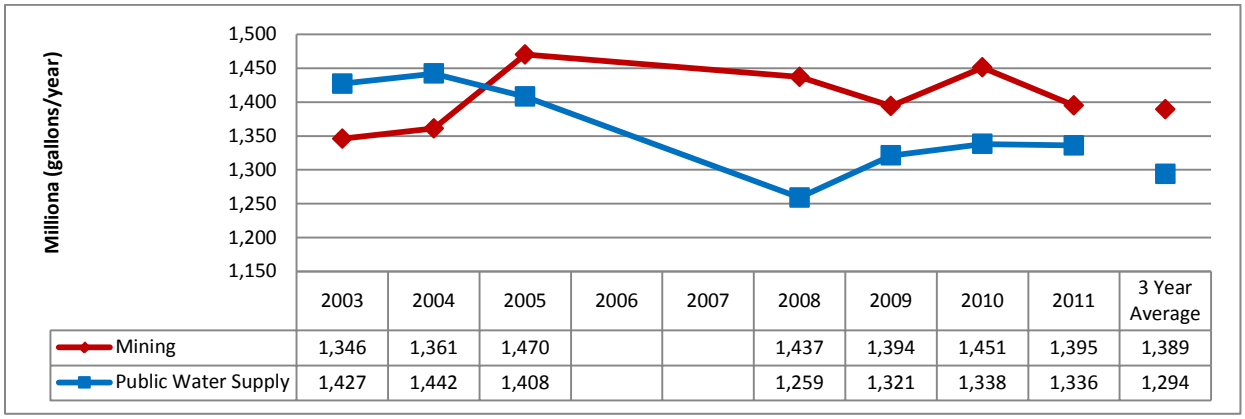


Figure 5-1 Upper Guyandotte Watershed LQU percent of total average annual water withdrawals by sector.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Mining	1,346	1,361	1,470			1,437	1,394	1,451	1,395	1,389
Public Water Supply	1,427	1,442	1,408			1,259	1,321	1,338	1,336	1,294

Figure 5-2 Upper Guyandotte Watershed LQU water withdrawal trends for the Agriculture/aquaculture, Mining, and Public Water Supply SIC categories, measured in millions of gallons per year.

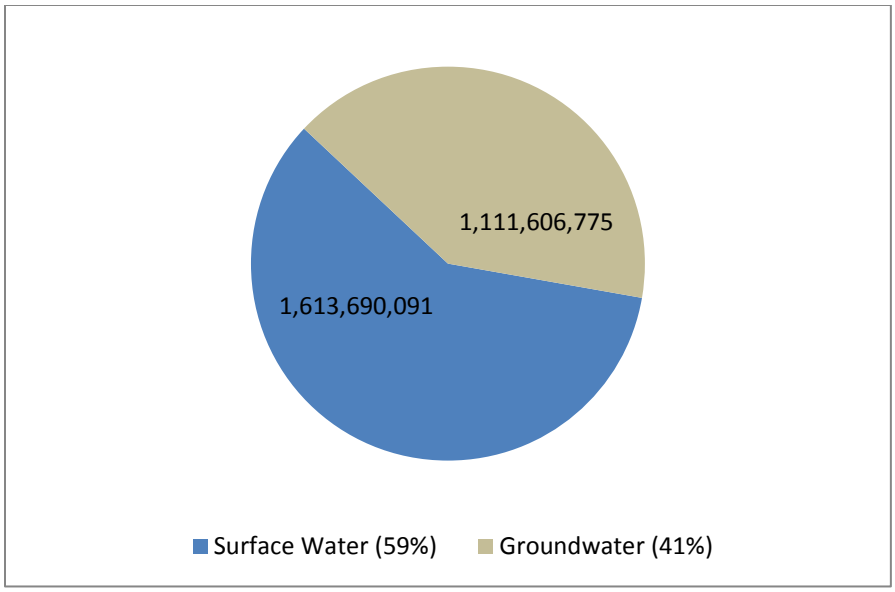
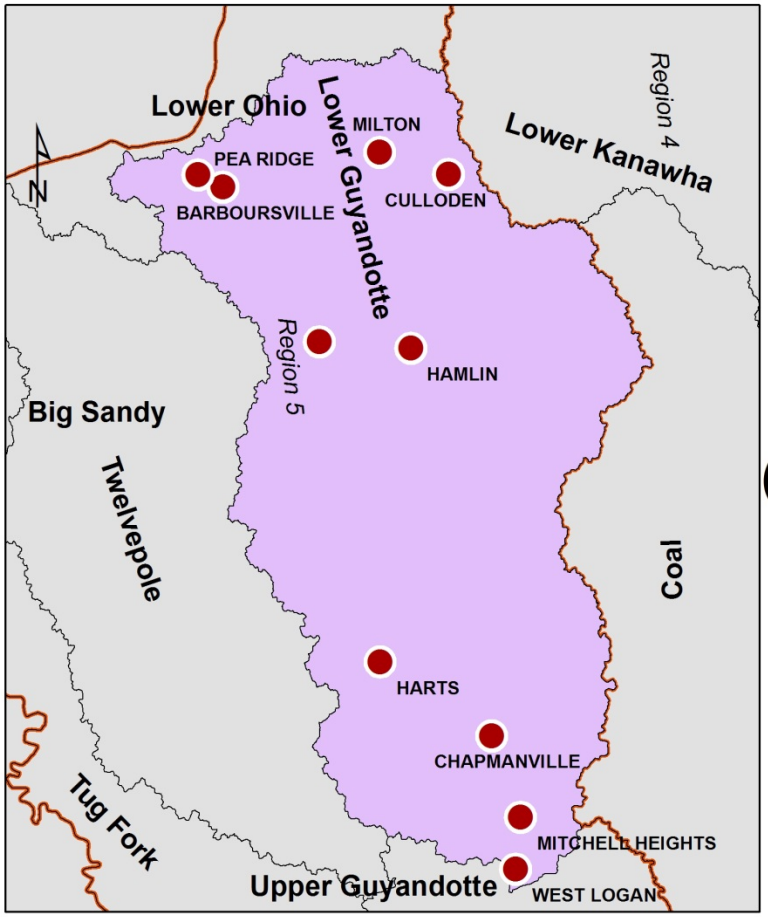


Figure 5-3 Average annual gallons of water withdrawn by LQUs from groundwater and surface water sources in the Upper Guyandotte Watershed.

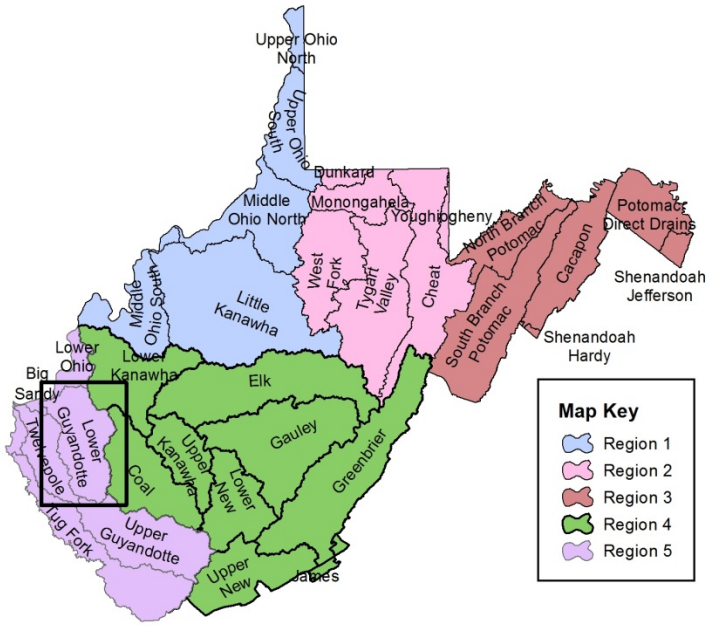
Interbasin transfers occur when water is permanently moved from one watershed to another. This can occur in a number of ways. However, only three possible routes of transfer are considered here; see Chapter 2 of the Plan for a discussion of possibilities and data limitations. The following is a detailed list of interbasin transfers occurring between the Upper Guyandotte and other HUC-8 watersheds as a result of LQU operations in 2011:

- Withdrawals vs. Stream Discharges
    - Cobra Natural Resources – Mountaineer Mine & Plant withdraws a three-year average of approximately 157 million gallons from ground water sources in the Upper Guyandotte Watershed and approximately 1.9 million gallons from ground water sources in the Tug Fork Watershed for use in the bath house and office. Approximately 1.9 million gallons are discharged into surface water sources in the Tug Fork Watershed annually.
- Withdrawals vs. POTW discharges
    - None reported

- Purchased water vs. Stream/POTW Discharges
    - Mingo Logan Coal Company – Mountain Laurel Complex purchases an approximate annual average of 12.9 million gallons of water from the Elk Watershed via West Virginia American Water. The water is used at multiple facilities in the process of mining coal including the preparation plant and longwall miner. A three-year average of approximately 345 million gallons of water a year is discharged into the Upper Guyandotte Watershed. There are no reported discharges into the Elk Watershed.

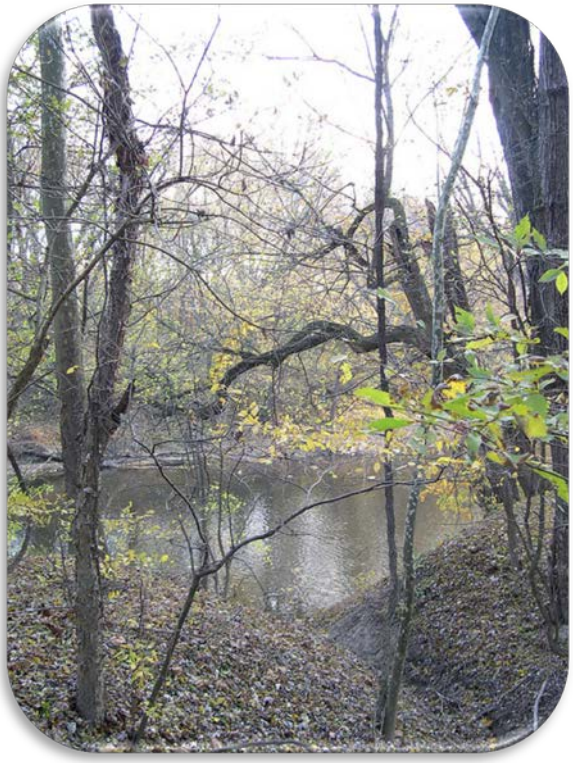


Lower Guyandotte River Watershed



Lower Guyandotte River Watershed

Watershed Description



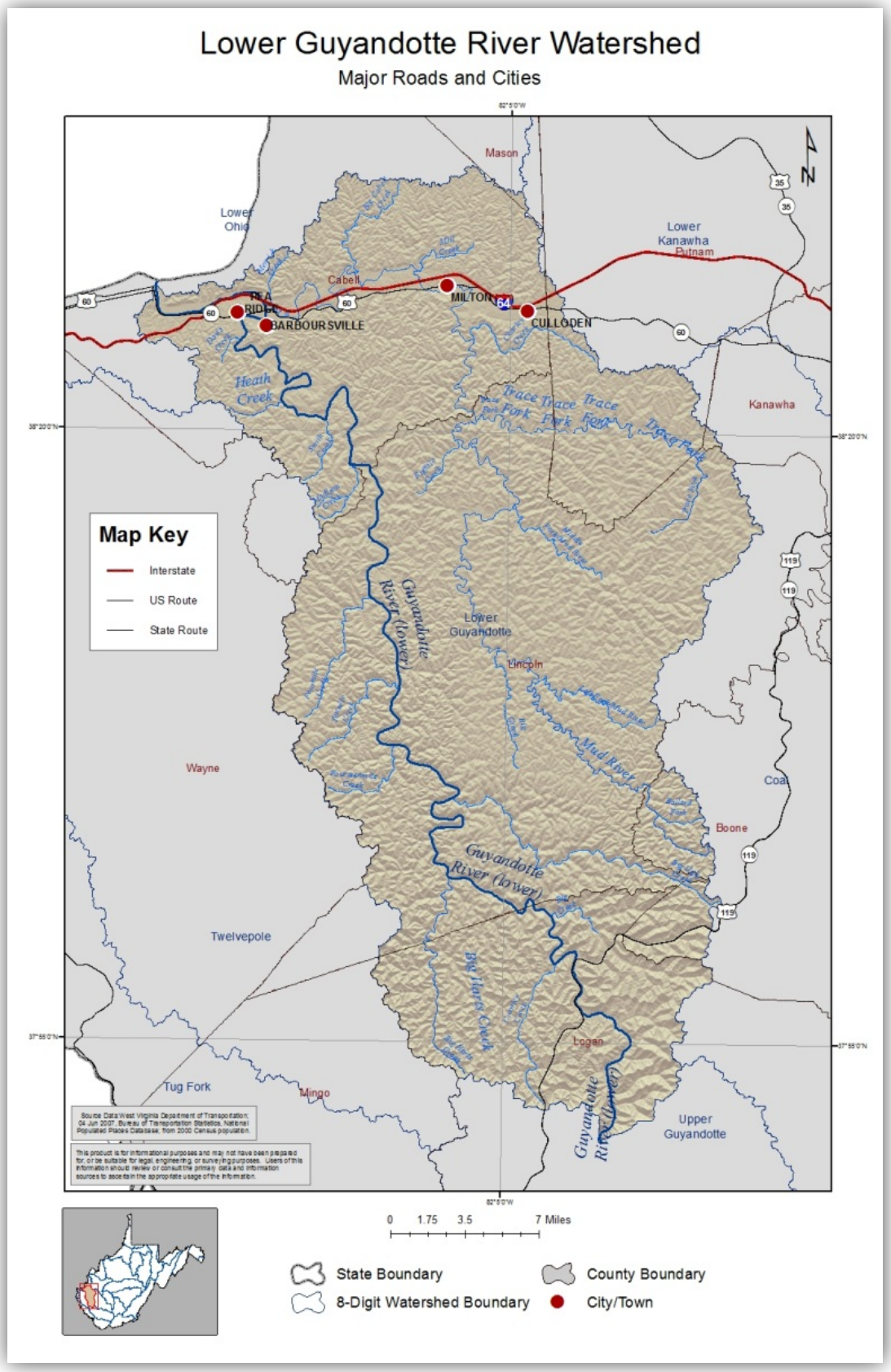
Located in southwestern West Virginia, the Lower Guyandotte River Watershed extends northerly from central Logan County to northern Cabell County. Encompassing 740 square miles, the watershed contains all, or portions, of seven West Virginia counties (Lincoln, Cabell, Logan, Putnam, Boone, Mason and Kanawha). Lincoln, Cabell and Logan counties comprise 90% of the total area of the watershed.

The Lower Guyandotte River Watershed has 1,796 miles of streams and rivers. The Guyandotte River mainstem flows northerly through the watershed from the City of Logan to its confluence with the Ohio River in Cabell County. The major tributaries include Big Harts Creek, Heath Creek and Mud River.

Additionally, the watershed encompasses all, or portions, of the following state public lands: one state park (Chief Logan) and five wildlife management areas (Big Ugly, Chief Logan, Hilbert, Mill Creek and Upper Mud River).

Demographics

The Lower Guyandotte River Watershed has a total population of approximately 87,210. The watershed has four cities/towns with a population exceeding 2,000. The largest town within the watershed is Pea Ridge CDP (Census Designated Place) in Cabell County with a total population of 6,650, followed by Barboursville (3,964), Culloden (3,061) and Milton (2,423).


Lower Guyandotte River Watershed
Major Roads and Cities
Mason
Lower Ohio
Lower Kanawha Putnam
Cabell
MILTON
CULLODEN
BARBOURSVILLE
Heath Creek
Trace Fork
Kanawha
Map Key
Interstate
US Route
State Route
Guyandotte River (lower)
Lower Guyandotte
Lincoln
Mud River
Wayne
Coal
Boone
Twelvepole
Big Harts Creek
Logan
Tug Fork
Mingo
Upper Guyandotte
0 1.75 3.5 7 Miles
State Boundary
County Boundary
8-Digit Watershed Boundary
City/Town

Geography and Geology

The Lower Guyandotte River Watershed lies within two ecoregions. More than 69% of the watershed occupies the Western Allegheny Plateau Ecoregion and is comprised of rounded hills with wide fertile valleys, mixed oak forests and agricultural lands. The southern portion (31%) of the watershed is contained within the Central Appalachians Ecoregion, which is characterized by its rugged and mountainous terrain, cooler climate and biologically diverse habitat. The average elevation for the watershed is 907 feet above mean sea level. The highest elevation, 2,124 feet, is located on a ridgeline northeast of the City of Logan. The lowest elevation, 518 feet, is located in the north at the mouth of the Guyandotte River. The average annual temperature is 53 degrees Fahrenheit and ranges from 51 to 55 degrees. The average annual precipitation for the Lower Guyandotte River Watershed is 43.28 inches per year.

More than 81% of the watershed is covered by forests, while 9% is classified as developed. The remaining land cover consists of grasslands, pastures, barren land, wetlands, crops, shrubs and open water. 4% of the entire watershed is covered by impervious surfaces.

The surface geology in the Lower Guyandotte River Watershed is comprised of sandstone (57%), shale (39%) and alluvium (4%).

The United States Geological Survey (USGS), in conjunction with federal, state and local agencies, including the DEP, cooperatively funds the USGS stream gaging network to monitor water availability. Currently, there are two surface water gaging stations within the watershed. The stations are located on the Guyandotte River at Branchland (1) and the Mud River at Palermo (1). The recorded data can be accessed at http://waterdata.usgs.gov/nwis.

LQU data

Table 5-2 contains a list of all Large Quantity User (LQU) facilities in the Lower Guyandotte Watershed that are currently operating, their Standard Industrial Category (SIC) of use, the average percent of source water withdrawn annually, percent withdrawn from the watershed and county, as well as others if intakes are located elsewhere, and the average amount of water withdrawn by the facility based on the most recent three years of monthly data. A detailed discussion about categories of use type and comparisons of use to statewide withdrawals and consumption is available in Chapter 2 of the Plan. Chapter 4 of the Plan includes data and discussion about future use projections. The following is a summary of data collected regarding the facilities:

- 4 Public Water Suppliers
    - 1 closed in 2007: Chapmanville Water
- 1 Mining facility: Hobet Mining – Hobet 21 Mine.
    - Hobet Mining gets 19% of their total withdrawals from the Lower Guyandotte; the rest comes from the Coal Watershed.
- 1 Industrial facility: Huntington Alloys Corporation.

Table 5-2 All facilities withdrawing from Lower Guyandotte Watershed organized by Use Category and Intake Source and Location (watershed and county). Blanks indicate that no additional withdrawals were occurring.

Facility ID	Facility Name	Use Category	Source and % of 3 Year Average		Watershed and % of 3 Year Average		County and % of 3 Year Average		3 Year Annual Average (gallons)
4454	Hobet Mining - Hobet 21 Mine	Mining	Surface Water 100.00%		Coal 81.36%	Lower Guyandotte 18.64%	Boone 94.92%	Lincoln 5.08%	914,308,971
2023	Huntington Alloys Corporation	Industrial	Surface Water 100.00%		Lower Guyandotte 100.00%		Cabell 100.00%		277,433,755
3979	Milton Municipal Utility Commission	Public water supply	Surface Water 100.00%		Lower Guyandotte 100.00%		Cabell 100.00%		212,046,838
3637	Northern Regional Water Treatment Plant	Public water supply	Surface Water 100.00%		Lower Guyandotte 100.00%		Logan 100.00%		720,085,000
8251	Town of West Hamlin Water Company	Public water supply	Surface Water 100.00%		Lower Guyandotte 100.00%		Lincoln 100.00%		127,566,000

Figures 5-4 through 5-6 summarize the breakdown of the share total withdrawals occurring among currently operating facilities, the trends in use over time for each industry group for currently operating LQUs in the watershed. 100% of the water withdrawn from the Lower Guyandotte Watershed is from surface water sources.

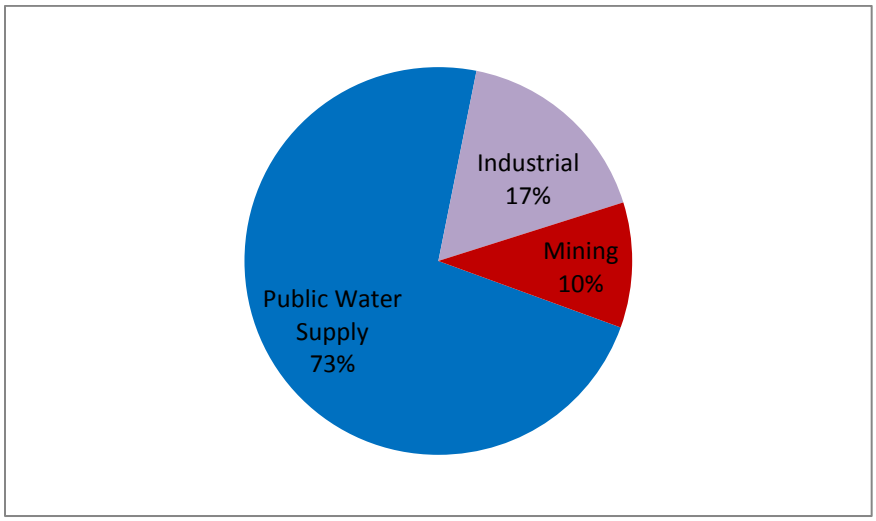
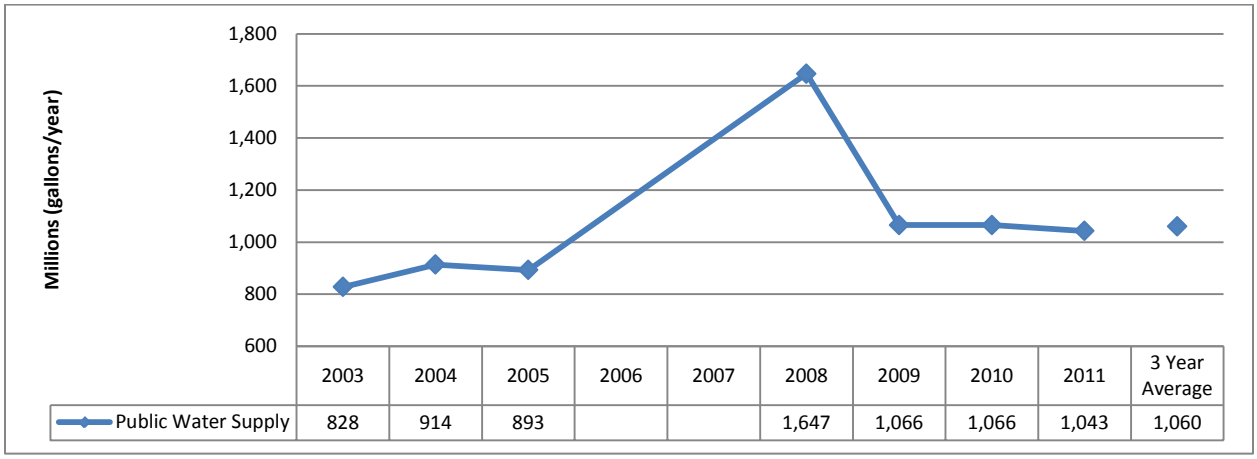
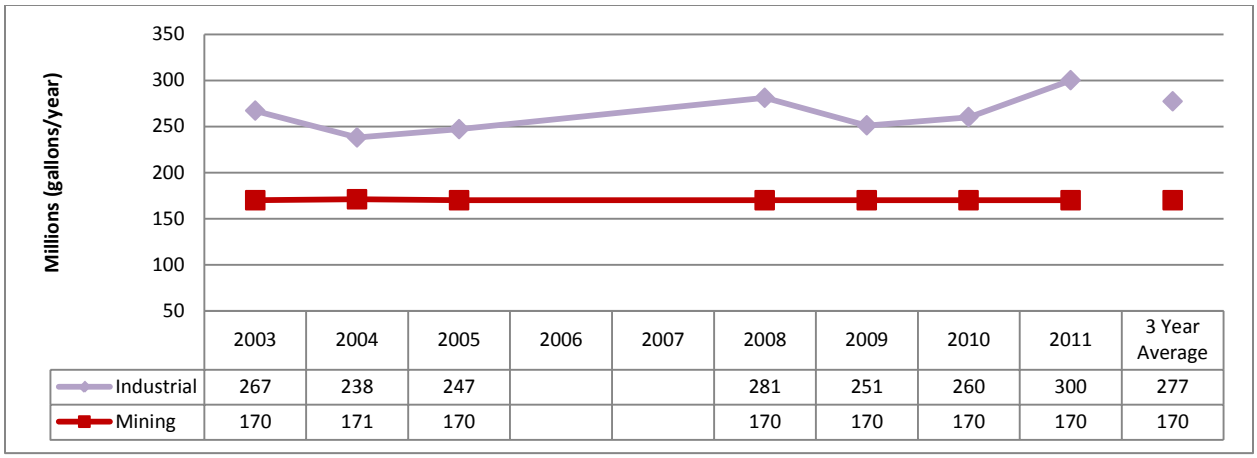


Figure 5-4 Lower Guyandotte Watershed LQU percent of total average annual water withdrawals by sector.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Public Water Supply	828	914	893			1,647	1,066	1,066	1,043	1,060

Figure 5-5 Lower Guyandotte Watershed LQU water withdrawal trends for Public Water Supply SIC category, measured in millions of gallons per year.

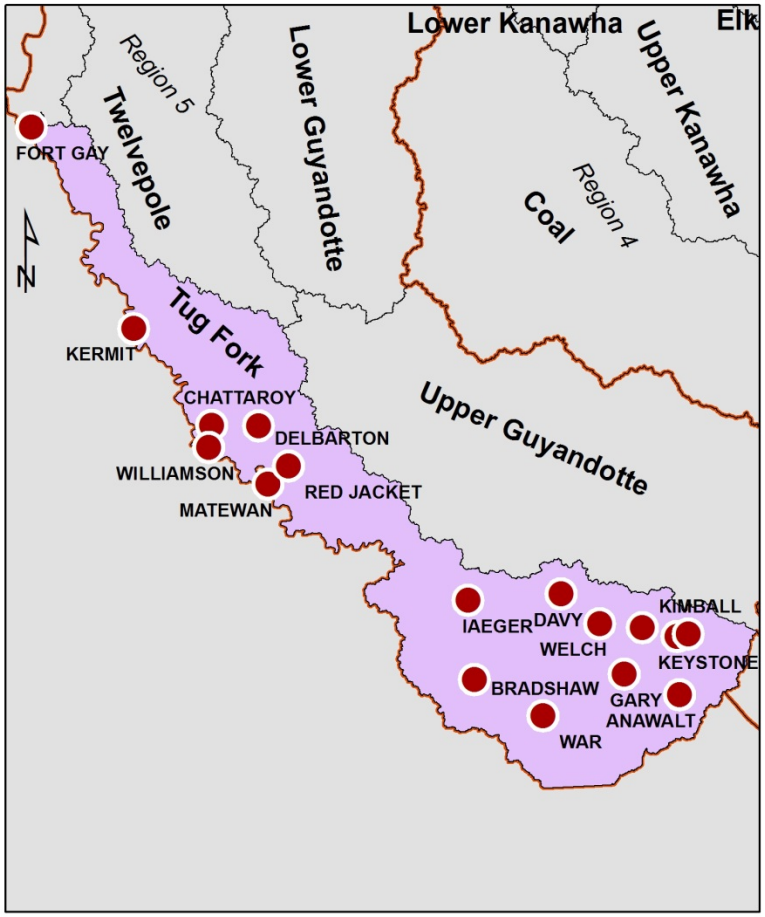


	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Industrial	267	238	247			281	251	260	300	277
Mining	170	171	170			170	170	170	170	170

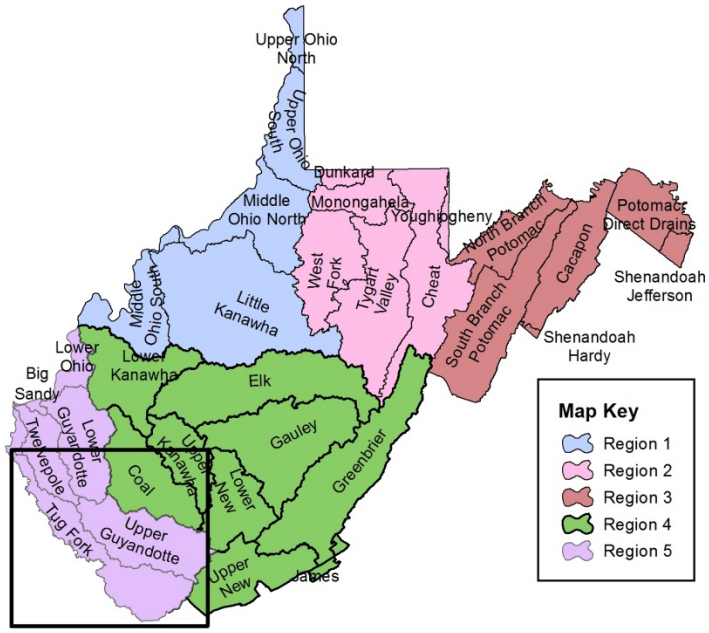
Figure 5-6 Lower Guyandotte Watershed LQU water withdrawal trends for the Industrial and Mining SIC categories, measured in millions of gallons per year.

Interbasin transfers occur when water is permanently moved from one watershed to another. This can occur in a number of ways. However, only three possible routes of transfer are considered here; see Chapter 2 of the Plan for a discussion of possibilities and data limitations. The following is a detailed list of interbasin transfers occurring between the Lower Guyandotte and other HUC-8 watersheds as a result of LQU operations in 2011:

- Withdrawals vs. Stream Discharges
    - None reported
- Withdrawals vs. POTW discharges
    - Huntington Alloys Corporation withdrawals a three-year average of around 277 million gallons of surface water a year from the Lower Guyandotte Watershed. Water at this facility is reportedly used for industrial processes including cooling water for boilers and process water. According to the three-year average, 347 million gallons of water a year are discharged by this facility into the Lower Ohio Watershed via the Huntington Sanitary POTW.
- Purchased water vs. Stream/POTW Discharges
    - Huntington Alloys Corporation purchases a three-year average of 87 million gallons annually from West Virginia American Water in the Lower Ohio Watershed. Water at the facility is reportedly used for industrial processes including cooling water for boilers and process water. According to the three-year average, 347 million gallons of water a year are discharged by this facility into the Lower Ohio Watershed via the Huntington Sanitary POTW.



Tug Fork Watershed



Tug Fork Watershed

Watershed Description

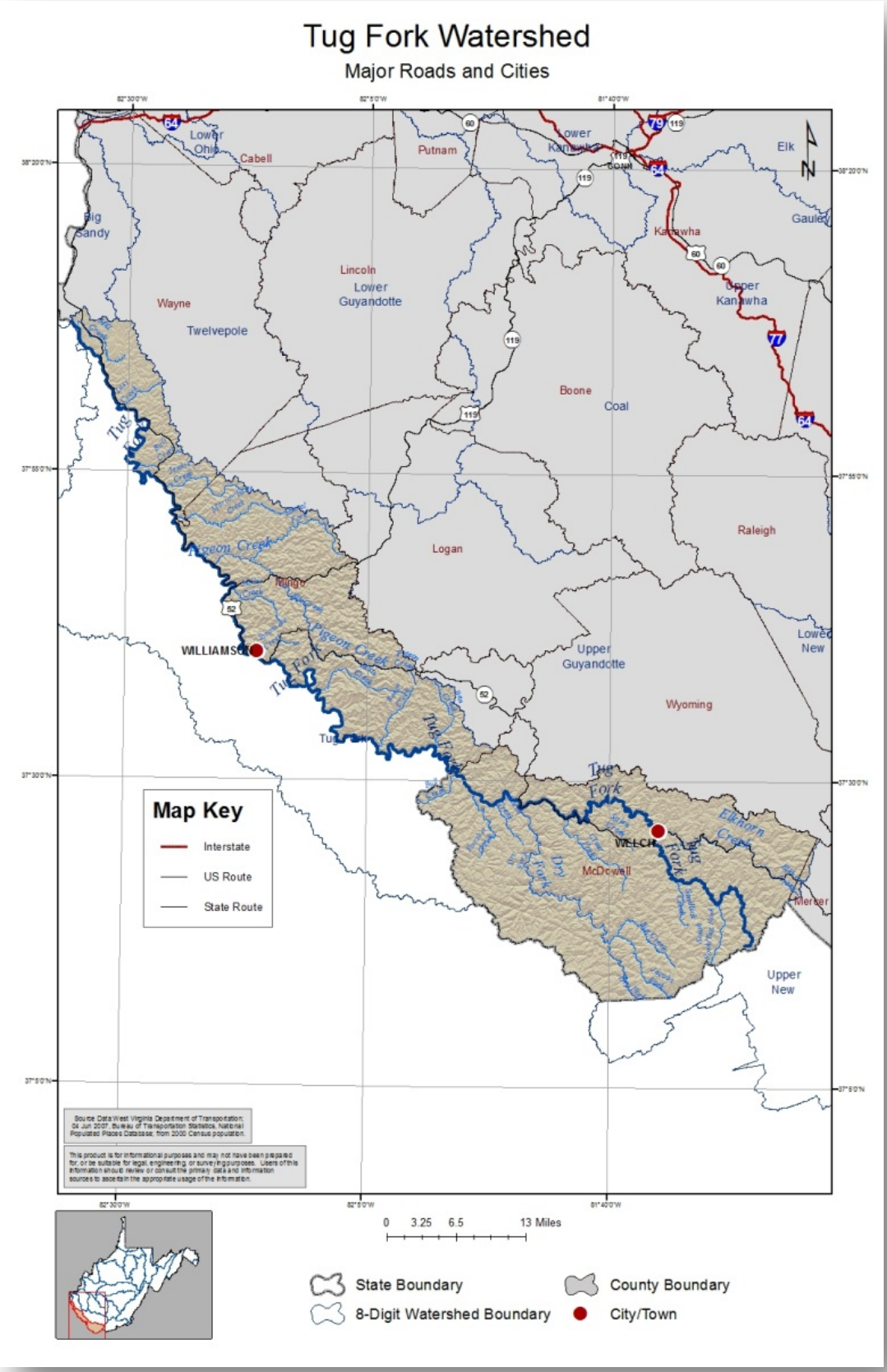
Located in southwestern West Virginia, the Tug Fork Watershed extends throughout the southern coalfields from McDowell County to the source of the Big Sandy River in Wayne County. Covering approximately 935 square miles in West Virginia, the watershed contains all, or portions, of three counties (Wayne, Mingo and McDowell). McDowell comprises 57% of the total area of the watershed.

The Tug Fork Watershed has 2,249 miles of streams and rivers and contains the headwaters of the Tug Fork mainstem (also known as the Tug Fork River). The Tug Fork flows northwesterly through the watershed along the West Virginia-Virginia and West Virginia-Kentucky border to its confluence with the Levisa Fork where the two converge to form the Big Sandy River at the town of Fort Gay, West Virginia. Major tributaries from within the state include Pigeon Creek, Dry Fork, Elkhorn Creek and Big Camp Branch.

Additionally, the watershed encompasses all, or portions, of the following state public lands: one state forest (Cabwaylingo) and five wildlife management areas (Anawalt Lake, Berwind Lake, Laurel Lake, Panther and Tug Fork).

Demographics

The Tug Fork Watershed has a total population of approximately 48,545. The watershed has two cities/towns with a population exceeding 1,000. The largest city is Williamson, with a total population of 3,191, followed by Welch (2,406).


Tug Fork Watershed
Major Roads and Cities
Lower Ohio
Cabell
Putnam
Lower Kanawha
Elk
Big Sandy
Kanawha
Gauley
Lincoln
Lower Guyandotte
Wayne
Twelvepole
Upper Kanawha
Boone
Coal
Logan
Raleigh
Pigeon Creek
Tug
WILLIAMSON
Upper Guyandotte
Wyoming
Tug Fork
WELCH
Elkhorn Creek
McDowell
Mercer
Upper New
Map Key
Interstate
US Route
State Route
0 3.25 6.5 13 Miles
State Boundary
County Boundary
8-Digit Watershed Boundary
City/Town

Geography and Geology

The Tug Fork Watershed lies within two ecoregions. More than 98% of the watershed occupies the Central Appalachians Ecoregion, which is characterized by its rugged and mountainous terrain, cooler climate and biologically diverse habitat. A small portion (2%) of the watershed near the mouth of the Tug Fork River in Wayne County lies with the Western Allegheny Plateau Ecoregion and is comprised of rounded hills with wide fertile valleys, mixed oak forests and agricultural lands. The average elevation for the watershed is 509 feet above mean sea level. The highest elevation, 3,402 feet, is located on a ridge on Flat Top Mountain in the east at the Wyoming-McDowell-Mercer border. The lowest elevation, 536 feet, is located in the northwest at the Town of Fort Gay in Wayne County.

The average annual temperature is 54 degrees Fahrenheit and ranges from 49 to 57 degrees. The average annual precipitation for the Tug Fork Watershed is 43.07 inches per year.

The majority (85%) of the Tug Fork Watershed is covered by deciduous, mixed and evergreen forests, while 7% of the land cover is classified as developed. The remaining land cover consists of grasslands, pastures, barren land, wetlands, crops, shrubs and open water. Approximately 3.2% of the entire watershed is covered by impervious surfaces.

Geologically, the Tug Fork Watershed consists predominantly (96%) of sandstone, as wells as shale and siltstone (4%).

The United States Geological Survey (USGS), in conjunction with federal, state and local agencies, including the DEP, cooperatively funds the USGS stream gaging network to monitor water availability. Currently, there are five surface water gaging stations and one groundwater gaging station located within the watershed. The groundwater gaging station is a well site located in McDowell County, while surface water data is collected from the stream gages located on Panther Creek (1), Dry Fork (1) and multiple locations on Tug Fork (3). The recorded data can be accessed at http://waterdata.usgs.gov/nwis.

LQU data

Table 5-3 contains a list of all Large Quantity User (LQU) facilities in the Tug Fork Watershed that are currently operating, their Standard Industrial Category (SIC) of use, the average percent of source water withdrawn annually, percent withdrawn from the watershed and county, as well as others if intakes are located elsewhere, and the average amount of water withdrawn by the facility based on the most recent

three years of monthly data. A detailed discussion about categories of use type and comparisons of use to statewide withdrawals and consumption is available in Chapter 2 of the Plan. Chapter 4 of the Plan includes data and discussion about future use projections. The following is a summary of data collected regarding the facilities:

- 31 Public Water Supply Facilities
    - 4 have closed: 1 in 2007, 1 in 2009 and 2 in 2010
    - Williamson Water Board withdraws the most water, averaging 816 million gallons annually
- 16 Mining facilities
    - 5 closed: 3 in 2009 and 2 in 2011
    - Arch coal - Coal-Mac, Inc. gets 63% of its water from Tug Fork while the rest comes from Upper Guyandotte Watershed
    - Cobra Natural Resources – Mountaineer Mine and Plant gets 1% of its water from Tug Fork, the rest comes from the Upper Guyandotte
- 1 Recreation facility: Twisted Gun Golf Course

Table 5-3 All facilities withdrawing from Tug Fork Watershed organized by Use Category and Intake Source and Location (watershed and county). Blanks indicate that no additional withdrawals were occurring.

Facility ID	Facility Name	Use Category	Source and % of 3 Year Average		Watershed and % of 3 Year Average		County and % of 3 Year Average		3 Year Annual Average (gallons)
			Surface Water	Groundwater	Tug Fork	Upper Guyandotte	Mingo	Logan	
4161	Arch Coal - Coal-Mac, Inc.	Mining	7.85%	92.15%	45.69%	54.31%	45.69%	54.31%	97,403,267
5160	Bluestone Coal - Pinnacle Ridge Surface Mine	Mining		Groundwater 100.00%	Tug Fork 100.00%		McDowell 100.00%		11,520,000
1768	Bradshaw Water Works	Public water supply		Groundwater 100.00%	Tug Fork 100.00%		McDowell 100.00%		15,012,227
10050	City of Gary	Public water supply		Groundwater 100.00%	Tug Fork 100.00%		McDowell 100.00%		130,502,333
1703	City of Welch Water Department	Public water supply		Groundwater 100.00%	Tug Fork 100.00%		McDowell 100.00%		242,426,333
4564	Cobra Natural Resources- Mountaineer Mine & Plant	Mining		Groundwater 100.00%	Tug Fork 1.18%	Upper Guyandotte 98.82%	Mingo 100.00%		158,548,357
4369	Consol of Kentucky - Miller Creek Prep Plant	Mining	Surface Water 98.32%	Groundwater 1.68%	Tug Fork 100.00%		Mingo 100.00%		162,183,756
10018	Crumpler Community Water	Public water supply	Surface Water 100.00%		Tug Fork 100.00%		McDowell 100.00%		9,690,000
7748	Davy Municipal Water Works	Public water supply		Groundwater 100.00%	Tug Fork 100.00%		McDowell 100.00%		11,443,633
7623	Delbarton Mining Company	Mining	Surface Water 100.00%		Tug Fork 100.00%		Mingo 100.00%		168,240,000
3782	Eastern Associated Coal - Rocklick Prep Plant	Mining	Surface Water 100.00%		Tug Fork 100.00%		McDowell 100.00%		248,832,000
3442	Fort Gay Water Works	Public water supply	Surface Water 100.00%		Tug Fork 100.00%		Wayne 100.00%		100,301,033
10025	KERMIT WATER WORKS	Public water supply	Surface Water 100.00%		Tug Fork 100.00%		Mingo 100.00%		138,416,846
10051	Keystone Municipal Water	Public water supply		Groundwater 100.00%	Tug Fork 100.00%		McDowell 100.00%		40,102,667
4128	Litwar Processing Company, LLC	Mining	Surface Water 100.00%		Tug Fork 100.00%		McDowell 100.00%		31,860,747
2701	Matewan Water	Public water supply	Surface Water 100.00%		Tug Fork 100.00%		Mingo 100.00%		112,752,800
4017	McDowell County PSD / Bartley	Public water supply		Groundwater 100.00%	Tug Fork 100.00%		VA 100.00%		42,907,667
4301	McDowell County PSD / Berwind	Public water supply		Groundwater 100.00%	Tug Fork 100.00%		McDowell 100.00%		25,081,464
4422	McDowell County PSD / Big Four	Public water supply		Groundwater 100.00%	Tug Fork 100.00%		VA 100.00%		11,589,233
3976	McDowell County PSD / Coalwood	Public water supply		Groundwater 100.00%	Tug Fork 100.00%		McDowell 100.00%		13,471,800
3566	McDowell County PSD / Elkhorn - Ennis - Crozer	Public water supply		Groundwater 100.00%	Tug Fork 100.00%		McDowell 100.00%		21,245,033
3674	McDowell County PSD / Gilliam - Rolfe - Worth	Public water supply		Groundwater 100.00%	Tug Fork 100.00%		McDowell 100.00%		5,607,821
3990	McDowell County PSD / Iaeger	Public water supply		Groundwater 100.00%	Tug Fork 100.00%		McDowell 100.00%		24,715,353
4680	McDowell County PSD / Kimball - Carswell	Public water supply		Groundwater 100.00%	Tug Fork 100.00%		VA 100.00%		79,158,697

Facility ID	Facility Name	Use Category	Source and % of 3 Year Average		Watershed and % of 3 Year Average		County and % of 3 Year Average		3 Year Annual Average (gallons)
4699	McDowell County PSD / Landgraff - Eckman	Public water supply		Groundwater 100.00%	Tug Fork 100.00%		McDowell 100.00%		13,190,664
3528	McDowell County PSD / Maybeury-Switchback	Public water supply		Groundwater 100.00%	Tug Fork 100.00%		McDowell 100.00%		44,355,887
3534	McDowell County PSD / Upland - Powhatan - Kyle	Public water supply		Groundwater 100.00%	Tug Fork 100.00%		McDowell 100.00%		66,368,750
4606	McDowell County PSD / Vivian - Tidewater	Public water supply		Groundwater 100.00%	Tug Fork 100.00%		McDowell 100.00%		22,926,850
3636	McDowell County PSD/ Greenbrier-Arlington-McDowell	Public water supply		Groundwater 100.00%	Tug Fork 100.00%		McDowell 100.00%		57,847,021
3864	Mingo County PSD - Naugatuck Water Plant	Public water supply	Surface Water 100.00%		Tug Fork 100.00%		Mingo 100.00%		255,209,000
10048	Northfork Water Works	Public water supply		Groundwater 100.00%	Tug Fork 100.00%		McDowell 100.00%		48,941,000
4230	Premium Energy - Surface Mine No. 2	Mining	Surface Water 99.67%	Groundwater 0.33%	Tug Fork 100.00%		Mingo 100.00%		14,904,120
1586	Second Sterling Corp - Keystone No. 1 Prep Plant	Mining	Surface Water 19.33%	Groundwater 80.67%	Tug Fork 100.00%		McDowell 100.00%		58,318,333
2439	Southern Minerals - Superior Preparation Plant	Mining	Surface Water 100.00%		Tug Fork 100.00%		100.00% 0.00%		26,121,000
4738	Twisted Gun Golf Club	Recreation	Surface Water 100.00%		Tug Fork 100.00%		Mingo 100.00%		2,718,500
4095	War Water Works / City Realty	Public water supply		Groundwater 100.00%	Tug Fork 100.00%		McDowell 100.00%		14,677,800
4749	White Flame Energy - No. 9 Surface Mine	Mining	Surface Water 100.00%		Tug Fork 100.00%		Mingo 100.00%		7,189,583
3033	Williamson Utility Board	Public water supply	Surface Water 100.00%		Tug Fork 100.00%		Mingo 100.00%		816,359,000

Figures 5-7 through 5-10 summarize the breakdown of the share total withdrawals occurring among currently operating facilities, the trends in use over time for each industry group, and the amount and share of source water withdrawn by the currently operating LQUs in the watershed.

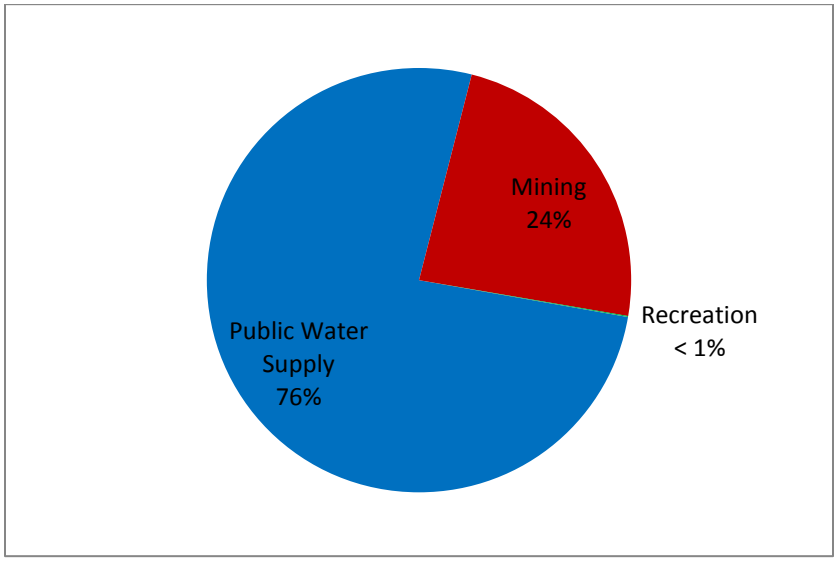
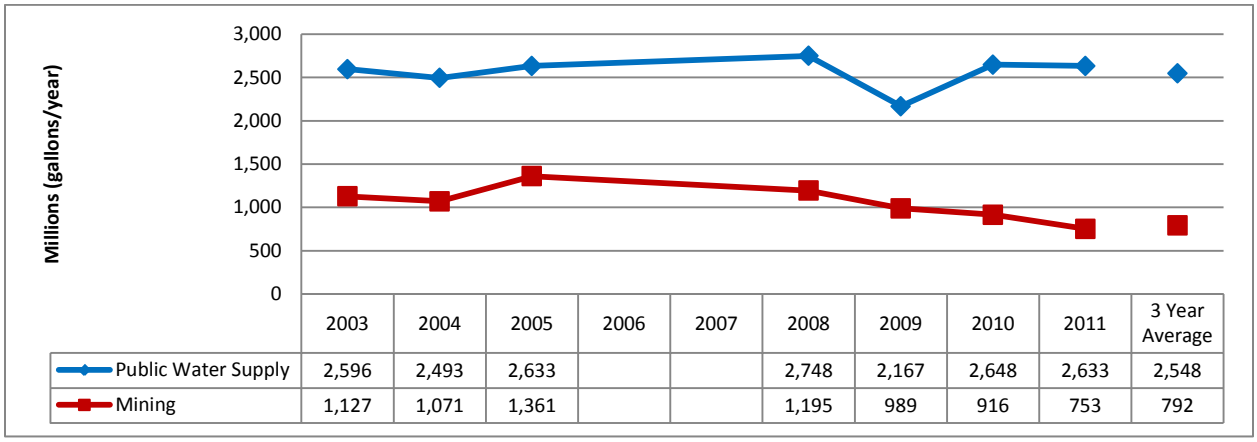


Figure 5-7 Tug Fork Watershed LQU percent of total average annual water withdrawals by sector.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Public Water Supply	2,596	2,493	2,633			2,748	2,167	2,648	2,633	2,548
Mining	1,127	1,071	1,361			1,195	989	916	753	792

Figure 5-8 Tug Fork Watershed LQU water withdrawal trends for the Public Water Supply and Mining SIC categories, measured in millions of gallons per year.

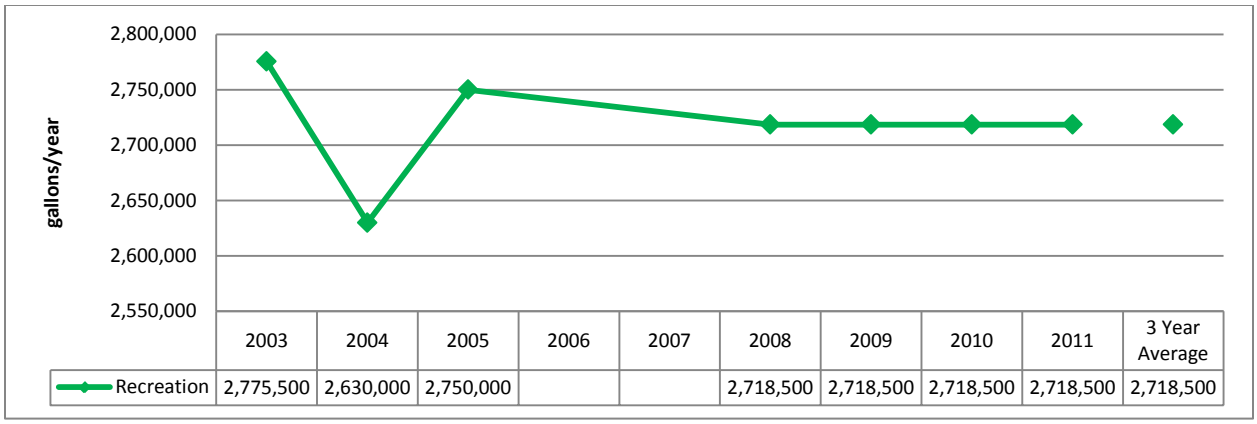


Figure 5-9 Tug Fork Watershed LQU water withdrawal trends for the Recreation SIC category, measured in millions of gallons per year.

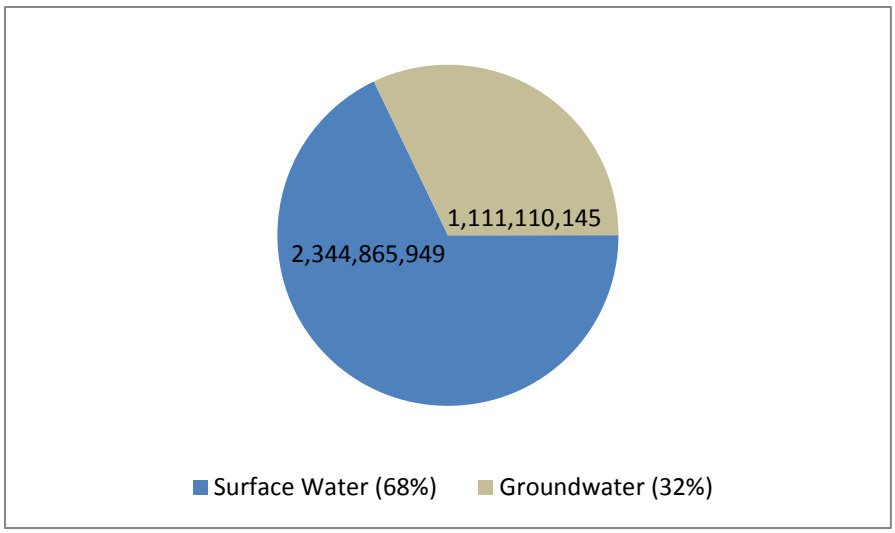
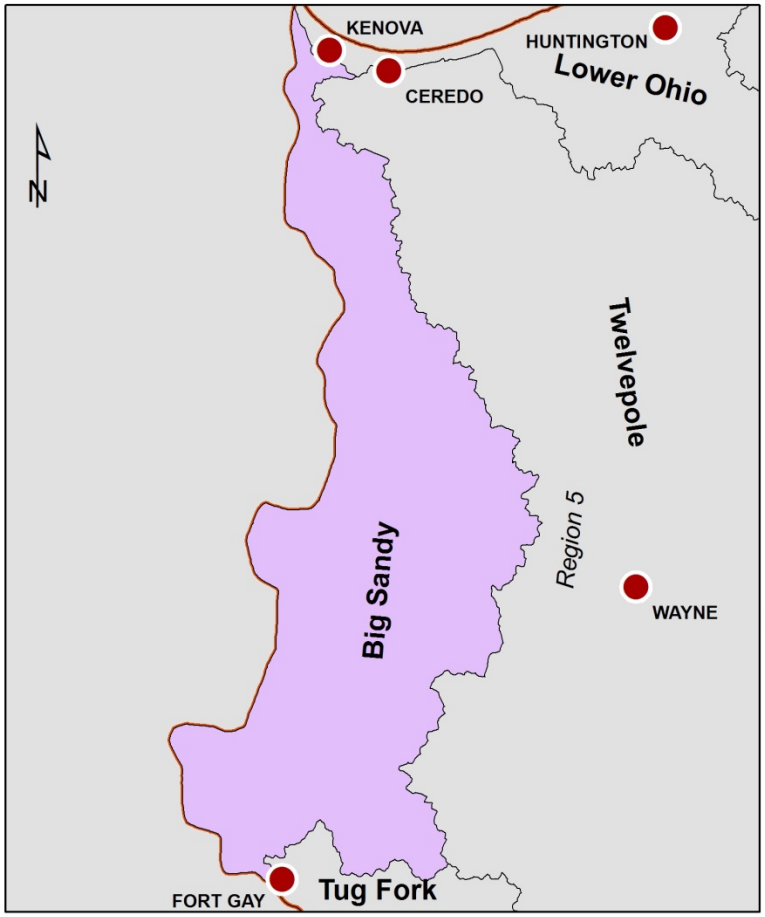


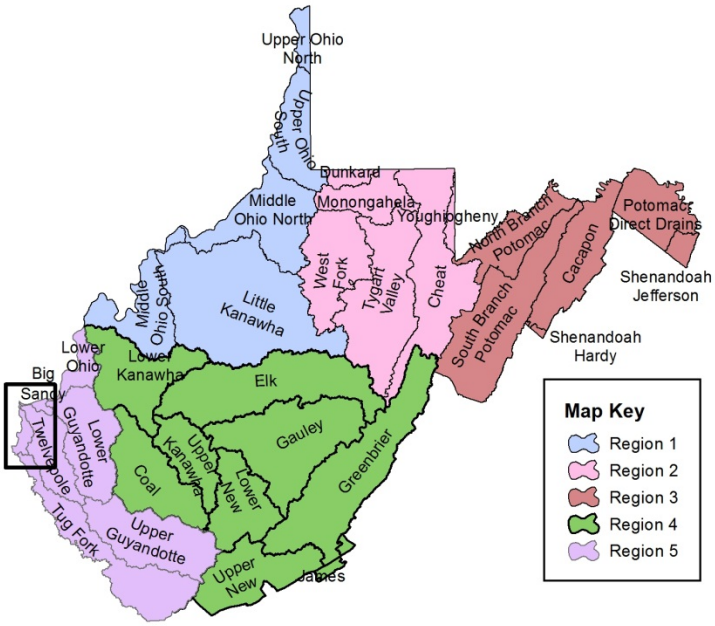
Figure 5-10 Average annual gallons of water withdrawn by LQUs from groundwater and surface water sources in the Tug Fork Watershed.

Interbasin transfers occur when water is permanently moved from one watershed to another. This can occur in a number of ways. However, only three possible routes of transfer are considered here; see Chapter 2 of the Plan for a discussion of possibilities and data limitations. The following is a detailed list of interbasin transfers occurring between the Tug Fork and other HUC-8 watersheds as a result of LQU operations in 2011:

- Withdrawals vs. Stream Discharges
    - Cobra Natural Resources – Mountaineer Mine & Plant withdraws a three-year average of approximately 157 million gallons from ground water sources in the Upper Guyandotte Watershed and approximately 1.9 million gallons from ground water sources in the Tug Fork Watershed for use in the bath house and office. Approximately 1.9 million gallons are discharged into surface water sources in the Tug Fork Watershed annually.
- Withdrawals vs. POTW discharges
    - None reported
- Purchased water vs. Stream/POTW Discharges
    - None reported



Big Sandy River Watershed



Big Sandy River Watershed

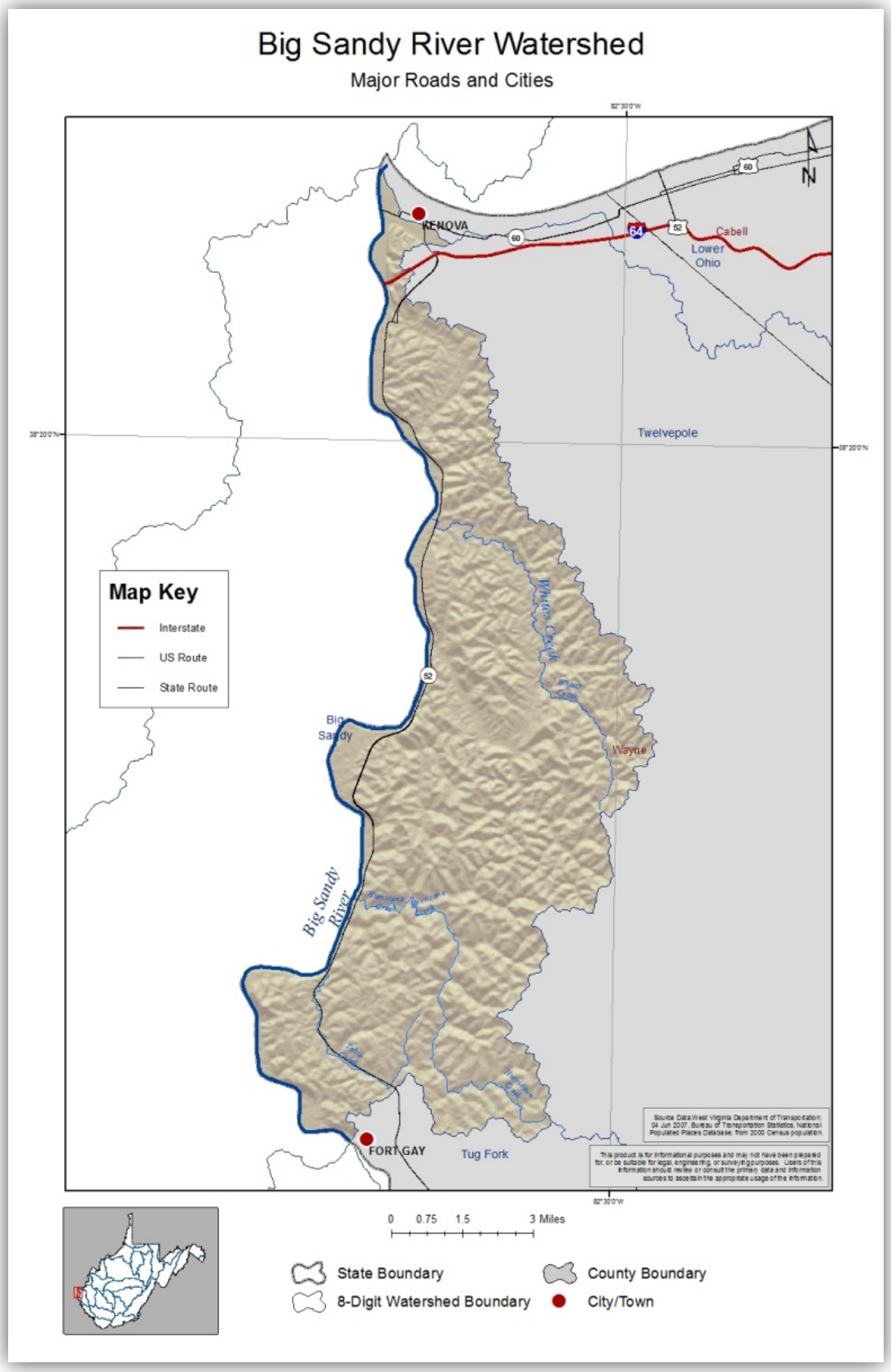
Watershed Description

Located in western West Virginia, the Big Sandy River Watershed extends northerly on the western border of Wayne County to the confluence of the Big Sandy River and Ohio River at Kenova, West Virginia. Encompassing 74 square miles in West Virginia, the entire watershed is contained within Wayne County.

The Big Sandy River Watershed has 201 miles of streams and rivers. The Big Sandy River mainstem, a navigable waterway, flows northerly through the watershed forming the West Virginia-Kentucky border. It is created by the convergence of the Tug Fork and Levisa Fork at the Town of Fort Gay. Major tributaries include Tabor Creek, Hurricane Creek and Whites Creek.

Demographics

The Big Sandy River Watershed has a total population of approximately 7,003. There are two cities/towns with a total population exceeding 500. The watershed contains a portion of Kenova, the largest city within the watershed with population of 3,216, followed by Prichard (527).


Big Sandy River Watershed
Major Roads and Cities
KENOVA
Cabell
Lower Ohio
Twelvepole
Wayne
Big Sandy
Big Sandy River
FORT GAY
Tug Fork
Map Key
Interstate
US Route
State Route
0 0.75 1.5 3 Miles
State Boundary
8-Digit Watershed Boundary
County Boundary
City/Town

Geography and Geology

The Big Sandy River Watershed lies completely within the Western Allegheny Plateau Ecoregion, which is comprised of rounded hills with wide fertile valleys, mixed oak forests and agricultural lands. The average elevation for the watershed is 762 feet above mean sea level. The highest elevation, 1,129 feet, is located on a ridgeline in the central portion of the watershed. The lowest elevation, 512 feet, is located in the north at the confluence of the Big Sandy River and the Ohio River at Kenova, West Virginia. The average annual temperature is 55 degrees Fahrenheit. The average annual precipitation for the Big Sandy River Watershed is 41.86 inches per year.

More than 72% of the watershed is covered by forests, while 13% is classified as developed. The remaining land cover consists of grasslands, pastures, barren land, wetlands, crops, shrubs and open water. Approximately 7% of the entire watershed is covered by impervious surfaces.

The surface geology in the Big Sandy River Watershed is comprised of shale (73%), sandstone (11%) and alluvium throughout the Big Sandy River valley (16%).

LQU data

Table 5-4 contains a list of all Large Quantity User (LQU) facilities in the Big Sandy Watershed that are currently operating, their Standard Industrial Category (SIC) of use, the average percent of source water withdrawn annually, percent withdrawn from the watershed and county as well as others if intakes are located elsewhere, and the average amount of water withdrawn by the facility based on the most recent three years of monthly data. A detailed discussion about categories of use type and comparisons of use to statewide withdrawals and consumption is available in Chapter 2 of the Plan. Chapter 4 of the Plan includes data and discussion about future use projections. The following is a summary of data collected regarding the facilities:

- 1 Public Water Supply facility: Kenova Water Plant
- 1 Chemical facility: Braskem America, Inc. – Neal Plant
- 1 Mining facility: LDH Energy Cyrus River Terminal, closed in 2010

Table 5-4 All facilities withdrawing from Big Sandy Watershed organized by Use Category and Intake Source and Location (watershed and county). Blanks indicate that no additional withdrawals were occurring.

Facility ID	Facility Name	Use Category	Source and % of 3 Year Average		Watershed and % of 3 Year Average		County and % of 3 Year Average		3 Year Annual Average (gallons)
4887	Braskem America, Inc. - Neal Plant	Chemical	Surface Water	100.00%	Big Sandy	100.00%	Wayne	100.00%	68,922,771
10034	Kenova Water Plant	Public water supply	Surface Water	100.00%	Big Sandy	100.00%	Wayne	100.00%	878,706,867

Figures 5-11 through 5-13 summarize the breakdown of the share total withdrawals occurring among currently operating facilities, the trends in use over time for each industry group for currently operating LQUs in the watershed. 100% of the water withdrawn from the Big Sandy Watershed is from surface water sources.

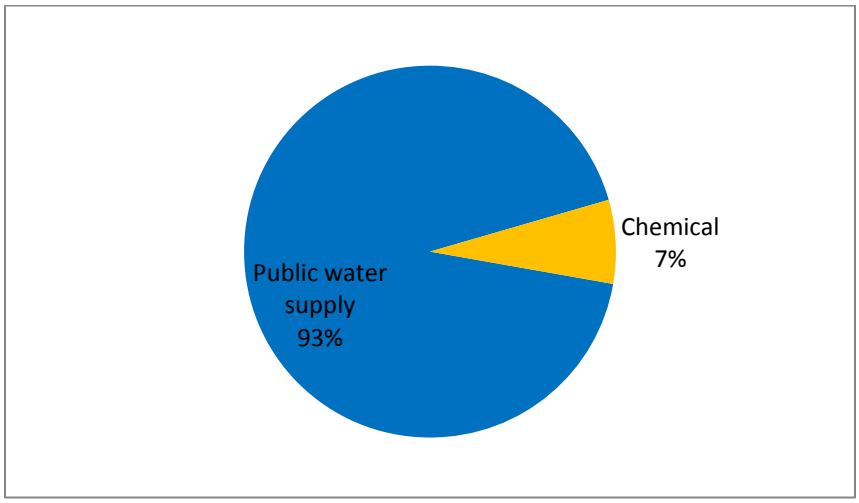
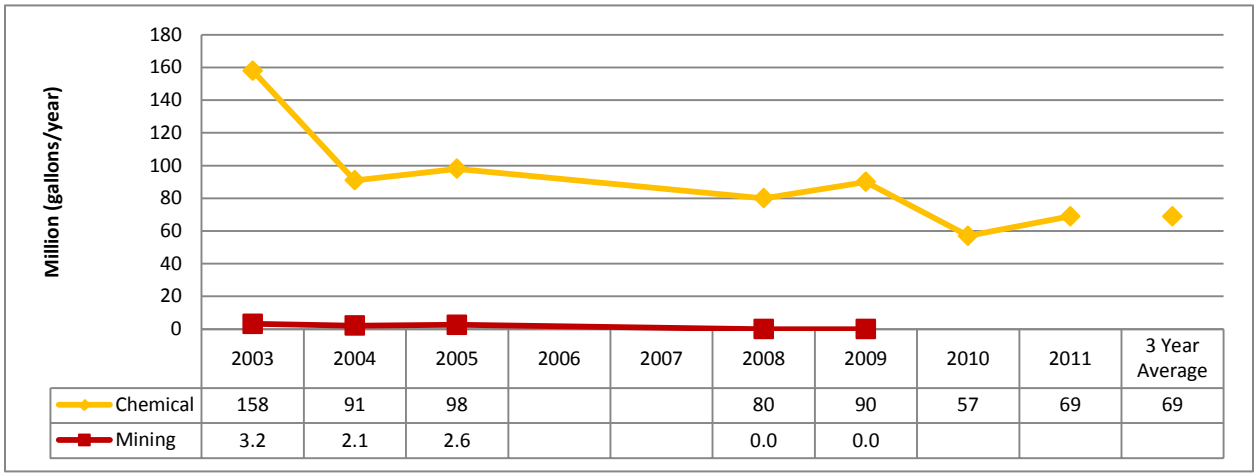


Figure 5-11 Big Sandy Watershed LQU percent of total average annual water withdrawals by sector.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Chemical	158	91	98			80	90	57	69	69
Mining	3.2	2.1	2.6			0.0	0.0			

Figure 5-12 Big Sandy Watershed LQU water withdrawal trends for the Chemical and Mining SIC categories, measured in millions of gallons per year.

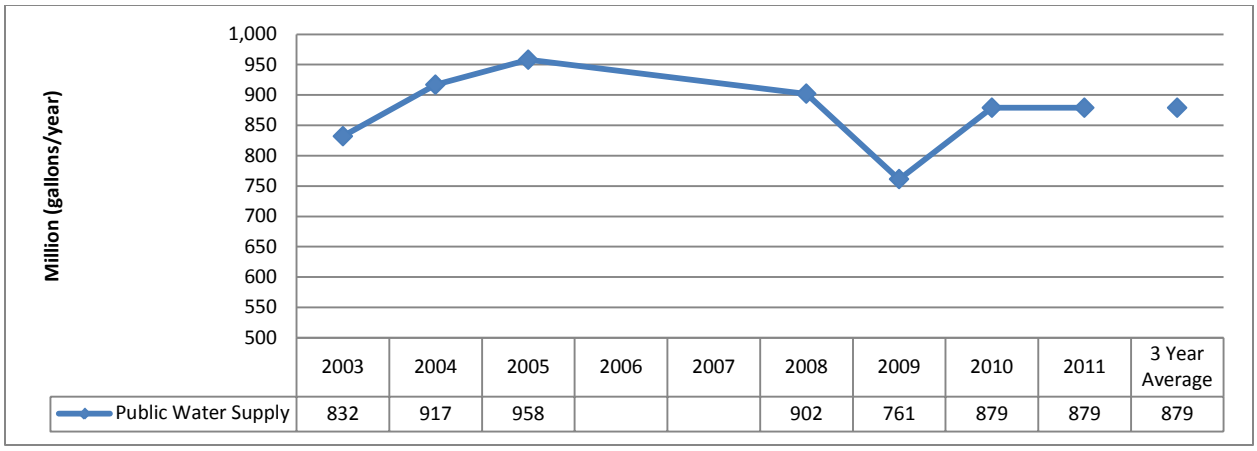
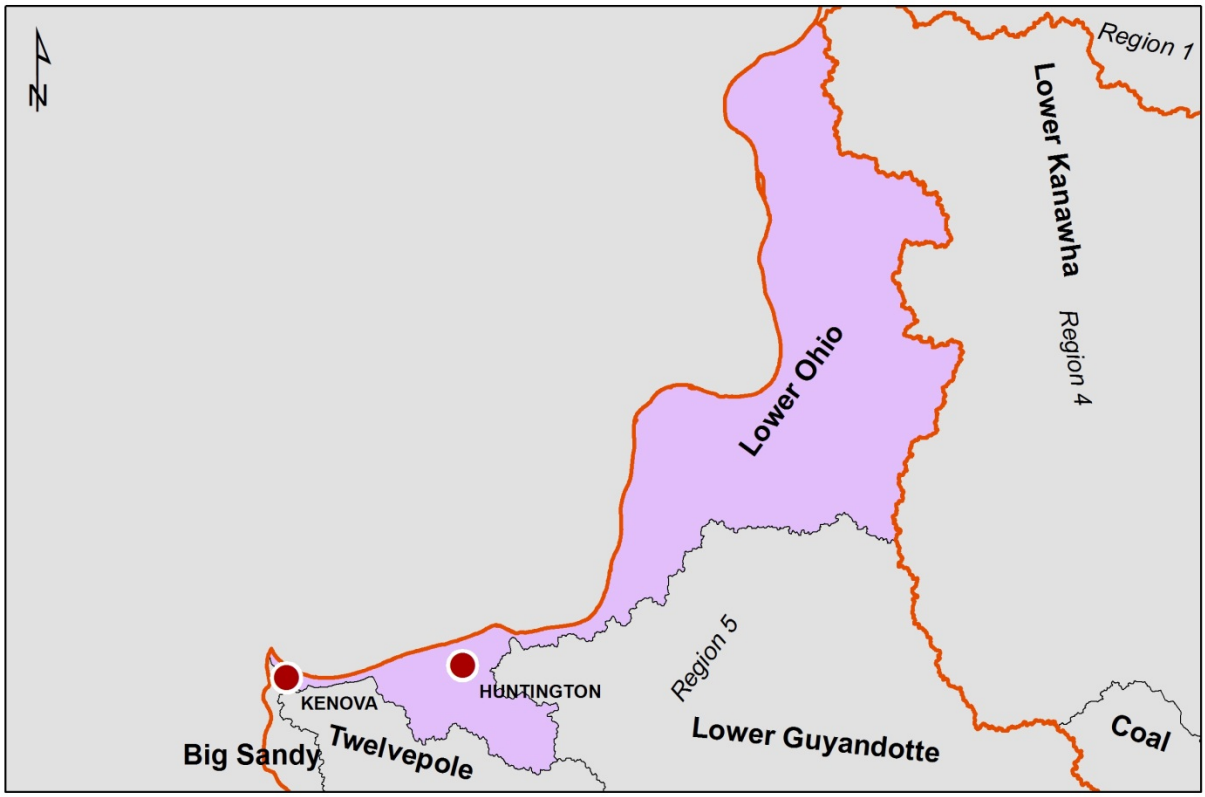


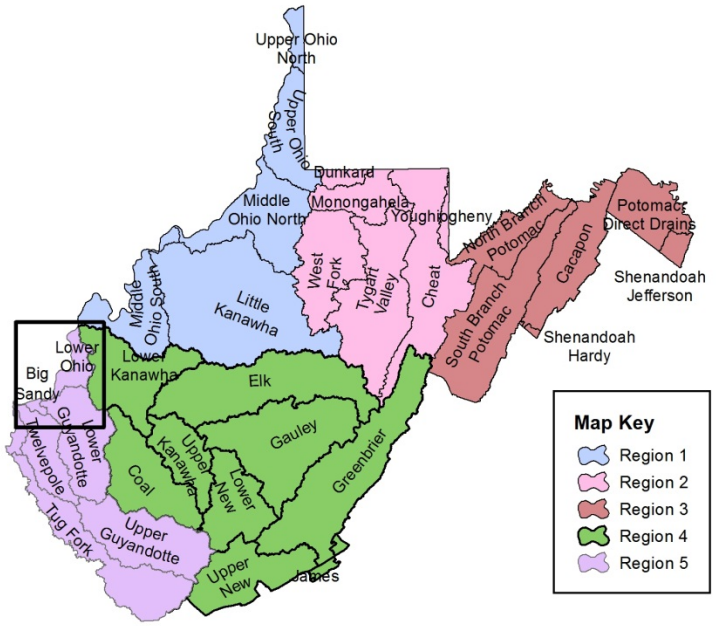
Figure 5-13 Big Sandy Watershed LQU water withdrawal trends for the Public Water Supply SIC category, measured in millions of gallons per year.

Interbasin transfers occur when water is permanently moved from one watershed to another. This can occur in a number of ways. However, only three possible routes of transfer are considered here; see Chapter 2 of the Plan for a discussion of possibilities and data limitations. The following is a detailed list of interbasin transfers occurring between the Big Sandy and other HUC-8 watersheds as a result of LQU operations in 2011:

- Withdrawals vs. Stream Discharges
    - None reported
- Withdrawals vs. POTW discharges
    - None reported
- Purchased water vs. Stream/POTW Discharges
    - Kanawha River Terminals – Ceredo Dock purchases an approximate three-year average of 514 thousand gallons annually from the Big Sandy Watershed via Ceredo PSD. This water is reportedly used for mining practices including dust suppression and wash-down applications. The same amount purchased, approximately 514 thousand gallons, are discharged into the Lower Ohio Watershed via the Huntington Sewage Treatment POTW.

Lower Ohio River Watershed





Lower Ohio River Watershed

Watershed Description

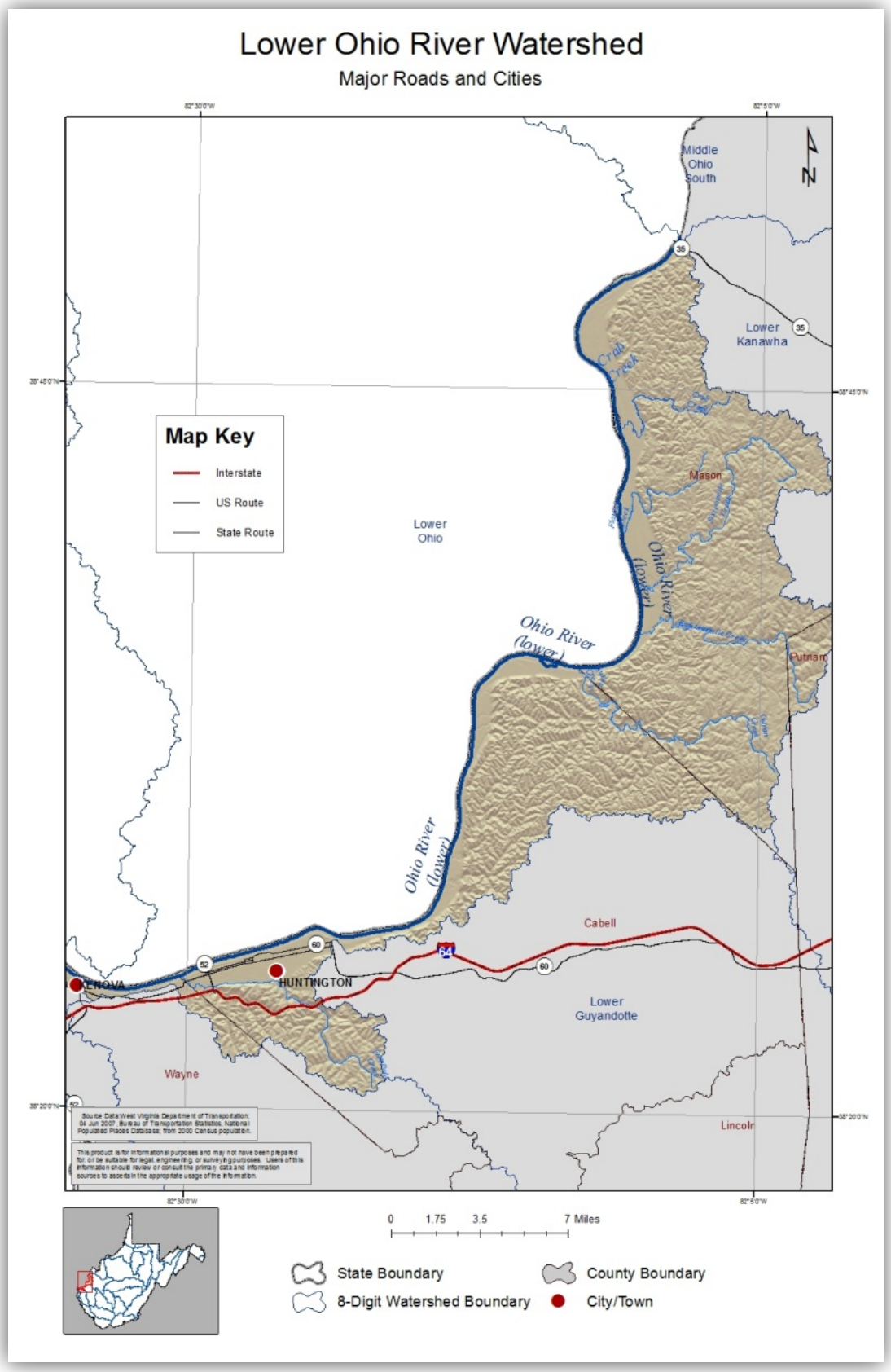
Located in western West Virginia, the Lower Ohio River Watershed extends from Wayne County in the southwest to Mason County in the northeast. Covering 221 square miles in West Virginia, the watershed contains portions of four counties (Mason, Cabell, Wayne and Putnam). Mason and Cabell counties comprise 95% of the total area of the watershed.

The Lower Ohio River Watershed has 546 miles of streams and rivers and contains the Ohio River mainstem. The Ohio River mainstem flows southwesterly along the West Virginia–Ohio border from the confluence of the Kanawha River and Ohio River to the town of Kenova in Wayne County. The major tributaries include Crab Creek, Flatfoot Creek, Sixteenmile Creek, Eighteenmile Creek, Guyan Creek, Guyandotte River, Fourpole Creek and Twelvepole Creek.

Additionally, the watershed encompasses all, or portions, of the following state and federal public lands: two wildlife management areas (Greenbottom and Chief Cornstalk), and one national wildlife refuge (Ohio River Islands).

Demographics

The Lower Ohio River Watershed has a total population of approximately 54,081. The watershed has three cities and towns with a population exceeding 1,000. The largest city within the watershed is Huntington with a total population of 49,138, followed by Kenova (3,216) and Lesage (1,358).


Lower Ohio River Watershed
Major Roads and Cities
Middle Ohio South
Lower Kanawha
Crab Creek
Mason
Lower Ohio
Ohio River (lower)
Ohio River (lower)
Putnam
Ohio River (lower)
Cabell
HUNTINGTON
Lower Guyandotte
Wayne
Lincoln
Map Key
Interstate
US Route
State Route
0 1.75 3.5 7 Miles
State Boundary
County Boundary
8-Digit Watershed Boundary
City/Town

Geography and Geology

The Lower Ohio River Watershed lies within two ecoregions. The southwestern portion (9%) of the watershed occupies the Central Appalachians Ecoregion. The majority (91%) of the watershed is contained within the Western Allegheny Plateau Ecoregion. The average elevation for the watershed is 730 feet above mean sea level, with the highest elevation of 1,115 feet. The lowest elevation, 512 feet, is located in the southwest at the confluence of the Big Sandy River and the Ohio River at Kenova, West Virginia. The average annual temperature is 54 degrees Fahrenheit and ranges from 53 to 55 degrees. The average annual precipitation for the Lower Ohio River Watershed is 40.43 inches per year.

The majority (67%) of the watershed is covered by forest area, while 13% is cultivated. Approximately 13% of the land cover is classified as developed and 7.8% is defined as impervious surface area.

The surface geology in the Lower Ohio River Watershed is predominantly (82%) sandstone and shale, while 18% is comprised of alluvium.

The United States Geological Survey (USGS), in conjunction with federal, state and local agencies, including the DEP, cooperatively funds the USGS stream gaging network to monitor water availability. Currently, there is one surface water gaging station located within the watershed. Data is collected from a stream gages located on the Ohio River at Huntington. The recorded data can be accessed at http://waterdata.usgs.gov/nwis.

LQU data

Table 5-5 contains a list of all Large Quantity User (LQU) facilities in the Lower Ohio Watershed that are currently operating, their Standard Industrial Category (SIC) of use, the average percent of source water withdrawn annually, percent withdrawn from the watershed and county, as well as others if intakes are located elsewhere, and the average amount of water withdrawn by the facility based on the most recent three years of monthly data. A detailed discussion about categories of use type and comparisons of use to statewide withdrawals and consumption is available in Chapter 2 of the Plan. Chapter 4 of the Plan includes data and discussion about future use projections. The following is a summary of data collected regarding the facilities:

- 3 Public Water Supply facilities
    - The largest being West Virginia American Water – Huntington which uses an annual average of 4.6 billion gallons
    - Point Pleasant Water Works gets 33% of its water from Lower Ohio, the remainder comes from the Middle Ohio South Watershed.
- 2 Agriculture/aquaculture facilities : G&G Nursery and WVDNR – Apple Grove Fish Hatchery
- 2 Chemical facilities: M &G Polymers USA- Apple Grove Plant and ICL-IP America, Inc.
- 1 Mining facility Kanawha River Terminals – Ceredo Dock which gets 21% of its total water used from the Lower Ohio, the rest comes from Twelvepole Watershed.

Table 5-5 All facilities withdrawing from Lower Ohio Watershed organized by Use Category and Intake Source and Location (watershed and county). Blanks indicate that no additional withdrawals were occurring.

Facility ID	Facility Name	Use Category	Source and % of 3 Year Average		Watershed and % of 3 Year Average		County and % of 3 Year Average		3 Year Annual Average (gallons)
4153	G & G Nursery	Agriculture/aquaculture		Groundwater 100.00%	Lower Ohio 100.00%		Cabell 71.43%	Mason 28.57%	20,160,000
1289	ICL-IP America, Inc.	Chemical		Groundwater 100.00%	Lower Ohio 100.00%		Mason 100.00%		242,466,093
2075	Kanawha River Terminals - Ceredo Dock	Mining	Surface Water 99.96%	Groundwater 0.04%	Lower Ohio 19.18%	Twelvepole 80.82%	Wayne 100.00%		9,841,011
1120	M&G Polymers USA - Apple Grove Plant	Chemical		Groundwater 100.00%	Lower Ohio 100.00%		Mason 100.00%		50,761,779
3043	Mason County PSD - Crab Creek Well Field	Public water supply		Groundwater 100.00%	Lower Ohio 100.00%		Mason 100.00%		157,248,633
1945	Point Pleasant Water Works	Public water supply		Groundwater 100.00%	Lower Ohio 35.30%	Middle Ohio South 64.70%	Mason 42.65%	OH 57.35%	454,604,867
2891	West Virginia American Water - Huntington	Public water supply	Surface Water 100.00%		Lower Ohio 100.00%		Cabell 100.00%		4,637,048,333
8134	WVDNR - Apple Grove Fish Hatchery	Agriculture/aquaculture		Groundwater 100.00%	Lower Ohio 100.00%		Mason 100.00%		90,071,267

Figures 5-14 through 5-18 summarize the breakdown of the share total withdrawals occurring among currently operating facilities, the trends in use over time for each industry group, and the amount and share of source water withdrawn by the currently operating LQUs in the watershed.

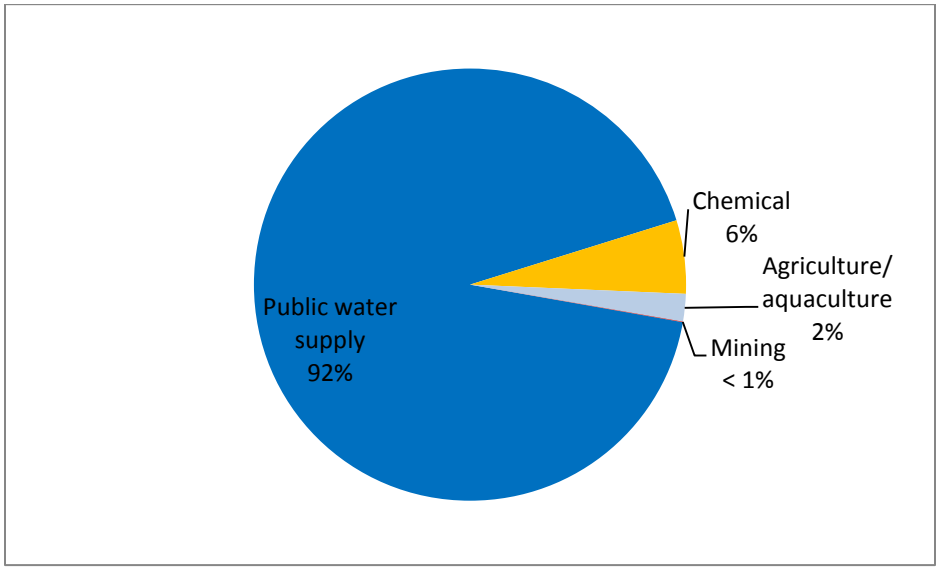
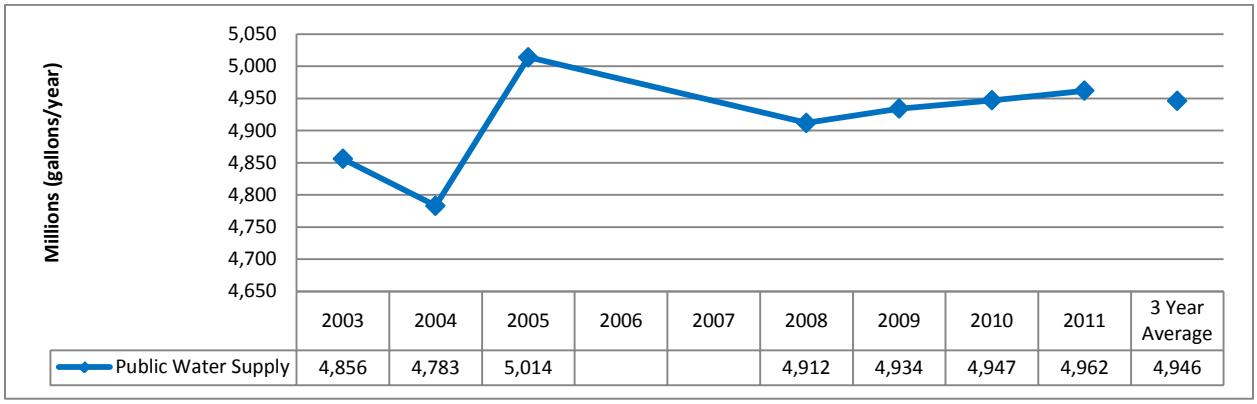
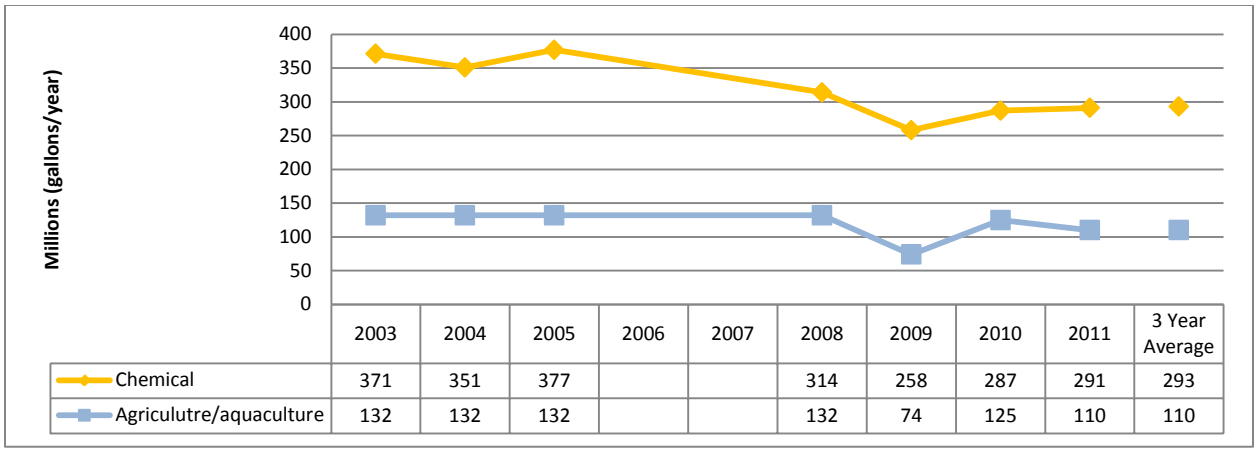


Figure 5-14 Lower Ohio Watershed LQU percent of total average annual water withdrawals by sector.



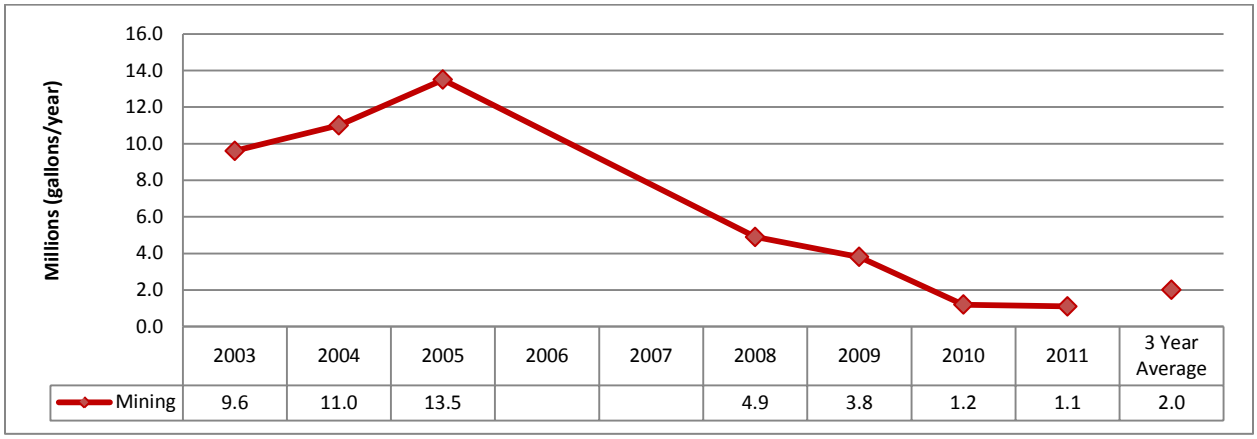
	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Public Water Supply	4,856	4,783	5,014			4,912	4,934	4,947	4,962	4,946

Figure 5-15 Lower Ohio Watershed LQU water withdrawal trends for the Public Water Supply SIC category, measured in millions of gallons per year.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Chemical	371	351	377			314	258	287	291	293
Agriculutre/aquaculture	132	132	132			132	74	125	110	110

Figure 5-16 Lower Ohio Watershed LQU water withdrawal trends for the Chemical and Agriculture/aquaculture SIC categories, measured in millions of gallons per year.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Mining	9.6	11.0	13.5			4.9	3.8	1.2	1.1	2.0

Figure 5-17 Lower Ohio Watershed LQU water withdrawal trends for the Mining SIC category, measured in millions of gallons per year.

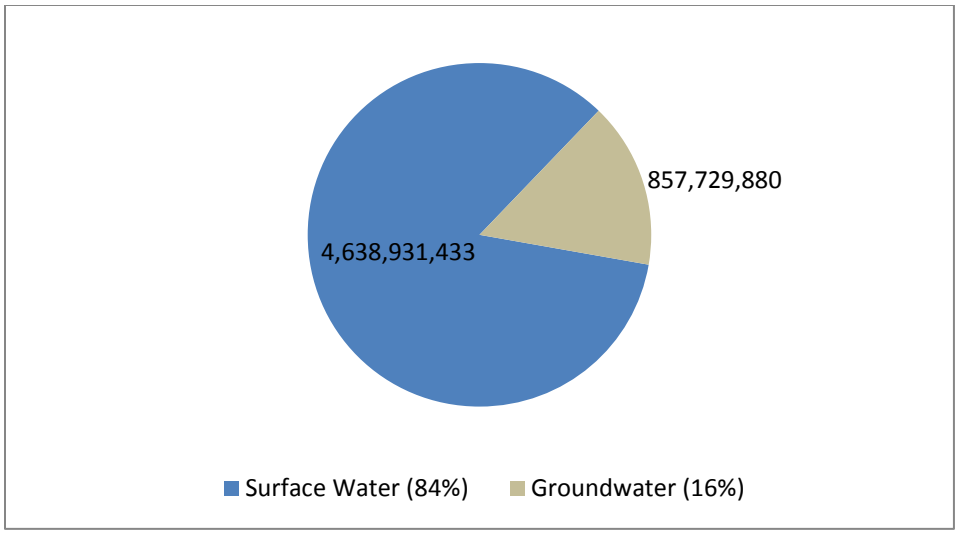
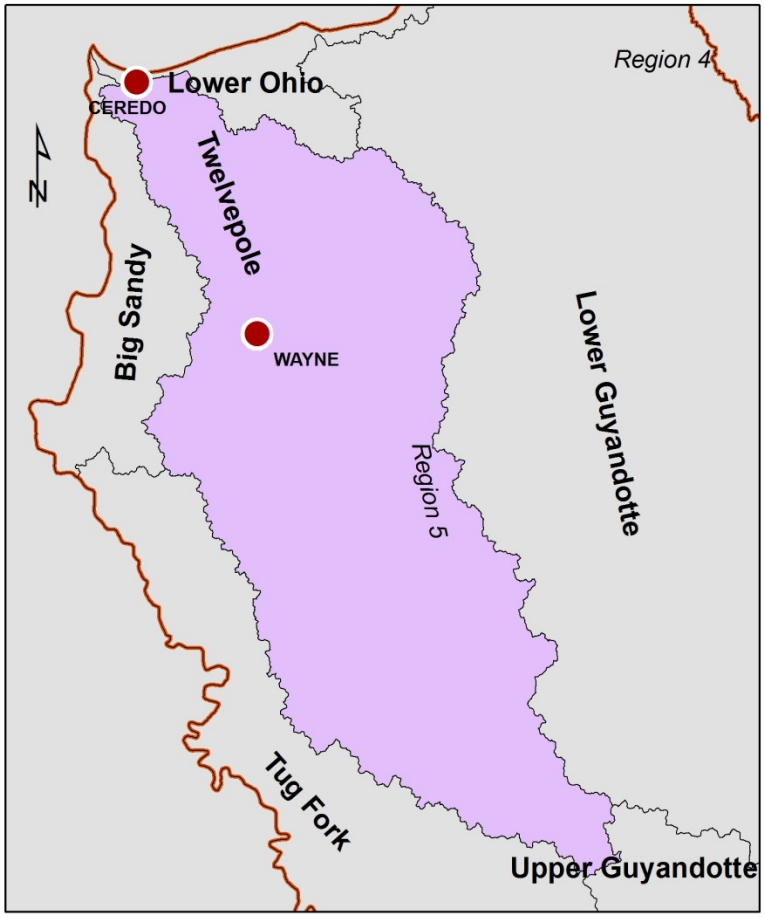


Figure 5-18 Average annual gallons of water withdrawn by LQUs from groundwater and surface water sources in the Lower Ohio Watershed.

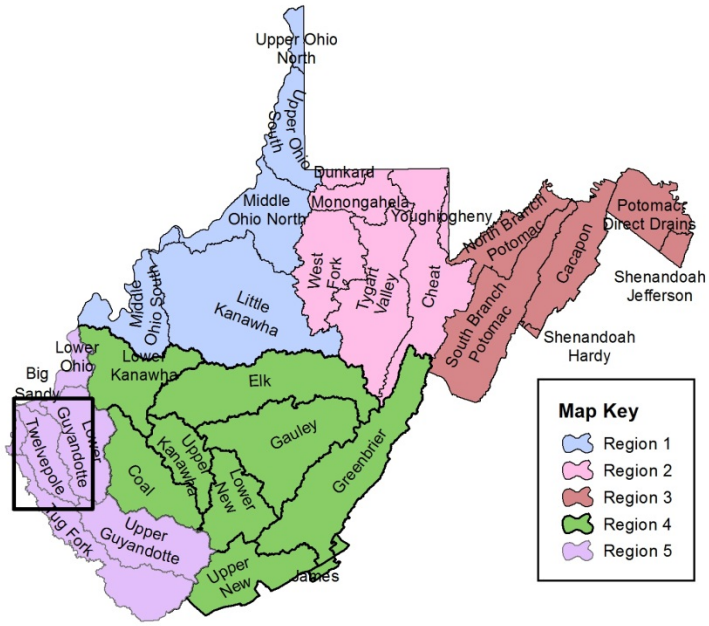
Interbasin transfers occur when water is permanently moved from one watershed to another. This can occur in a number of ways. However, only three possible routes of transfer are considered here; see Chapter 2 of the Plan for a discussion of possibilities and data limitations. The following is a detailed list of interbasin transfers occurring between the Lower Ohio and other HUC-8 watersheds as a result of LQU operations in 2011:

- Withdrawals vs. Stream Discharges
    - Kanawha River Terminals – Ceredo Dock has a three-year average of around 1.9 million gallons of water a year withdrawn from surface and groundwater sources in the Lower Ohio Watershed and approximately 8 million gallons are withdrawn from surface water sources in the Twelvepole Watershed. This water is reportedly used for mining practices including dust suppression and wash-down applications. Of the withdrawn water, a three-year average of 40,000 gallons per year is discharged into the Twelvepole Watershed via Twelvepole Creek and 231,670 gallons are discharged into the Lower Ohio Watershed via the Ohio River.
- Withdrawals vs. POTW discharges
    - Huntington Alloys Corporation withdraws a three-year average of around 277 million gallons of surface water a year from the Lower Guyandotte Watershed. Water at this facility is reportedly used for industrial processes including cooling water for boilers and process water. According to the three-year average, 347 million gallons of water a year are discharged by this facility into the Lower Ohio Watershed via the Huntington Sanitary POTW.

- Purchased water vs. Stream/POTW Discharges
    - Huntington Alloys Corporation purchases a three-year average of 87 million gallons annually from West Virginia American Water in the Lower Ohio Watershed. Water at the facility is reportedly used for industrial processes including cooling water for boilers and process water. According to the three-year average, 347 million gallons of water a year are discharged by this facility into the Lower Ohio Watershed via the Huntington Sanitary POTW.
    - Kanawha River Terminals – Ceredo Dock purchases an approximate three-year average of 514 thousand gallons annually from the Big Sandy Watershed via Ceredo PSD. This water is reportedly used for mining practices including dust suppression and wash-down applications. The same amount purchased, approximately 514 thousand gallons, are discharged into the Lower Ohio Watershed via the Huntington Sewage Treatment POTW.



Twelvepole Creek Watershed



Twelvepole Creek Watershed

Watershed Description

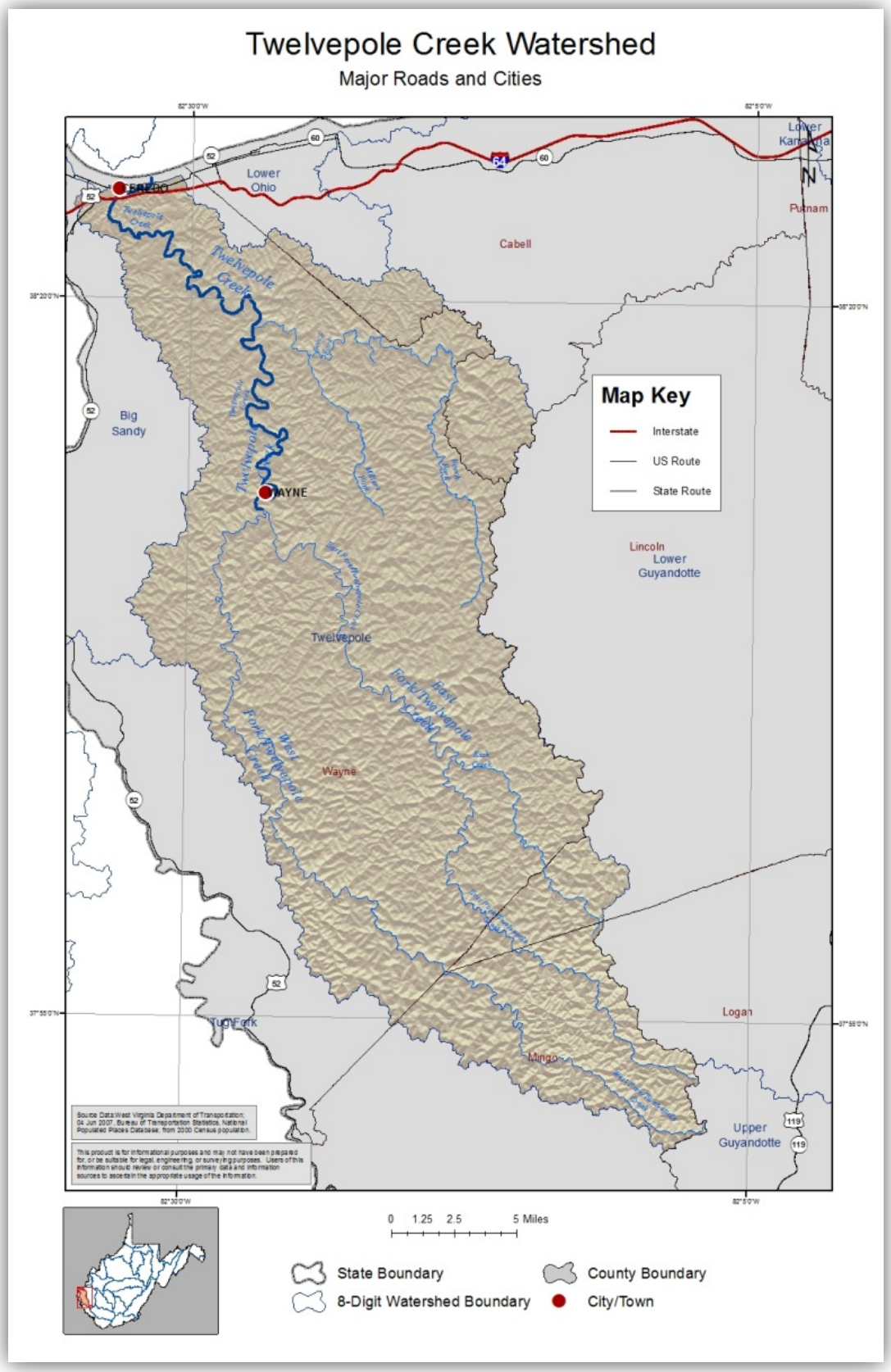
Located in western West Virginia, the Twelvepole Creek Watershed extends north from Mingo County to the town of Ceredo in Wayne County. Encompassing 442 square miles, the watershed contains all, or portions, of four West Virginia counties (Wayne, Mingo, Cabell and Lincoln). Wayne County comprises 79% of the total area of the watershed.

The Twelvepole Creek Watershed has 1,139 miles of streams and rivers. The Twelvepole Creek mainstem flows northerly through the watershed from its source, just south of the Town of Wayne, to its confluence with the Ohio River in northern Wayne County. The major tributaries include East Fork, West Fork and Beech Fork.

Additionally, the watershed encompasses all, or portions, of the following state public lands: one state park (Beech Fork), one state forest (Cabwaylingo) and three wildlife management areas (Beech Fork Lake, East Lynn Lake and Laurel Lake). As well, the Twelvepole Creek Watershed has two United States Army Corps of Engineers operated reservoirs. Beech Fork, located on the Wayne-Cabell County border, has 720 surface acres during summer pool and the Beech Fork Dam maintains a minimum flow release of five cubic feet per second. East Lynn Lake, located south of the Town of Wayne, has 1,005 surface acres during summer pool, while the East Lynn Dam maintains a minimum flow release of 10 cubic feet per second.

Demographics

The Twelvepole Creek Watershed has a total population of approximately 30,054. There are two cities/towns with a population exceeding 1,000. The watershed contains a portion of Ceredo, the largest city within the watershed, with a population of 1,450, followed by the Town of Wayne (1,413).


Twelvepole Creek Watershed
Major Roads and Cities
Lower Ohio
Lower Kanawha
Putnam
Cabell
Big Sandy
Twelvepole Creek
WAYNE
Map Key
Interstate
US Route
State Route
Lincoln
Lower Guyandotte
Twelvepole
East Fork Twelvepole Creek
West Fork Twelvepole Creek
Wayne
Tug Fork
Logan
Mingo
Upper Guyandotte
0 1.25 2.5 5 Miles
State Boundary
County Boundary
8-Digit Watershed Boundary
City/Town

Geography and Geology

The Twelvepole Creek Watershed lies within two ecoregions. Approximately 60% of the watershed occupies the Western Allegheny Plateau Ecoregion and is comprised of rounded hills with wide fertile valleys, mixed oak forests and agricultural lands. The southern portion (40%) of the watershed is contained within the Central Appalachians Ecoregion, which is characterized by its rugged and mountainous terrain, cooler climate and biologically diverse habitat. The average elevation for the watershed is 949 feet above mean sea level. The highest elevation, 1,893 feet, is located on a ridgeline southwest of the unincorporated community of Dingess in Mingo County. The lowest elevation, 517 feet, is located in the north at the confluence of Twelvepole Creek and the Ohio River at Ceredo, West Virginia. The average annual temperature is 53 degrees Fahrenheit and ranges from 53 to 55 degrees. The average annual precipitation for the Twelvepole Creek Watershed is 43.34 inches per year.

More than 82% of the watershed is covered by forests, while 7% is classified as developed. The remaining land cover consists of grasslands, pastures, barren land, wetlands, crops, shrubs and open water. Only 2.7% of the entire watershed is covered by impervious surfaces.

The surface geology in the Twelvepole Creek Watershed is comprised of shale (52%), sandstone (47%) and alluvium (1%).

The United States Geological Survey (USGS), in conjunction with federal, state and local agencies, including the DEP, cooperatively funds the USGS stream gaging network to monitor water availability. Currently, there are two surface water gaging stations and one groundwater gaging station located within the watershed. The groundwater gaging station is a well site located in Wayne County. The surface water gages are located on East Fork of Twelvepole Creek and Twelvepole Creek. The recorded data can be accessed at http://waterdata.usgs.gov/nwis.

LQU data

Table 5-6 contains a list of all Large Quantity User (LQU) facilities in the Twelvepole Watershed that are currently operating, their Standard Industrial Category (SIC) of use, the average percent of source water withdrawn annually, percent withdrawn from the watershed and county, as well as others if intakes are located elsewhere, and the average amount of water withdrawn by the facility based on the most recent three years of monthly data. A detailed discussion about categories of use type and comparisons of use to statewide withdrawals and consumption is available in Chapter 2 of the Plan. Chapter 4 of the Plan

includes data and discussion about future use projections. The following is a summary of data collected regarding the facilities:

- 3 Mining facilities
    - Kanawha River Terminals – Ceredo dock only gets an average of 50% of its water from Twelvepole, the remainder comes from the Lower Ohio Watershed.
- 1 Public Water Supply facility: Wayne Water Service

Table 5-6 All facilities withdrawing from Twelvepole Watershed organized by Use Category and Intake Source and Location (watershed and county). Blanks indicate that no additional withdrawals were occurring.

Facility ID	Facility Name	Use Category	Source and % of 3 Year Average		Watershed and % of 3 Year Average		County and % of 3 Year Average		3 Year Annual Average (gallons)
3508	Argus Energy - Kiah Creek Operation	Mining	Surface Water 100.00%		Twelvepole 100.00%		Wayne 100.00%		96,472,000
2075	Kanawha River Terminals - Ceredo Dock	Mining	Surface Water 99.96%	Groundwater 0.04%	Lower Ohio 19.18%	Twelvepole 80.82%	Wayne 100.00%		9,841,011
4710	Rockspring Development- Camp Creek Mine/Prep Plant	Mining	Surface Water 99.06%	Groundwater 0.94%	Twelvepole 100.00%		Wayne 100.00%		134,171,417
1561	Wayne Water Services	Public water supply	Surface Water 100.00%		Twelvepole 100.00%		Wayne 100.00%		207,817,538

Figures 5-19 through 5-21 summarize the breakdown of the share total withdrawals occurring among currently operating facilities, the trends in use over time for each industry group, and the amount and share of source water withdrawn by the currently operating LQUs in the watershed.

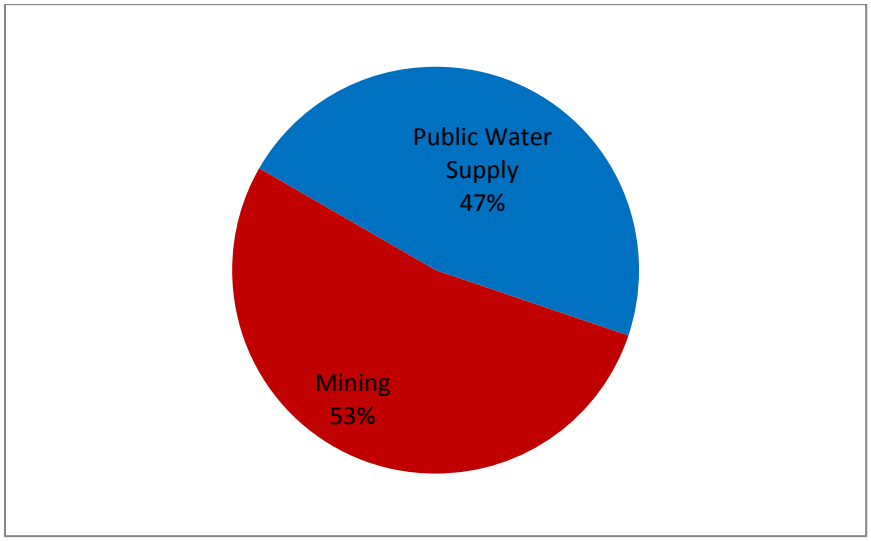
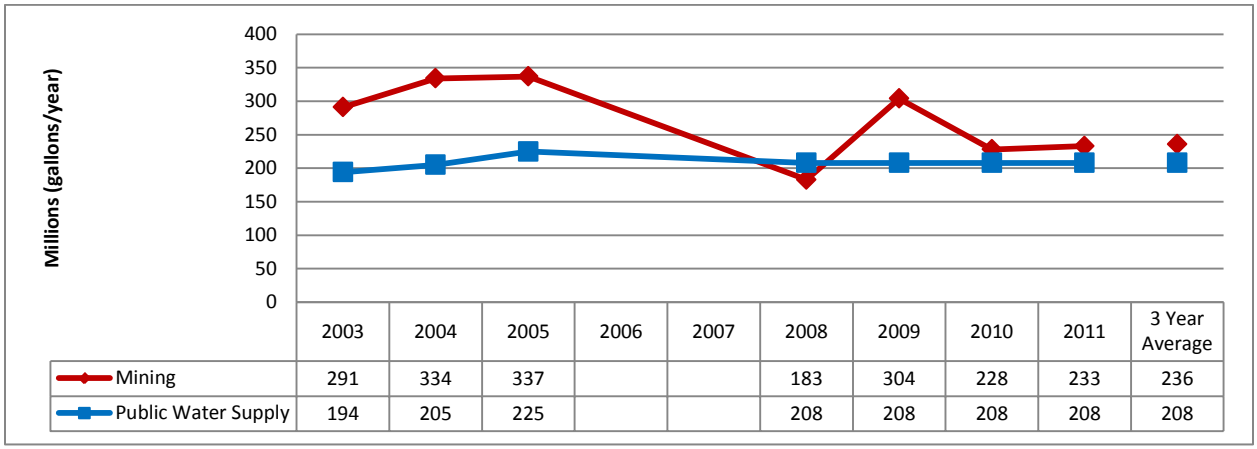


Figure 5-19 Twelvepole Watershed LQU percent of total average annual water withdrawals by sector.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	3 Year Average
Mining	291	334	337			183	304	228	233	236
Public Water Supply	194	205	225			208	208	208	208	208

Figure 5-20 Twelvepole Watershed LQU water withdrawal trends for the Mining and Public Water Supply SIC categories, measured in millions of gallons per year.

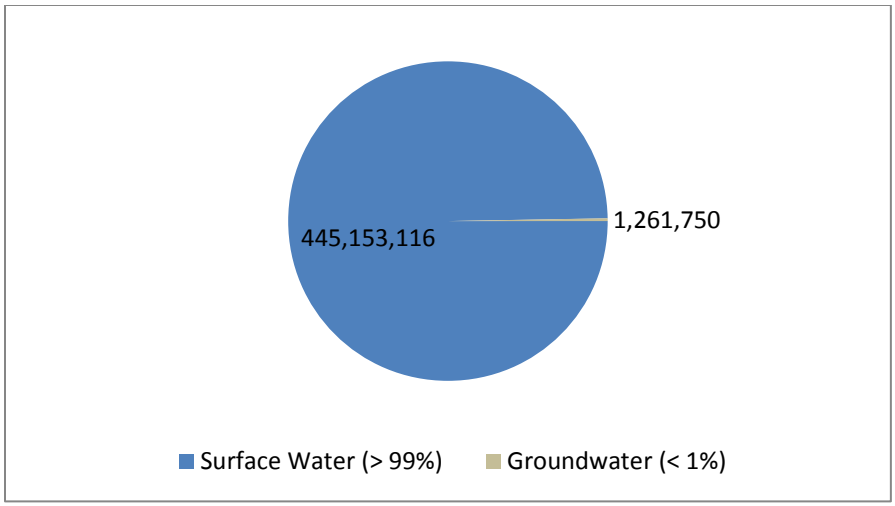


Figure 5-21 Average annual gallons of water withdrawn by LQUs from groundwater and surface water sources in the Twelvepole Watershed.

Interbasin transfers occur when water is permanently moved from one watershed to another. This can occur in a number of ways. However, only three possible routes of transfer are considered here; see Chapter 2 of the Plan for a discussion of possibilities and data limitations. The following is a detailed list of interbasin transfers occurring between the Twelvepole and other HUC-8 watersheds as a result of LQU operations in 2011:

- Withdrawals vs. Stream Discharges
    - Kanawha River Terminals – Ceredo Dock has a three-year average of around 1.9 million gallons of water a year withdrawn from surface and groundwater sources in the Lower Ohio Watershed and approximately 8 million gallons are withdrawn from surface water sources in the Twelvepole Watershed. This water is reportedly used for mining practices including dust suppression and wash-down applications. Of the withdrawn water, a three-year average of 40,000 gallons per year is discharged into the Twelvepole Watershed via Twelvepole Creek and 231,670 gallons are discharged into the Lower Ohio Watershed via the Ohio River.
- Withdrawals vs. POTW discharges
    - None reported
- Purchased water vs. Stream/POTW Discharges
    - None reported