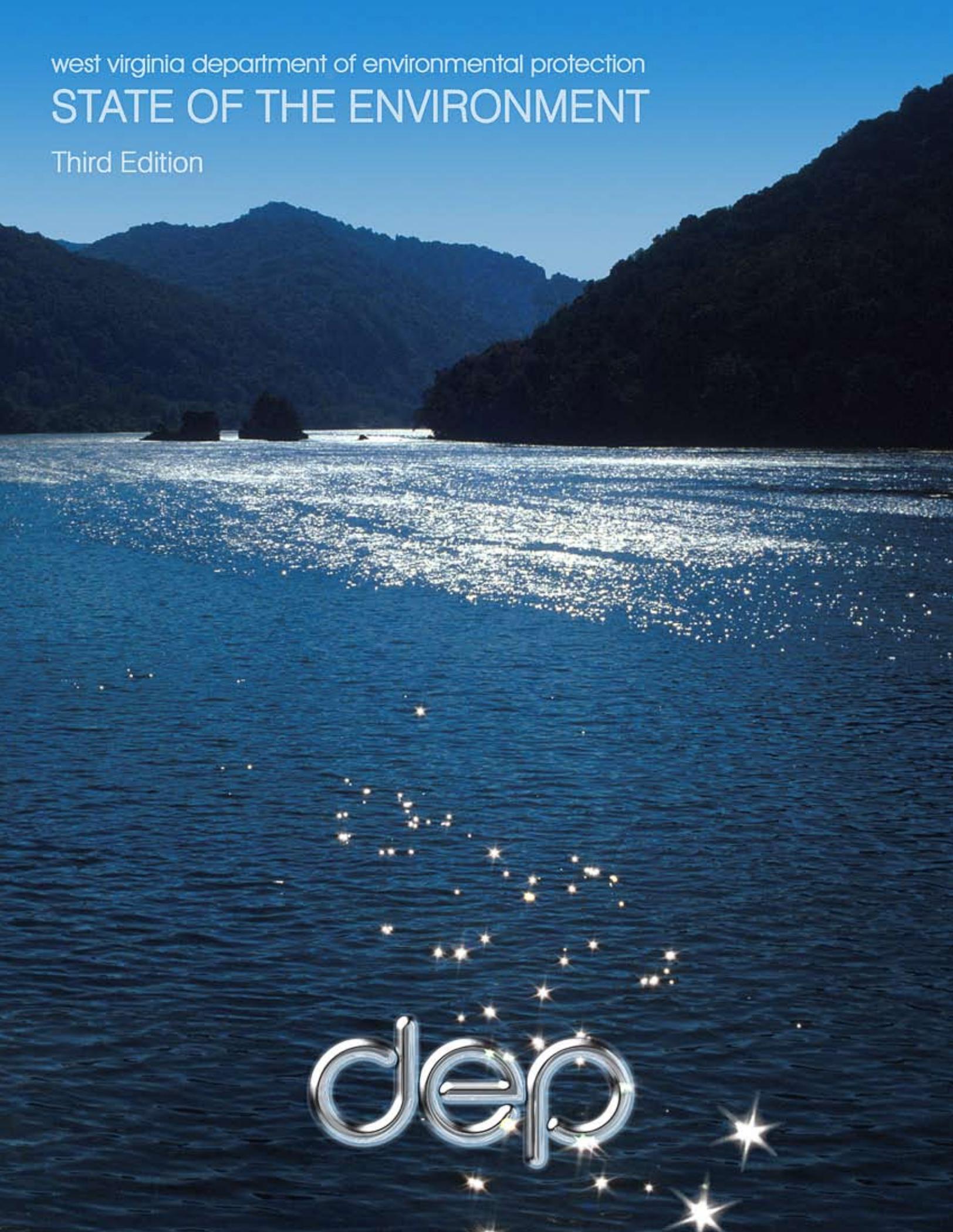


west virginia department of environmental protection

# STATE OF THE ENVIRONMENT

Third Edition



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## Letter from the Governor

Greetings from the Governor:

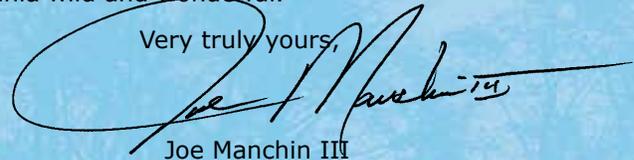
With its scenic views, rolling hills and abundance of streams and rivers, West Virginia is getting noticed as one of America's best kept secrets. With increased interest in what we have to offer, it is more important than ever that we continue to protect our air, land and water, and continue to develop new ideas on how to do so.

The third edition of the State of the Environment shows the great progress our state has made and details the latest trends and statistics related to our progress in protecting the environment. It also serves as a tool that will be used to measure future efforts.

We are seeking new energy opportunities for our state that will be both environmentally responsible and financially sound and will include all forms of feasible energy technologies. We have already begun using brownfields sites, relieving some of the pressure to develop our state's uncontaminated pristine land. We have also seen great improvement from the Rehabilitation Environmental Action Plan, or REAP—The Next Generation. Through this program, volunteerism is at an all time high and we have seen the benefits from our cleaner highways, streams and public lands.

Although we have accomplished a great deal, it is still up to us to continue protecting our environment through volunteerism and educational outreach. It is important we all work together and continue to promote a healthy environment and keep West Virginia wild and wonderful.

Very truly yours,



Joe Manchin III

## Letter from the Secretary

Dear Fellow West Virginians:

Four years ago, the West Virginia Department of Environmental Protection began compiling information and exploring environmental indicators to bring to you a report on the latest trends and statistics of West Virginia's environment.

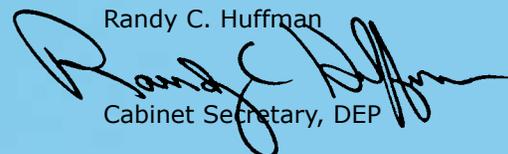
Thanks to the hard work and cooperation of several of the state's agencies, it is with great pleasure I present to you the third edition of the State of the Environment Report. With this report, we are able to continue to set a baseline against which future changes may be compared.

Since the late 19th century, West Virginia's economy has been based largely on manufacturing and natural resource industries that contributed significantly to the nation's growth and well-being. As many communities compete for tomorrow's jobs, the exceptional quality of life offered in West Virginia is a major advantage. The reuse and redevelopment of former industrial sites or "brownfields" offers employers and employees a high quality of life providing communities new commercial, residential and recreational activities. Further, the reuse of brownfield sites reduces potential environmental hazards, encourages economic development and efficiently uses existing utilities and roads contributing to healthier air, land and water. The Report this year highlights that Program's accomplishments.

It is our mission at the DEP to promote a healthy environment, but the task is not ours alone. We must enlist the help of our fellow West Virginians through volunteerism and education to continue to protect our resources and influence others to do the same. Together, we will be able to accomplish great things for our state.

I hope you find the information contained in this report beneficial and informative. Like past reports, we welcome all comments and suggestions. It is your feedback that will lead to the success of future State of the Environment Reports. Thank you for all your efforts in promoting a healthy environment.

Randy C. Huffman



Cabinet Secretary, DEP

# WEST VIRGINIA STATE OF THE ENVIRONMENT REPORT

Prepared by the

West Virginia Department of Environmental Protection

June 2008  
Third Edition

## Purpose of this report

*The report presents a numerical view of the air we breathe, the quality of our waters, and the land we live on.*

The second edition of West Virginia's State of the Environment Report is based on a scientific approach to describing elements of environmental quality. To the extent possible, the report presents a numerical view of the air we breathe, the quality of our waters, and the land we live on. It shifts the focus from reporting about activities that are conducted to protect the environment to the results those activities achieve in improving environmental quality. In some instances environmental impacts of human activity cannot be measured directly. For those cases, indirect measures such as regulatory and non-regulatory program activities may be used.

The report does not draw conclusions about the quality of West Virginia's environment. It simply presents a common base of data and trends, where possible, for others to interpret and analyze. Furthermore, this report continues what will be a long-term process to identify and track changes in the environment resulting from human activities. It also provides a basis for evaluating the success of regulatory and nonregulatory programs designed to improve environmental quality.

In this report, information about environmental quality is presented through the use of environmental indicators. These are measures of physical, chemical, biological, or socioeconomic factors that represent the key elements of complex ecosystems or environmental issues.

In the same way economic and social indicators are used to evaluate the health of our economy and the welfare of our citizens, environmental indicators can provide an objective, scientific-based representation of the state of the environment.

They can be used to communicate information to the public about the condition of the environment statewide and locally where they live and work. They also can help improve understanding of how different components of the environment interact and how environmental quality is affected by human activity.

The indicators used to describe the status and trends of the state's air, water and land resources were chosen based on data that was readily available within DEP and other state and federal agencies. This year's report is more comprehensive

*Environmental indicators can provide an objective, scientific-based representation of the state of the environment.*

*This year's report is more comprehensive than the first, with more in-depth data from all environmental media.*

than the first, with more in-depth data from all environmental media. There is always room for improvement, so DEP will continue to seek new environmental indicators to track and more comprehensive data to report on so West Virginians can see trends in environmental protection measures.

### Framework for indicators

Environmental indicators are scientifically-based measures of air, water and land quality. They measure pressures caused by human activities, as well as natural phenomena, on ecosystems and public health. Indicators have been used by many states, the United States Environmental Protection Agency (EPA), and leading international organizations to examine how environmental quality is changing.

Indicators are powerful tools in a results-based environmental management system. They focus on outcomes of environmental protection programs, such as cleaner air or water, rather than on administrative actions, such as the number of permits issued. Indicators can be used for strategic planning, priority setting, resource allocation, and other decision-making processes.

Most environmental indicator systems are based on a "pressure-state-effects-response" model. This report follows a variation of the model originally developed by the International Organization for Economic Cooperation and Development (OECD). The OECD model has been adapted, modified and used by several states and by EPA to report environmental initiatives. It offers a useful perspective on how indicators may be developed and used. The version used in this report

is borrowed from Environmental Protection Indicators for California, published jointly by the California Environmental Protection Agency and California Resources Agency in April 2002.

The model looks at environmental quality from five aspects:

- The driving forces which are the human activities or aspects that exert pressures on the environment, that are the underlying cause or causes of a problem. Examples of driving forces include population growth, economic expansion, and energy use.
- The pressures on the environment resulting from the driving forces. These are physical, biological and chemical stresses on the environment such as pollution emissions and discharges, waste generation, and land use patterns.
- The state variable which describes some physical measurable characteristic of the environment that results from the pressure. Examples include indicators that monitor aspects such as water and air quality, waste generation, and existence and quality of habitats.
- The effects variable which evaluates the impact of the stresses on the environment on human health and ecosystem health.
- The response variable which measures to what degree society is responding to environmental changes and concerns. This includes policies, regulatory actions, or investments that are made to address an issue.

Indicators can be developed for each of the five aspects of this model. Typi-

*Environmental indicators measure pressures caused by human activities, as well as natural phenomena, on ecosystems and public health.*

*Many factors can influence change in the environment, and care must be taken to investigate all possible influences before attributing change to a particular program activity.*

cally, state environment reports have focused on indicators of pressure, state, and response.

For this report, the recommended environmental indicators include pressure and state indicators only. Response indicators will continue to be reported separately in DEP's annual activity report.

As helpful as they are in planning and decisionmaking, indicators must be viewed with caution because they vary widely in their ability to provide useful information. At best, indicators provide direct measures of environmental, human and ecological health. However, definitive measures are available in only a relatively few areas. Caution must be used in any attempts to establish a cause and effect relationship between an activity and a change in the environment.

Many factors can influence a single change in the environment, and care must be taken to investigate all possible influences before attributing the change to a particular program activity, for example.

## How the indicators were developed

The first edition of this report was developed in conjunction with the National Institute for Chemical Studies (NICS). NICS is a nonprofit research and education organization and has collaborated with DEP on numerous projects.

In the second edition, DEP chose to use the same indicators as the first report. In addition, several indicators make their debut in this report with data collected from our sister agencies and the U. S. Fish and Wildlife Service. The data was compiled by DEP for the selected in-

dicators and is depicted in both text and graphics throughout the report.

Ten criteria guided the selection of the environmental indicators:

1. The indicator should be results-based, to the extent possible; that is, it should provide a measure of actual changes in environmental conditions.
2. The indicator should have a relatively high level of significance to the health of West Virginia citizens and/or its ecosystems.
3. The indicator should be based on scientifically accepted data collection methods.
4. The indicator should be able to distinguish meaningful differences in environmental conditions with an acceptable degree of resolution.
5. The indicator should provide information useful for making policy decisions.
6. The indicator should provide an early warning of changes in the environment or part thereof.
7. The indicator should be useful for making comparisons to indicators in other states, regions or nations.
8. Data collection that produces the type and amount of information needed to support an indicator should be carried out at a reasonable cost.
9. The indicator should be stated in a manner that allows comparison to a benchmark value or point of reference so that users can assess its significance.
10. The indicator should relate to the mission of DEP. Data that is readily available should be used to support the indicator.

*Past editions of this report were developed in conjunction with the National Institute for Chemical Studies (NICS).*

*Several indicators make their debut in this report with data collected from our sister agencies and the U.S. Fish and Wildlife Service.*

INDEX

Air ..... 1  
 Water ..... 7  
 Land .....15  
 Energy .....21

EXHIBITS

Historical trends of air concentrations in West Virginia ..... 2  
 Ozone 4th highest daily maximum 8 hour concentrations ..... 3  
 West Virginia PM<sub>2.5</sub> annual averages ..... 4  
 Sulfur Dioxide annual average concentration ..... 4  
 West Virginia power plant emissions 1990-2007 and sulfur dioxide average concentration ..... 5  
 Toxic air releases in West Virginia ..... 5  
 Toxic air releases (in pounds) by industry sector ..... 6  
 Water resources information ..... 7  
 West Virginia Ecoregions ..... 7  
 Stream condition based on benthic macroinvertebrate community ..... 8  
 Biological impairment sources ..... 8  
 Stream miles exceeding targeted water quality indicator values ..... 9  
 Sediment deposition ..... 9  
 Width of undisturbed vegetative zone..... 9  
 Trash/aesthetic index ..... 9  
 Designated use support.....11  
 Stream miles impaired by reason for listing.....11  
 Toxic water releases in West Virginia by industry sector (List) .....11  
 Toxic releases to water in WV 2006 (pie chart) .....12  
 Toxic water releases in West Virginia .....12  
 West Virginia households served by a public sewer system .....12  
 Wastewater systems .....13  
 Fish consumption advisories.....13  
 Examples of High Quality West Virginia Streams .....14  
 West Virginia National Priority List sites .....15  
 Total leaks from underground storage tanks awaiting final cleanup .....15  
 Acreage available for reuse (Certificates of completion per year) .....16  
 Top fifteen quantities of hazardous waste generated in West Virginia in 2005 (list) .....16  
 Hazardous waste generated in West Virginia.....17  
 Solid waste disposal tonnage .....17  
 Total solid waste collected (REAP) .....18  
 Waste tires collected (REAP) .....18  
 OSR acres revoked and reclaimed .....20  
 OSR water treatment progress and reclamation progress on current revoked permits .....20  
 U.S. Energy production in 2006 (West Virginia energy production in 2006) .....21  
 Coal prospect permits issued.....21  
 Annual production from coal refuse pile reprocessing.....22  
 West Virginia coal, crude oil and natural gas production .....22  
 2007 Released permits with postmining land use .....22  
 New permit acres .....23  
 Active surface and underground coal mines.....23  
 Abandoned wells inventory (Wells plugged).....24



*Air pollutants can affect ecosystems to a significant degree... ground-level ozone has been associated with reduced agricultural and commercial forest yields*

Exposure to air pollution is associated with numerous effects on human health. These include respiratory problems, heart and lung disease, and even premature death. Children are at greater risk because they are generally more active outdoors and their lungs are still developing. Elderly people and people with heart or lung diseases are more sensitive to some types of air pollution.

Air pollutants can also significantly affect ecosystems. According to the United States Environmental Protection Agency (EPA), ground-level ozone has been associated with reduced agricultural and commercial forest yields. Airborne releases of nitrogen oxide have contributed to nitrogen pollution, which can decrease a water supply's ability to support habitat, and acid deposition of mercury compounds resulting in statewide fish consumption advisories is a contributing factor to impaired water quality.

Unlike a watershed where rivers, streams and runoff flow into a specific body of water, air has few natural or manmade boundaries that constrain its flow. Air movement is affected by complex relationships between the sun, oceans, the jet stream and high and low pressure systems. The synergy between these systems moves air across large regions of the Earth. The states located east of the Mississippi River may be thought of as a regional area that shares air patterns and movement. Contributors to the eastern states' regional air quality are large stationary sources (factories and power plants); smaller sources (dry cleaners and degreasing operations); mobile sources (automobiles, airplanes, and trains); and natural sources (windblown dust and forest fires).

This report examines two aspects of air quality: (1) current levels of criteria pollutants in West Virginia and (2) reported emissions of toxic air pollutants into the atmosphere.

### **Criteria Air Pollutants**

Under the federal Clean Air Act, standards were set by the EPA for six common criteria pollutants that have adverse effects on human health and the envi-

ronment: carbon monoxide (CO); lead; nitrogen dioxide (NO<sub>2</sub>); ground level ozone; particulate matter; and sulfur dioxide (SO<sub>2</sub>). Known as National Ambient Air Quality Standards (NAAQS), these standards established acceptable concentrations of these pollutants in the ambient (outdoor) air. The Clean Air Act established two sets of standards. Primary standards are limits set to protect the health of people who are sensitive to the pollutant. Secondary standards set limits that protect physical structures, plants and animals. This report focuses on the primary standards only.

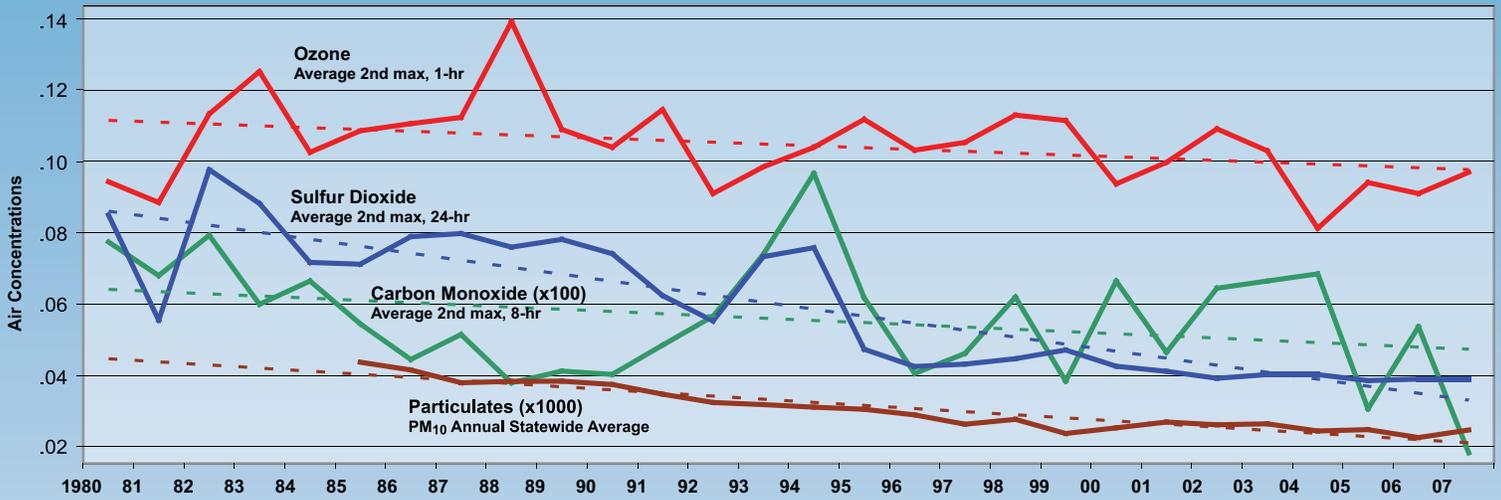
Health effects from air pollution vary greatly depending on the exposure level, duration of exposure, and the nature of the pollutant. Air quality standards for the criteria pollutants are expressed as an average concentration over a specific period of time (hour, day, year) because the concentration of a pollutant in air varies over time. The standards also specify whether the limit applies to an annual average concentration, a specific percentile, or the number of times the level may be exceeded during the calendar year.

The DEP measures the ambient levels of the criteria pollutants through a statewide network of monitoring stations. During 2007, the DEP had monitoring stations in 13 counties to monitor for one or more of the criteria pollutants. These counties are Berkeley, Brooke, Cabell, Greenbrier, Hancock, Harrison, Kanawha, Marion, Marshall, Monongalia, Ohio, Raleigh, and Wood. Sulfur dioxide and particulate matter have the greatest number of monitoring sites.

**Carbon monoxide (CO)** is formed any time a carbon-containing compound such as coal, oil or natural gas is burned and is not completely oxidized. Vehicular traffic is usually a leading source of carbon monoxide emissions, although CO levels may also be impacted by certain manufacturing activities. When the NAAQS is exceeded for this colorless and odorless gas, it can cause dizziness and sluggish reflexes. At higher concentrations it is considered a poison and may be fatal. The NAAQS standard for this pol-

*...six common criteria pollutants have adverse effects on human health...*

*The DEP measures the ambient levels of the criteria pollutants through a statewide network of monitoring stations.*



**Historical Trends of Air Concentrations in West Virginia**  
*(Values are in parts per million except particulates which are micrograms per cubic meter; dotted lines represent trends)*

lutant is 9.0 parts per million (8-hour average) and 35 parts per million (1-hour average). CO is only monitored in West Virginia near a local industrial emission source in the area of Hancock and Brooke counties. Since this is a neighborhood-scale monitor, the data would not be considered either a regional or statewide environmental indicator. The DEP no longer monitors ambient CO in other parts of the state due to historically low concentrations.

**Lead** was once used as an additive to gasoline to improve fuel efficiency. Before the use of lead was phased out between 1975 and 1986, vehicular traffic was the leading source of lead emissions. Lead exposure is known to cause mental retardation, behavioral disorders and seizures. Even exposure at low levels can cause developmental problems and lowered IQ in children. The NAAQS standard for lead is 1.5 parts per million (quarterly average).

The DEP no longer monitors for ambient levels of lead in the air due to low concentrations previously detected.

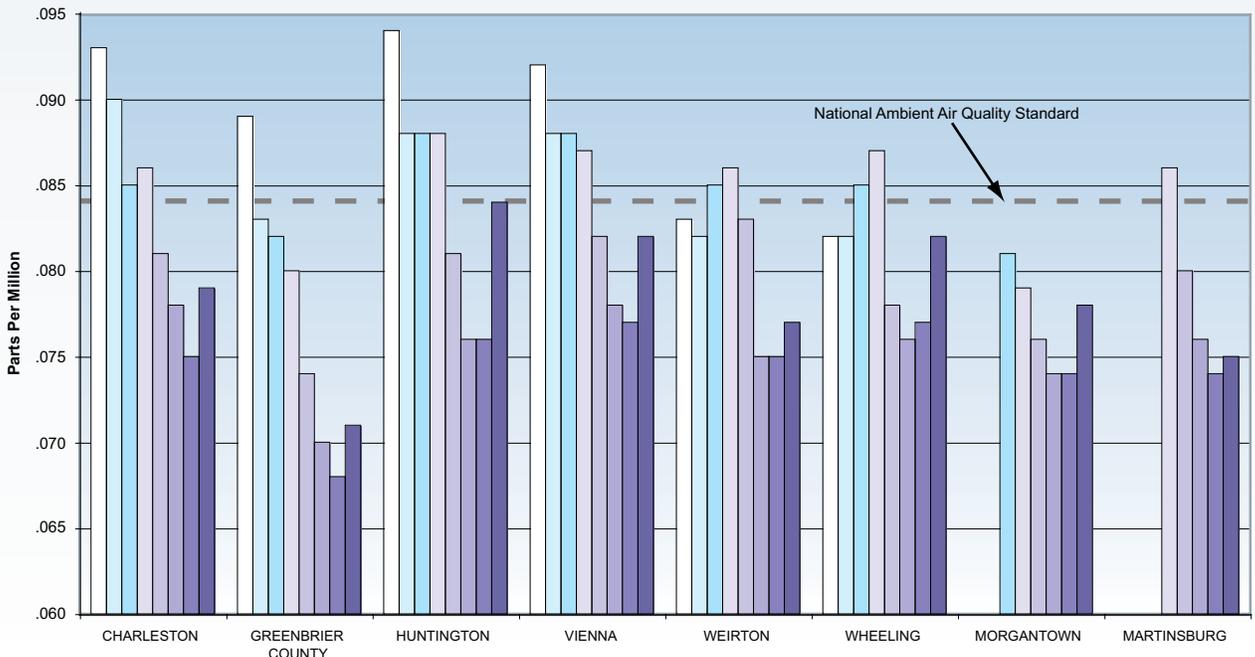
**Nitrogen dioxide** is formed from the combustion of fossil fuels such as coal, oil and natural gas. The leading sources of nitrogen dioxide emissions are power plants and vehicular traffic. NO<sub>2</sub> is a brownish gas that can react with a variety of compounds in the air to form other pollutants.

NO<sub>2</sub> and the pollutants it forms have the ability to negatively affect human health if levels exceed the NAAQS. It is also a precursor to acid rain by reacting with water to form nitrous acid and nitric acid. The NAAQS for nitrogen dioxide is 0.05 parts per million (annual average, arithmetic mean).

The DEP has discontinued monitoring for nitrogen dioxide due to low concentrations found in the air. However, since nitrogen oxides are involved in the formation of ozone, they are accounted for in the measurement of ground-level ozone.

**Ground-level ozone** is formed in a complex series of sunlight-driven reactions involving nitrogen oxides (NO<sub>x</sub>) and a class of compounds called vola-

*Continued on page 6*



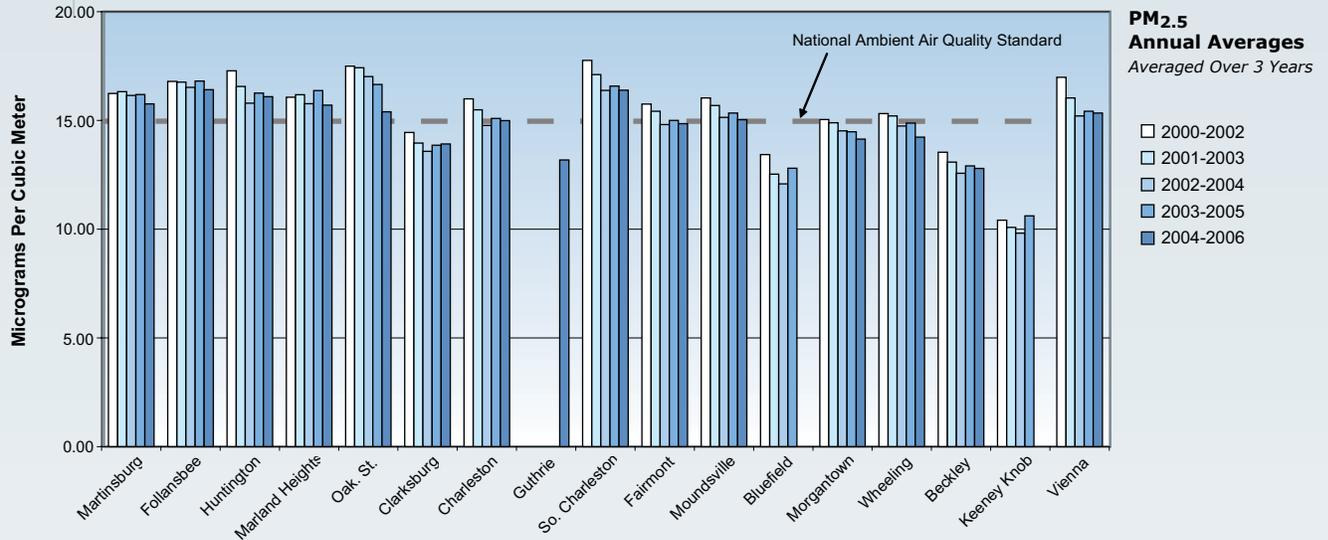
**Ozone 4th Highest Daily Maximum 8-Hour Concentrations**

- 98-00
- 99-01
- 00-02
- 01-03
- 02-04
- 03-05
- 04-06
- 05-07

**On January 25, 2008**, a strong temperature inversion caused an air pollution episode down river from Charleston. Although skies were clear at noon, the DEP began receiving complaints of a blue fog with a chlorine bleach odor by early afternoon. The episode, referred to by news media and residents as the "Blue Haze" Incident, is a classic example of a temperature inversion combined with industrial contributors.

While environmental inspectors began their investigation by contacting local industrial facilities to determine if any leaks had occurred, others were dispatched to the area to make visual observations on the ground, as well as in the air. Air monitoring stations in downtown Charleston recorded elevated concentrations of particulate matter and sulfur dioxide starting in early afternoon, peaking in the evening. It was later determined that a local power plant was the major contributor to the haze, particularly to visibility impairment.





tile organic compounds (VOCs). VOCs come from a variety of sources including vehicular traffic and industrial plants. Since sunlight is needed to generate these reactions, ozone levels are usually higher during the day than at night, and higher in the summer than during the winter. Ozone is the main constituent in smog. Ozone levels above the NAAQS level can cause difficulty in breathing and are especially dangerous for those with existing lung diseases such as asthma or emphysema. There are two standards for ozone: a 1-hour average of 0.12 parts per million, and an 8-hour average of 0.08 parts per million. Because West Virginia meets the 1-hour ozone standard, that standard is no longer applicable to West Virginia counties.

Several of the state's metropolitan areas previously failed to meet the 8-hour ozone standard. During late 2006 and early 2007, the DEP developed plans to ensure that all the areas meet, and will continue to meet, the ozone standard. EPA formally approved these plans and, by June 2007, had designated the areas as in attainment of the standard.

*Several of our metropolitan areas fail to meet the new primary and secondary ozone standards of .075 parts per million.*

In March 2008, EPA promulgated new primary and secondary ozone standards of .075 parts per million. Current monitoring data indicates that several of our metropolitan areas fail to meet the new standards. DEP will be working with other states and EPA to develop control plans to reduce precursor emissions, locally and regionally, and demonstrate that those reductions will be sufficient to show attainment of the standards.

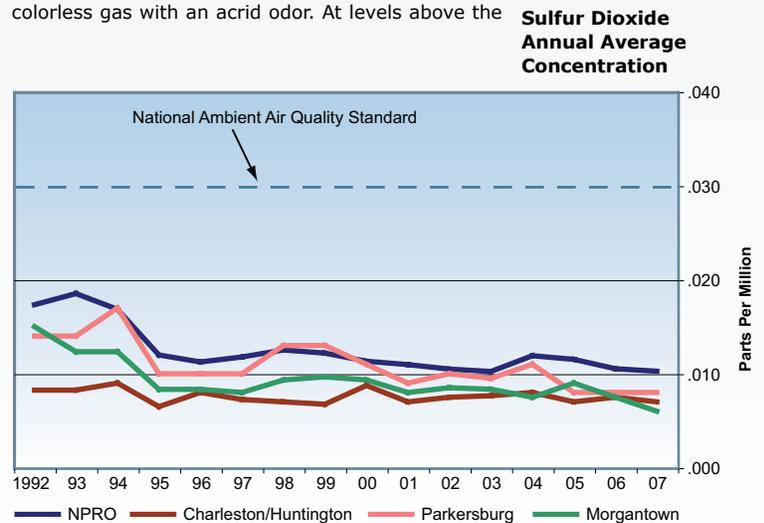
**Particulate matter** is solid particles or liquid droplets found in the air. These particles come from a variety of sources and are commonly thought of as dust, soot or mist. At levels above the NAAQS, particulates can cause respiratory problems especially

for those individuals with existing lung diseases such as asthma or emphysema. Particulate matter is also a major cause of reduced visibility, or haze. There are two standards for particulates: one for coarse particles less than 10 micrometers (0.01 millimeters) in size; and one for fine particles less than 2.5 micrometers (0.0025 millimeters). Particles greater than 10 micrometers are likely to be captured and removed by the body's natural defense systems. Particles less than 10 micrometers have a tendency to enter and remain in the respiratory system. The annual standard for PM<sub>10</sub> was revoked by EPA in 2006. The short-term, 24-hour PM<sub>10</sub> standard remains at 150 micrograms per cubic meter.

The annual standard for PM<sub>2.5</sub> is 15 micrograms per cubic meter. Particulate matter was monitored in 12 counties in 2007.

**Sulfur dioxide** is formed when sulfur-containing compounds are burned. The leading source of sulfur dioxide emissions is coal-fired power plants. SO<sub>2</sub> is a colorless gas with an acrid odor. At levels above the

*Particulate matter is commonly thought of as dust, soot or mist.*



**WV Power Plant Emissions 1990-2007**  
 (Calendar year 2007 Emission Data from US EPA is not yet final)

NAAQS, sulfur dioxide causes respiratory problems especially for those individuals with existing lung diseases. Sulfur dioxide, like nitrogen dioxide, is a precursor for acid rain, combining with water to form sulfuric acid. It is also known to damage vegetation. The NAAQS standard for sulfur dioxide is 0.03 parts per million (annual average, arithmetic mean). In 2007 sulfur dioxide was monitored in seven counties in West Virginia.

*It is anticipated that CAIR will reduce SO<sub>2</sub> emissions in the eastern United States by 70%, and NO<sub>x</sub> emissions by 60%, much of this from coal-fired electric generating utilities.*

**West Virginia Power Plant Emissions**

Traditionally, coal-fired electric generating utilities have the highest emissions of nitrogen oxides (NO<sub>x</sub>) and sulfur dioxides (SO<sub>2</sub>), but these emissions have been nearly cut in half over the past decade. The first major reduction in NO<sub>x</sub> and SO<sub>2</sub> emissions from power plants was the result of Phase I of EPA's Acid Rain Program, promulgated in 1990. Phase I required reductions of these emissions from some of the nation's largest power plants by 1995. The implementation of Phase II of the "Acid Rain Program" in 2000 affected the remaining power plants and further reduced emissions of these pollutants.

Further reductions in the emissions of NO<sub>x</sub> and SO<sub>2</sub> from coal-fired power plants will be achieved as a result of EPA's Clean Air Interstate Rule or CAIR, which ultimately will achieve the largest reduction in air pollution in the U.S. in more than a decade. It is anticipated that CAIR will reduce SO<sub>2</sub> emissions in the eastern United States by 70 percent, and NO<sub>x</sub> emissions by 60 percent, much of this from coal-fired electric generating utilities. Additionally, CAIR



will help West Virginia meet and maintain the NAAQS for ground-level ozone and fine particulates.

**Toxic Air Releases**

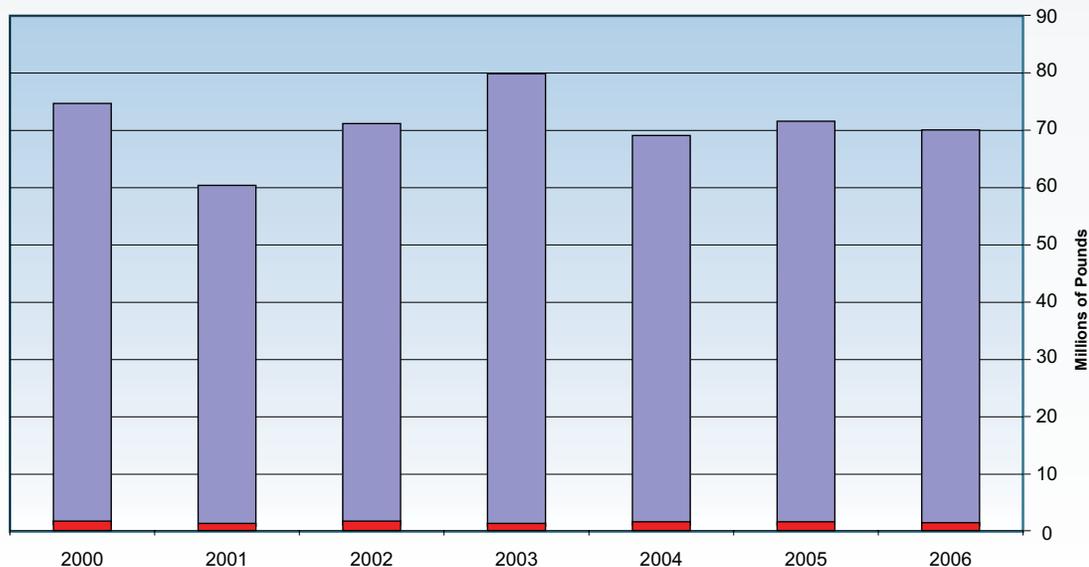
The EPA established the Toxic Release Inventory (TRI) under the federal Emergency Planning and Community Right to Know Act of 1986. The TRI tracks releases of more than 650 different toxic chemicals to the air, water and soil. Toxic chemicals are those that may present a serious hazard to human health or the environment. These compounds include those known to cause cancer and to have other life-threatening health effects. In 1998, EPA added electric utilities, mining operations, hazardous waste facilities, and chemical wholesalers to the list of industries required to report under TRI. The adoption of these industries, as well as the periodic addition and deletion of chemicals from the reportable list, makes trend analysis difficult.

The graph (below) shows total statewide toxic air releases from 2000 through 2006. During that time,

**Toxic Air Releases in WV**  
 in Millions of Pounds

Total Carcinogens ■  
 Total Releases ■

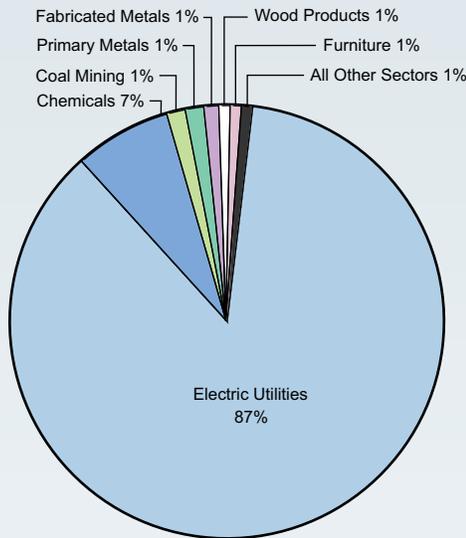
Source: US EPA Toxic Release Inventory; National Institute for Chemical Studies



**2006 Toxic Air Releases by Industry Sector**

69.1 Million Pounds of Toxic Air Releases

Source: US EPA Toxic Release Inventory



the reporting industries and reportable quantities have remained fairly consistent. The pie chart shows toxic air releases in 2006 by industry sector. Several factors affecting the trends in toxic air releases from 2000 through 2006 are changing demands on power output from the electric utilities sector; variability in coal composition; changes in estimation factors; and increased awareness, resulting in more extensive reporting.

**Greenhouse Gas Emissions**

The DEP is becoming more involved with climate change issues. The agency has followed the related development of state, regional and national greenhouse gas programs for several years. Many reputable scientists predict that climate change may cause a variety of unwanted effects, including droughts, decreases in arctic land and sea ice, and species displacement. The DEP recognizes that national and international greenhouse gas quantification and reduction initiatives are imminent and believes that an important initial step is to quantify the anthropogenic (manmade) emissions that are contributing to global warming.

During the 2007 legislative session, DEP worked with key lawmakers to develop legislation that confirms and clarifies the DEP’s authority to collect greenhouse gas information. The resulting Senate Bill 337 gives DEP a variety of associated responsibilities, including development of greenhouse gas programs and collection of pertinent emissions data.

Accordingly, the DEP has adopted a regulation that lays out a program for the reporting and inventory of greenhouse gas emissions by facilities, which emit more than a de minimis amount of greenhouse gases. The program will inventory greenhouse gas emissions from stationary, area, mobile and biogenic sources, and account for reductions, capture and sequestration activities. Carbon sequestration refers to the provision of long-term storage of carbon in the terrestrial biosphere, underground, or the oceans, so that the buildup of carbon dioxide (the principal greenhouse gas) concentration in the atmosphere will reduce or slow.

The regulation also provides for a periodic compilation of a net greenhouse gas emissions inventory, and a determination whether West Virginia is a net sink or emitter of greenhouse gases. Another provision of the rule provides for development of a registry for voluntary reductions of greenhouse gas emissions, and a determination whether the reduction, capture and sequestration of greenhouse gas emissions can be developed as an asset for economic development.

**Mercury**

In 2006, DEP adopted the federal mercury emissions control requirements for coal-fired power plants referred to as the Clean Air Mercury Rule or CAMR. It affected all coal-fired power plants nationally and established caps on mercury emissions in two phases and allowed emissions trading to achieve the caps.

Several states and others challenged the federal mercury rule and subsequently, the D.C. Circuit Court of Appeals vacated the rule in February 2008. EPA appealed the ruling and litigation continues. Notwithstanding the court decision, mercury reductions expected under the first phase of CAMR, in 2010, will still occur in West Virginia because the affected plants remain subject to the Clean Air Interstate Rule (CAIR). CAIR requires reductions of sulfur dioxide and nitrogen dioxide in a similar two-phase approach. Control devices used to achieve these pollutant reductions also have a co-benefit effect of significantly reducing mercury emissions. In West Virginia, facilities have installed, or have begun installation of, these control devices that obtain the same mercury reductions CAMR would have required by the year 2010.

# Water

The DEP implemented the Watershed Management Framework in 1996, creating a five-year cycle in which to collect comprehensive water quality data. The agency uses the framework as a tool to not only assess waters, but also to implement water quality improvement plans on each of the state's 32 watersheds.

## West Virginia's Aquatic Integrity

West Virginia has many miles of high quality streams that support healthy communities of aquatic organisms. Many of these streams are the raw water sources for the state's drinking water suppliers, as well as for the construction, manufacturing, chemical, power generation, mineral extraction, and agricultural industries. Recreation in and around West Virginia's waters contributes significantly to the state's economy. However, many stream miles are impaired by a variety of pollutants. Leading causes of impairment include mine drainage constituents (like acid and iron), sewage and livestock waste (like nutrients and pathogens), sediment, and streamside habitat destruction.

effort allow the DEP and the EPA to make statistically valid comparisons of aquatic integrity between watersheds and ecoregions. The data also assist in monitoring long-term trends in watershed and ecoregion health.

The probabilistically selected sites are assessed using three broad categories of aquatic integrity indicators: water quality, habitat quality, and benthic macroinvertebrate community quality. From these, several individual indicators were chosen to help illustrate the condition of West Virginia's rivers and streams during the periods of interest in this State of the Environment report.

### Biological

- West Virginia Stream Condition Index (WVSCI)

### Water Quality Indicators

- pH less than 6.0 standard units
- Sulfate greater than 50 milligrams per liter
- Fecal coliform bacteria greater than 400 colonies/100 milliliters

### Habitat Quality Indicators

- Relative presence of sediment deposition
- Relatively intact riparian vegetation zones
- A range of human-refuse intensity values

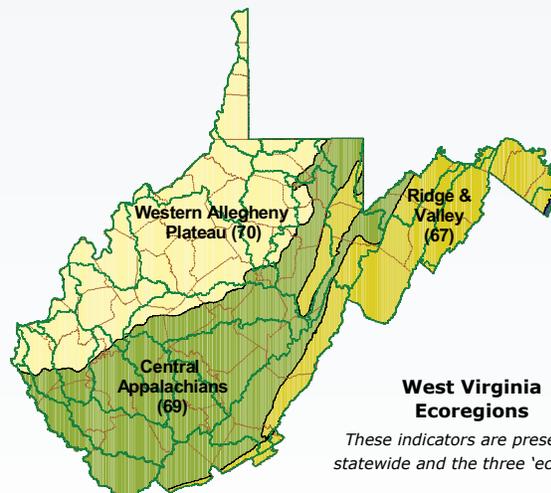
*Sites are assessed using three broad categories of aquatic integrity indicators*

## Water Resources Information - WV

2006 est. state population (U.S. census).....	1,818,470
WV Land surface area (sq. mi.) (U.S. Census).....	24,078
Number of major watersheds.....	32
Total river & stream miles (1:100K scale USGS).....	32,278
Perennial stream miles (flow year round).....	21,114
Intermittent stream miles (may dry).....	11,164
Stream miles on state border.....	619
Number of public lakes, reservoirs, & ponds.....	108
Total wetland acres.....	102,000

## Ecological Assessment of Aquatic Integrity

In 1997, the DEP Watershed Assessment Section began sampling sites selected through the EPA random stratified procedure in order to better assess the ecological health of watersheds and ecoregions within the state. The data generated from this random stratified (also known as probabilistic) sampling



### West Virginia Ecoregions

*These indicators are presented for statewide and the three 'ecoregions'.*

With the exception of the Designated Use Support section, the data used to create the charts presented in this report is from the 2002-2006 probabilistic monitoring effort. The original 5-year effort (1997-2001), though similar in appearance, is not directly comparable to the information in this summary. The 3rd 5-year round of probabilistic monitoring was started in 2007 and will allow statistically valid trend analyses to be possible in the future.

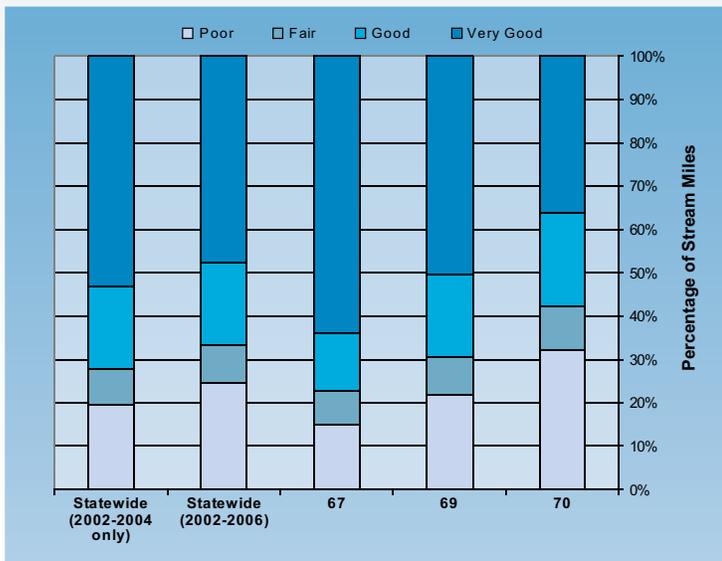
*Benthic macroinvertebrates are bottom-dwelling organisms with no backbones, and are visible with the naked eye.*

**West Virginia Stream Condition Index**

Biological impairment is defined by a low score on the West Virginia Stream Condition Index. The WVSCI is a scoring system that integrates the results of six measures of benthic macroinvertebrate community health. Benthic macroinvertebrates are bottom-dwelling organisms with no backbones, and are visible with the naked eye. Typically, aquatic insects (e.g. mayflies and stoneflies) comprise the largest diversity of these animals, but snails, mussels, aquatic worms, and crayfish are also members of the benthic community.

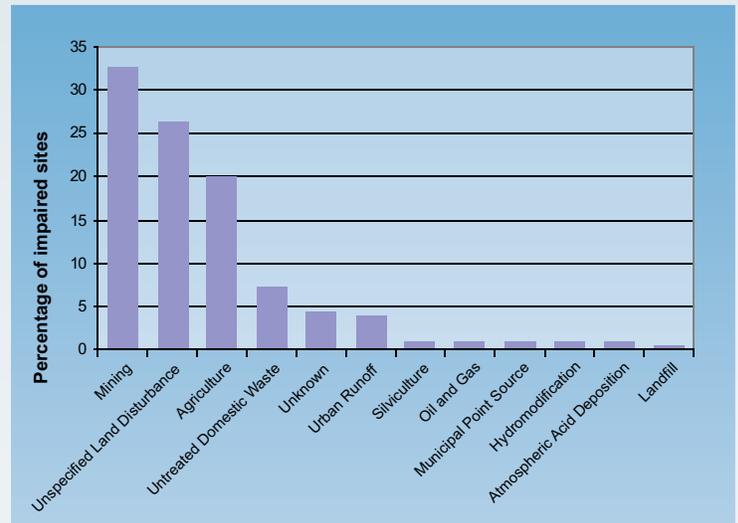
These animals are important in the processing and cycling of nutrients, and are major food sources for fish and other aquatic animals. Communities of such organisms are excellent indicators of water quality because they reflect overall ecological condition, by integrating the combined effects of water quality and habitat quality. More so than fish communities, macroinvertebrate communities measurably respond to slight changes in aquatic environments due to human activities. The percentages of stream miles in four WVSCI categories for the data generated in 2002-2006 are shown in the bar chart titled 'Stream condition based on benthic macroinvertebrate community'.

**Stream Condition Based on Benthic Macroinvertebrate Community**



brate community'. The chart compares the results for the three ecoregions and also includes the results of the first three years (2002-04) of the study that were reported on in the 2006 State of the Environment Report. The individual and combined influences of pollution and stream habitat alterations are the causes of fair and poor WVSCI scores.

**Biological Impairment Sources**  
(based on 2002-2006 probabilistically sampled sites with WVSCI < 60.6)



**Sources of Bio-impairment**

The results of the 2002-2006 probabilistic sampling revealed that 205 out of 753 samples received a WVSCI score of 60.6 or less. Benthic macroinvertebrate communities that score within this range are considered impaired, and the DEP would describe them as not supporting their aquatic life use designation.

Twelve categories of major sources of biological impairment were determined using water chemistry analyses, narrative descriptions by sampling personnel, benthic community characteristics, and several Geographic Information System data layers depicting landuse activities. Each of the 205 sites was assigned a primary source of impairment from one of the 12 categories. For sites with possibly more than one source of impairment, the most obvious source was listed. Of the 205 bio-impaired sites, mining affected almost 33 percent. The next highest sources of impairment are 'unspecified land disturbance' and agriculture. Unspecified land disturbances are characterized by heavy sand and sedimentation associated with dirt roads, poor riparian zones and highly erodable areas.

**Water Quality Indicators of Aquatic Integrity**

The DEP analyzes more than 20 different water quality parameters at each of the sites sampled as part of the probabilistic monitoring program. The graph

to the right summarizes the results of three parameters that are indicators of different sources of impairment.

Fecal coliform bacteria analysis provides an indication of whether human or animal wastes are present in waterbodies.

Sulfates are typically fairly low unless there are large land disturbances (such as surface mining and road construction) that allow rainwater to percolate through fractured rock.

Low pH or acidic conditions are found in areas that are vulnerable to the affects of acidic precipitation as well as areas with untreated mine drainage. Ecoregion 69 has the highest percentage of acidic waters (17.6%), this region includes the sterile (low buffered) headwaters of the Gauley, Little Kanawha, Elk, Tygart and Cheat River watersheds.

**Habitat Indicators of Aquatic Integrity**

The bar charts to the right show the percentage of stream miles in very good, good, fair, and poor categories for three habitat indicators of aquatic integrity. The bar charts below include statewide estimates for the first three years of the 5-year probabilistic study (2002-2004), the entire 5-year study (2002-2006), and compares the three major ecoregions for these three indicators.

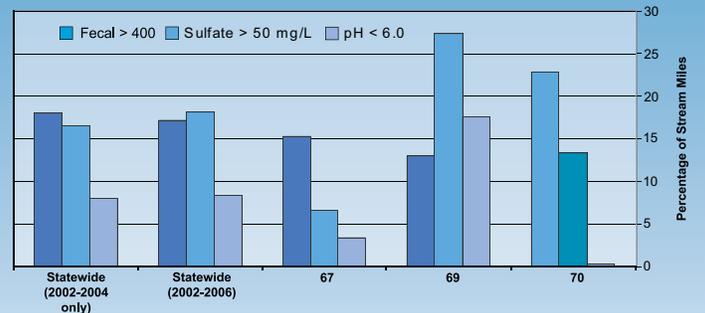
The chart titled **Sediment Deposition** shows the percentages of stream miles with different levels of sand and silt deposited instream. Ecoregion 70 had a much higher percentage of streams with poor and fair ratings of sediment deposition. This is likely because this region has more slow, low gradient streams, has more erodable soils, and more land disturbing activities than in other areas.

Ecoregion 69, the Central Appalachians, had the highest percentage of **wide undisturbed vegetation zones**. This indicator rates streamside zones on the amount of undisturbed vegetation present, which is desirable for minimizing the amount of sediment, excess nutrients, and other pollutants entering the stream.

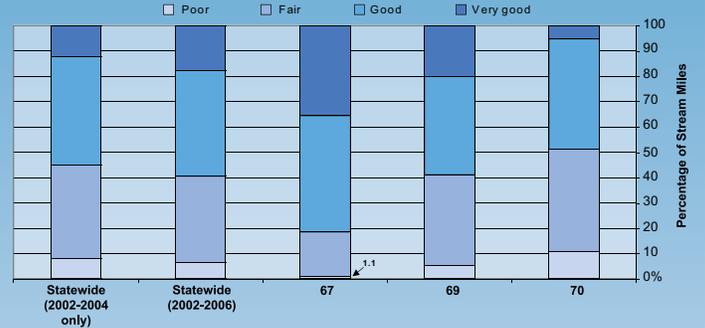
The **Trash/Aesthetic Index** is a measure of the amount of human refuse that is in and around the stream (including that which could be washed into the stream at high flows).

Ecoregion 67, the Ridge and Valley Ecoregion, has the highest percentage of 'clean' streams, with more than 75 percent of stream miles in the very good category.

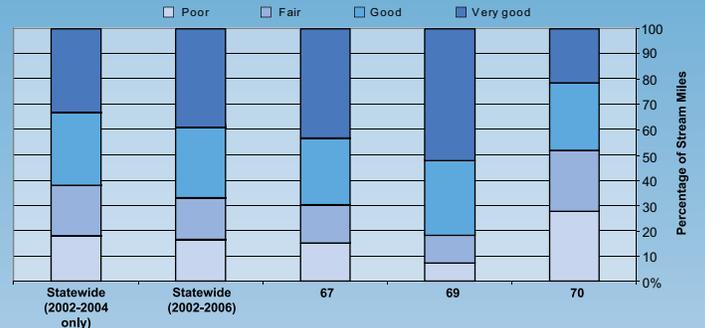
**Percent of Stream Miles that Exceeded Targeted Water Quality Indicator Values**



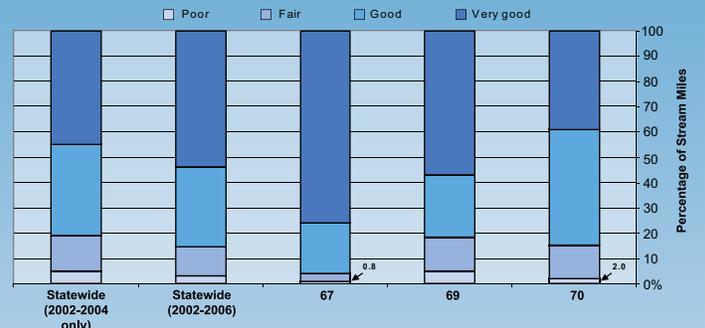
**Sediment Deposition**



**Width of Undisturbed Vegetation Zone**



**Trash/Aesthetic Index**



The scale showing three stream photographs helps illustrate the range of trash impacts encountered across the state.



North Fork/South Branch Potomac River (WVPSB-28) Trash Index Score = 16 (Very good)



Shrivers Run/Tyler County (WVOMI-18) Trash Index Score = 10 (Fair)



Conley Branch/Logan County (WV06-65-L) Trash Index Score = 1 (Poor)

### Designated Use Support

Designated uses refer to those stream uses outlined in Title 47CSR2, Requirements Governing Water Quality Standards. Examples include warm water fishery, public water supply, and water contact recreation, including swimming and skiing, etc.

Water bodies fall into five categories of support for their designated uses:

#### Waterbodies fall into five categories of support for their designated uses

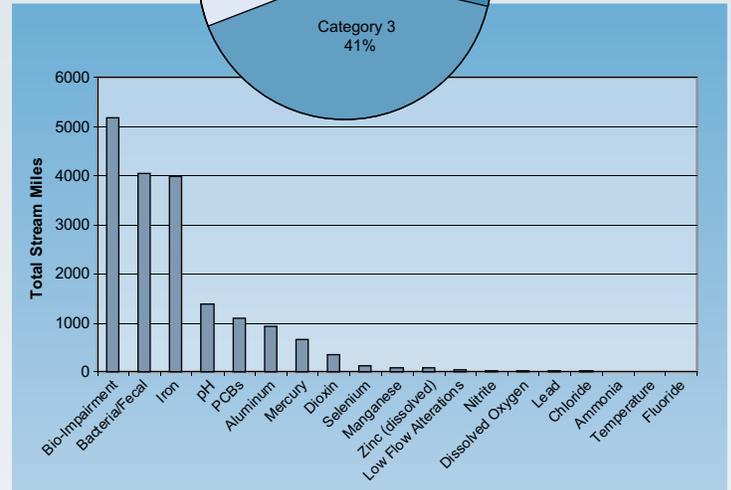
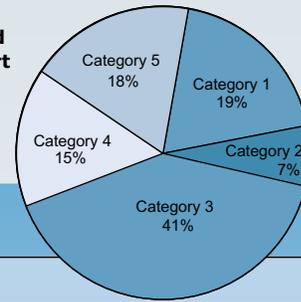
- Category 1** fully supporting all designated uses.
- Category 2** fully supporting some designated uses, but insufficient data exist to assess the other designated uses.
- Category 3** insufficient data to determine if any of the uses are met.
- Category 4** waters that are impaired or threatened, but do not need a TMDL developed.
- Subcategory 4a** waters that already have an approved TMDL plan, but still do not meet designated uses.
- Subcategory 4b** waters with control mechanisms in place that are expected to restore the waters to designated uses.
- Category 5** impaired waters that are expected to need a TMDL plan developed.

Data source - Preliminary Draft 2008 Integrated Report

Section 303(d) of the federal Clean Water Act requires the compilation of streams and other bodies of water that do not meet their designated uses due to impairments by various causes. The primary reason for developing 303(d) lists is to formulate plans to restore impaired waters to their designated uses.

Such plans include the determination of total maximum daily loads of pollutants allowed in the impaired waters.

### Designated Use Support



### Leading Sources of Impairment

The chart titled Stream Miles Impaired by Reason for Listing shows bio-impairment as the most extensive reason for listing streams as impaired. Biological impairment reflects a low score (< 60.6) on the West Virginia Stream Condition Index (see the discussion under the section titled Ecological Assessments of Aquatic Integrity).

### Stream Miles Impaired by Reason for Listing

includes Category 4 & Category 5 (Impaired) Streams

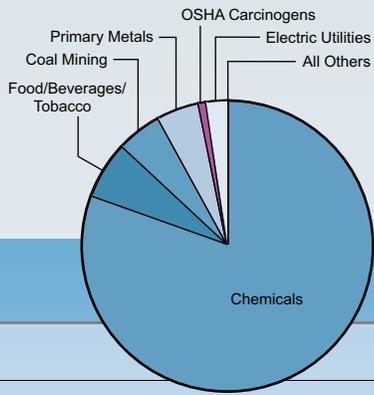
### Toxic Releases to Surface Water

The chart below represents toxic chemical releases to surface water. This information is tracked by the EPA through the Toxic Release Inventory that was established in 1986. Electronic fact sheets with TRI data are available for each state at [www.epa.gov/triexplorer](http://www.epa.gov/triexplorer).

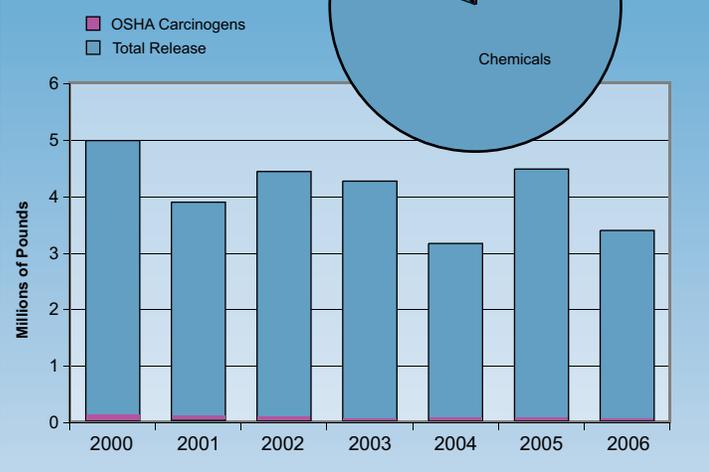
#### Toxic Water Releases by Industry Sector (in pounds)

Industry	2000	2001	2002	2003	2004	2005	2006
Chemicals	2,663,782	2,308,275	3,544,697	3,453,484	2,211,710	3,723,301	2,688,549
Food/Beverages/Tobacco	860,922	134,801	143,023	192,901	281,030	220,754	214,802
Coal Mining	724,441	693,887	133,410	181,547	165,626	175,818	167,293
Primary Metals	215,895	416,951	335,605	157,196	239,262	143,023	164,175
OSHA Carcinogens	103,031	69,775	54,440	23,951	43,900	36,664	26,309
Electric Utilities	91,564	92,083	81,649	94,564	88,922	95,922	79,795
Plastics and Rubber	64,899	63,857	66,288	71,957	18,633	1	2
Machinery	34,878	No Data	No Data	34,561	46,703	22,669	No Data
Petroleum	16,142	18,570	22	24	20	20	522
Stone/Clay/Glass	534	701	263	74	120	126	139
Fabricated Metals	368	720	633	7,859	435	890	1,533
Petroleum Bulk Terminals	281	No Data	285	304	285	285	40
Wood Products	41	24	88	5	155	21	18
Electrical Equipment	9	251	251	50	0	0	10

**2006 Toxic Releases to Water in WV**



**2006 Toxic Water Releases in WV**



**Wastewater Treatment**

The availability of publicly owned wastewater collection and treatment facilities is a key determinant in defining the health and water quality of a community. Residents without access to public sewer systems either rely on individual sewage systems or pipe the untreated sewage directly to streams. Inadequate or untreated sewage can have severe environmental and health implications and can impair water quality with disease-causing bacteria, metals and nutrient laden effluent. Reducing or eliminating these risks through development of publicly owned wastewater collection and treatment systems is a fundamental

part of the federal Clean Water Act and state environmental law.

Many West Virginia municipalities are also struggling with problems associated with combined sewer systems and wet weather overflows. After a heavy rain or snow melt, excess water entering combined systems can easily exceed the capacity of these lines, and mixed with sewage, exits the system through overflows directly into streams. In addition, wastewater treatment plants can be burdened to the point in which sewage bypasses may occur at the plant or otherwise discharge inadequately treated sewage.

The funding of publicly owned wastewater projects in West Virginia is facilitated through the coordination and cooperation of the Infrastructure and Jobs Development Council (IJDC), of which DEP is a member. Every three years, the IJDC assembles a statewide inventory and needs assessment for wastewater systems. The next report should be issued later this year (2008).

An additional 1.4 million pounds of pollutants is estimated to have been removed from West Virginia waters over the past two years. Seventeen communities are providing sewer service for the first time to 4,577 customers, who previously relied on septic tanks, direct pipes to streams, or other inadequate means of treatment as a means of sewage disposal. Twenty other communities serving 54,154 customers have upgraded their facilities providing for a better degree of treatment which has reduced the amount of pollutants discharged to receiving streams.

**Summary of Needs**

**Sewer**  
45% of population not connected to centralized public wastewater system

Needs include treatment, collection, extension and compliance with the Clean Water Act and the State Water Pollution Act

Needs exceed \$1.8 billion

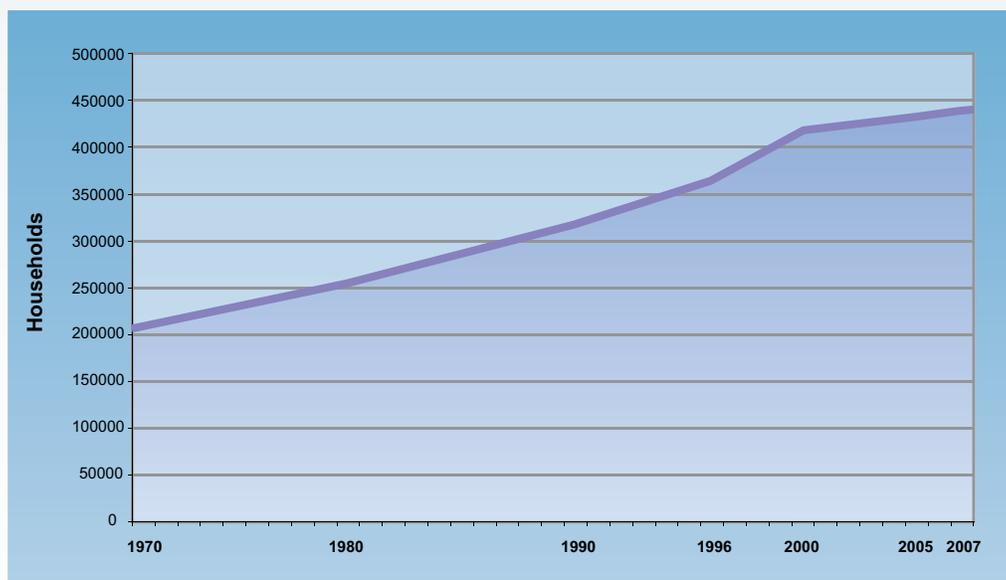
**Combined Sewer Overflow**

57 communities have identified CSO corrections

Upgrades to reduce combined sewer overflows

Needs exceed \$1.1 billion

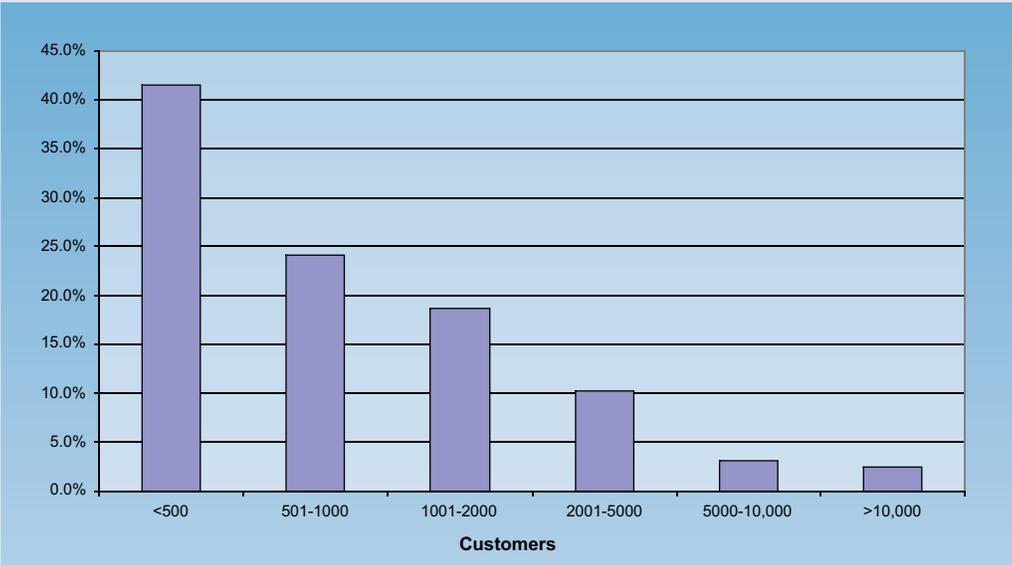
**WV Households Served by a Public Sewer System**



*The graphs here and on the next page summarize the progress being made toward providing adequate wastewater service to our citizens and also describe the tremendous future needs that still must be met.*

**Sewage facilities built in 2006 and 2007**

- 17 new facilities built
  - 4,577 new customers
  - 217,178,650 gallons of raw sewage and 652,057 pounds of pollutants removed annually
- 
- 20 facilities upgraded
  - 54,154 existing customers
  - 474,384,450 gallons of raw sewage and 730,909 additional pounds of pollutants removed annually



**Wastewater Systems**  
by number of customers served

**Totals**

- 37 new or upgraded facilities
- 58,731 customers
- 691,563,100 gallons of raw sewage removed annually
- 1,382,966 pounds of pollutants removed annually

The chart on existing sewer systems in West Virginia indicates that the vast majority of wastewater systems serve a very small customer base. It is estimated that 436,425 households or customers are currently served by a public sewer system. This number represents 55 percent of the population. More than 40 percent of the systems serve fewer than 500 customers, 65 percent serve fewer than 1,000 customers and over 94 percent serve fewer than 5,000 customers. This is really a true indication of the rural makeup of our communities and state, and the inherent challenges of providing adequate wastewater collection and treatment to our residents.

developed and issued in accordance with an inter-agency agreement between the DEP, Division of Natural Resources, and the Bureau for Public Health.

There are currently waterbody-specific fish consumption advisories on 18 state streams and five lakes for a variety of fish species and contaminants. The risk-based approach estimates the probability of adverse health effects and provides a statement on the health risk facing the angler and high-risk groups including women of childbearing age and children. There is a general statewide advisory that recommends limiting the consumption of sport-caught fish from all West Virginia waters in relation to low-level mercury and/or polychlorinated biphenyl (PCB) contamination. The statewide advisory provides species-specific recommendations ranging from one meal per week to one meal per month. The graphs below represent a summary of all fish tissue data collected and used to generate statewide advisories and waterbody specific advisories. Get a comprehensive fish advisory list from the Department of Health and Human Resources online at [www.wvdhhr.org/fish](http://www.wvdhhr.org/fish).

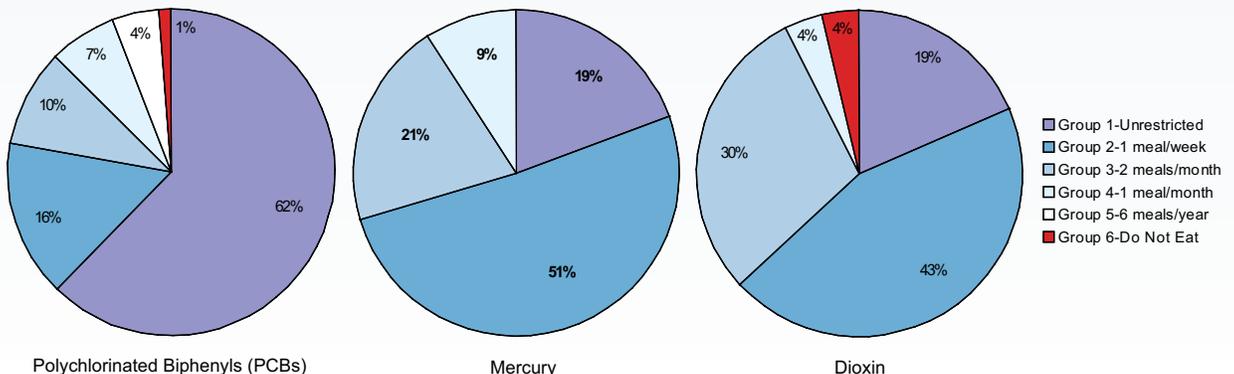
*West Virginia's fish consumption advisories include guidelines on the number of meals to eat and information on proper fish preparation to further minimize risk.*

**Fish Consumption**

West Virginia Water Quality Standards prohibits the presence of materials in concentrations that are harmful, hazardous, or toxic to man, animal, or aquatic life in state waters. Fish consumption advisories are used to inform the public about potential health risks associated with eating fish from West Virginia's streams. Fish consumption advisories are

**Fish Consumption Advisories**

Percent of samples in each meal category

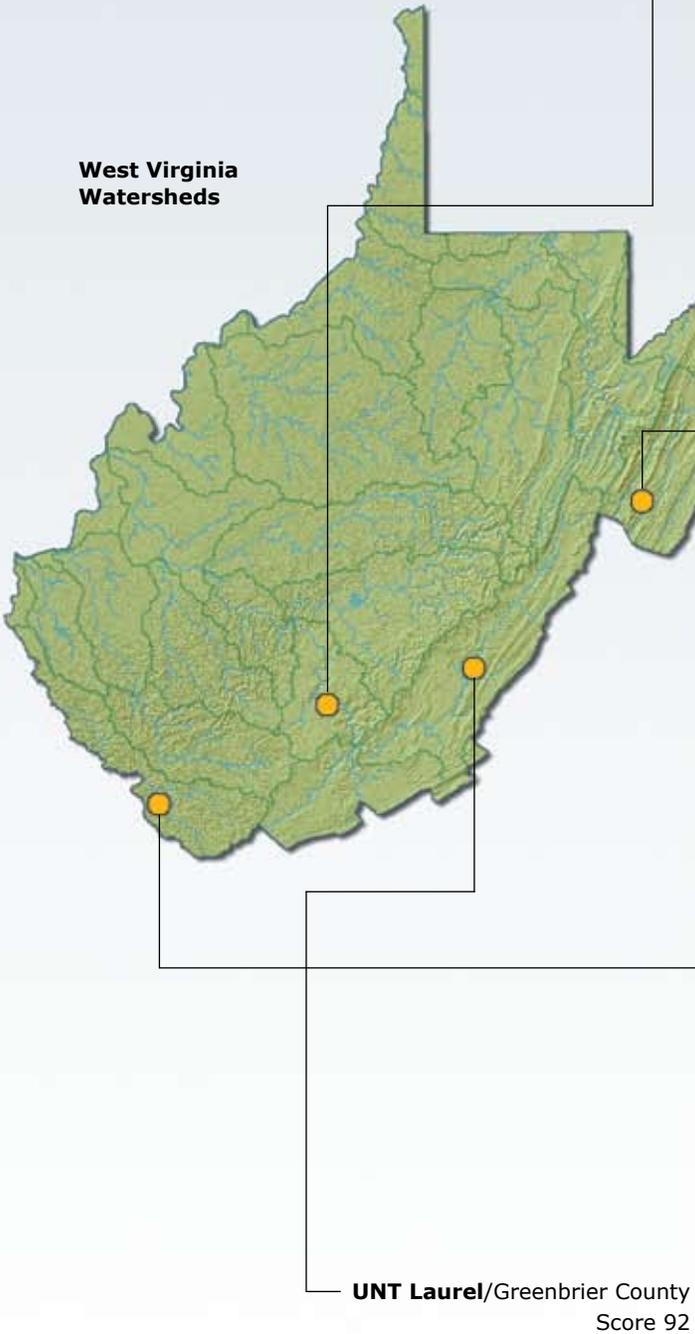


### Examples of High Quality WV Streams

These streams are considered examples of high-quality streams because they have a high West Virginia Stream Condition Index (WVSCI) score and because they have an overall high physical habitat quality score.

The WVSCI denotes the overall health of a stream based on the presence of benthic macroinvertebrates.

#### West Virginia Watersheds



**Glade Creek/Raleigh County**

Score 88.7



**Gravel Lick Run/Pendleton County**

Score 87.6



**Hurricane Branch/McDowell County**

Score 83.3



**UNT Laurel/Greenbrier County**  
Score 92

# Land

Since the late 19th Century, West Virginia's economy has been based largely on manufacturing and natural resource industries that contributed significantly to the nation's growth. As a result, a legacy of environmental problems has led to the creation of multiple cleanup programs. The DEP has embarked on a path of coordinating cleanup programs to provide sound, effective remedies using the best available scientific and technical approaches. The goal is to eliminate separate, redundant and potentially inconsistent cleanup standards and procedures for cleanup projects.

The DEP has taken additional steps to ensure safe and protective cleanup efforts by adopting provisions of the West Virginia Uniform Environmental Covenant Act, participating in the One Call Program, and developing measures to ensure the long-term compliance with applicable land use restrictions.

DEP maintains an extensive list of sites with potential contamination requiring remediation. The list includes sites in the federal Superfund program, including those with enough contamination to be designated as National Priority List sites.

## West Virginia National Priority List Sites

Site Name	City	County
Allegany Ballistics Lab	Short Gap	Mineral
Big John Salvage - Hoult Rd Site	Fairmont	Marion
Fike Chemical, Inc	Nitro	Kanawha
Hanlin-Allied-Olin	Moundsville	Marshall
Ordnance Works Disposal Area	Morgantown	Monongalia
Sharon Steel Corporation (Fairmont Coke Works)	Fairmont	Marion
Vienna Tetrachloroethene	Vienna	Wood
West Virginia Ordnance	Pt. Pleasant	Mason
Ravenswood PCE	Ravenswood	Jackson

## Leaking Underground Storage Tanks

Leaking underground fuel tanks can act as point sources for shallow groundwater contamination. Until the mid 1980s, underground storage tanks were made of bare steel that corroded and then leaked. Faulty installation and inadequate operating and

maintenance procedures can also result in tank leaks. Depending on the amount of fuel released, the hydro-geologic properties of the aquifer impacted by the release, and the location of nearby public drinking water sources, public water supplies can be threatened or directly impacted.

According to data from the EPA, West Virginia has 5,696 active underground storage tanks as of Sept. 30, 2007, and a total of 19,255 tanks that have closed. Since 1982, there have been 3,091 confirmed releases from these tanks, with nine emergency responses related to underground tank leaks. More than 2,000 tank cleanups have been completed during this period, with 1,036 yet to be completely remediated and the files closed.

**Total Leaks from Underground Storage Tanks Awaiting Final Cleanup**



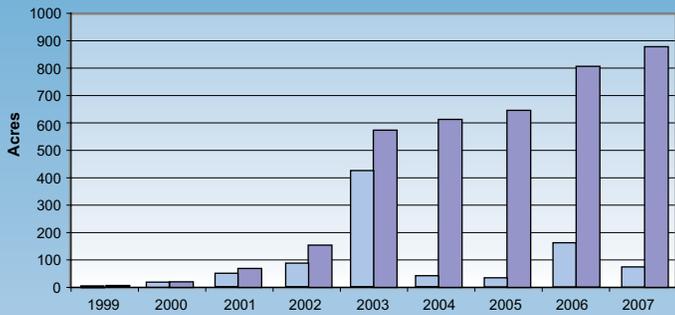
The graph above shows historical trends in confirmed releases in the state awaiting final cleanup between 1982 and 2007.

## Voluntary Remediation Sites

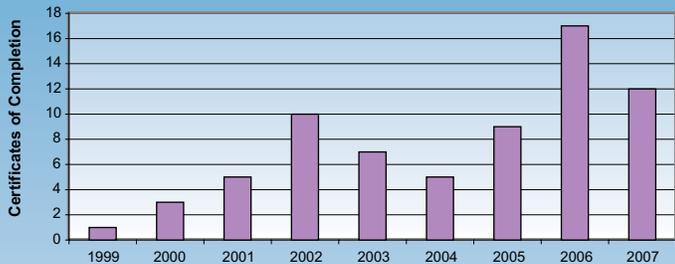
The abandonment or under-use of contaminated or potentially contaminated industrial sites results in inefficient use of public facilities and services and increases the pressure for development of uncontaminated pristine land. Because existing industrial areas frequently have transportation networks, utilities, and an existing infrastructure, it can be less costly to society to redevelop existing industrial areas than to relocate amenities for industrial facilities at pris-

**Acreage Available for Reuse**

□ by year ■ Cumulative



**Number of Certificates of Completion Per Year**



tine sites. The Voluntary Remediation Program was established to facilitate voluntary remediation activities and Brownfield revitalization.

The DEP Brownfield and Voluntary Remediation programs have matured as structured and predictable mechanisms to achieve compliance with applicable state and federal environmental requirements, while promoting the reuse and redevelopment of former industrial and mine-scarred properties. The DEP has promoted an active partnership with the Northern and Southern Brownfield Assistance Centers located at West Virginia University and Marshall

University, respectively. The Assistance Centers empower communities to plan and implement brownfields redevelopment projects by conducting general citizen and local government education efforts and by providing assistance to specific local communities interested the reuse of brownfields in their communities. Support can be provided to help groups solicit grants and low-interest loans for site assessments, clean-ups, and environmental job training as well as provide support for preliminary legal and planning work. The DEP and the Assistance Centers have jointly participated in annual West Virginia Brownfield Conferences and have conducted informational workshops for banking, economic development and real estate agents.

**Hazardous waste generation**

Hazardous waste has the potential to cause serious health and environmental threats if not managed in an environmentally sound manner. The transportation, storage, treatment and disposal of hazardous waste create a potential for release of hazardous chemicals into the environment.

These wastes are regulated under the federal Resource Conservation and Recovery Act of 1976 (RCRA) and state law. A waste may be classified as hazardous if it exhibits certain characteristics (ignitable, corrosive, reactive or toxic).

In addition to these "characteristic" wastes, over 500 specific hazardous wastes have been identified under RCRA. Hazardous wastes may be solid, semi-solid, liquid, or gas.

The following chart shows the top 15 quantities of hazardous waste generated by the industry sector for 2005, the last year statewide data was available.

*The Voluntary Remediation Program promotes private party cleanup of hazardous sites without the threat of government enforcement activity.*

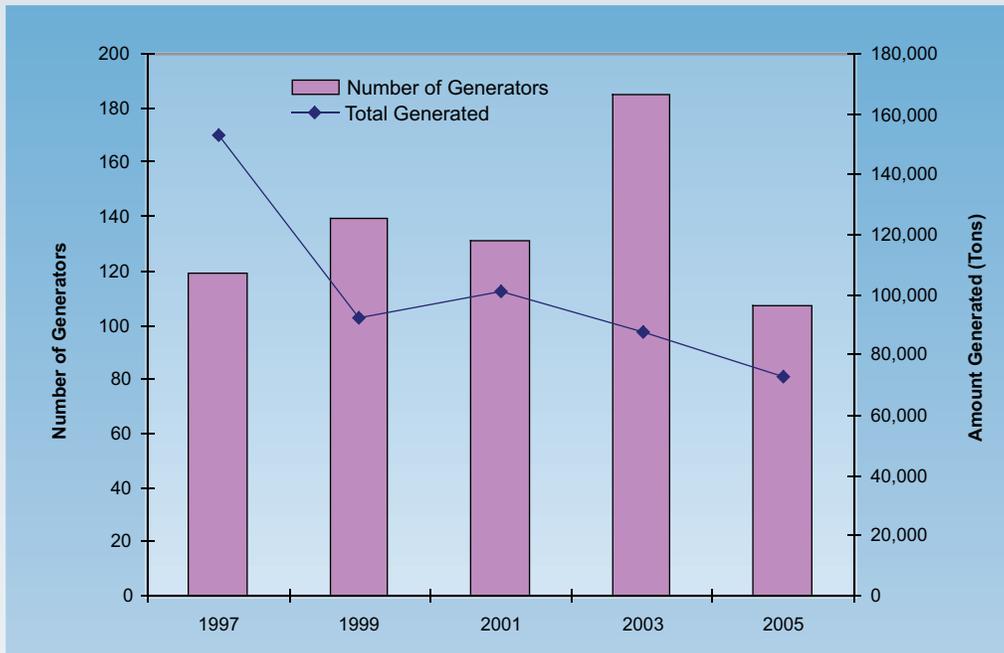
**Hazardous Waste**  
Top Fifteen Quantities of Waste Generated in WV in 2005  
By North American Industry Classification System (NAICS) Code

2005 Ranking	NAICS	Description	Tons Generated
1	3251	Basic Chemical Manufacturing	29,753
2	3253	Pesticide, Fertilizer, and Other Agricultural Chemical Mfg.	14,590
3	3311	Iron and Steel Mills and Ferroalloy Manufacturing	7,970
4	3252	Resin, Syn. Rubber & Artificial Synthetic Fibers & Filaments Mfg	3,161
5	3261	Plastics Product Manufacturing	2,989
6	3241	Petroleum and Coal Products Manufacturing	2,554
7	3328	Coating, Engraving, Heat Treating, and Allied Activities	2,319
8	3314	Nonferrous Metal (except Aluminum) Production and Processing	1,881
9	3312	Steel Products Manufacturing from Purchased Steel	1,076
10	5621	Waste Collection	740
11	3219	Other Wood Product Manufacturing	725
12	3321	Forging and Stamping	664
13	3364	Aerospace Product and Parts Manufacturing	514
14	4452	Specialty Food Stores	472
15	5629	Remediation and Other Waste Management Services	467
TOTAL			69,875

Source: National Biennial RCRA Hazardous Waste Report, based on 2005 data.

**Hazardous Waste Generated in WV**

Source: USEPA, National Biennial Hazardous Waste Reports from <http://www.epa.gov/epaoswer/hazwaste/data/biennialreport/index.htm>



Also, the graph above shows the number of large quantity generators in West Virginia in 1997, 1999, 2001, 2003 and 2005, along with the total tons of waste generated. In 2003, the number of generators increased by 38 percent from the 2001 reporting year. This increase was a result of a rise in one-time cleanups (remediation) of regulated waste, rather than an increase of permanent hazardous waste generating businesses in the state.

**Solid Waste Generation**

The use of materials, both raw and manufactured, leads to the generation of solid waste. The illegal disposal of solid waste creates pressure on the environment in terms of the loss of land and other resources necessary for solid waste disposal and treatment, and the potential for adverse health effects resulting from illegal disposal practices.

*The amount of municipal solid waste per person has increased from 2.7 pounds per person in 1960 to 4.4 pounds per person currently.*

National data reveal that Americans continue to generate increasing amounts of municipal solid waste. The amount for Americans has increased from 2.7 pounds per person in 1960 to 4.4 pounds per person currently. For West Virginians that number is believed to be about four pounds per day. Municipal solid waste includes garbage, paper, litter, refuse, cans and bottles, resulting from industrial, residential, commercial, mining, agricultural operations, and similar community activities.

The volume of municipal solid waste disposed in West Virginia is more of an indicator of opportunities for reuse, recycling, materials recovery, and waste reduction than of direct stress on the environment, because properly managed municipal solid waste landfills pose little direct risk to human health and the environment.

Solid waste landfills construct approximately 30 acres of composite lined area per year to ensure the disposal needs of the state are met. For the purposes of this report, the indicator chosen to reflect the dis-

**Solid Waste Disposal Tonnage (tons per year)**



posal of solid waste is the trend of solid waste disposed during the period from fiscal year 1992 through FY 2007. As shown on the chart, there has been only a slight decrease in recent totals.

Source: Solid Waste Management Board and Department of Tax and Revenue validated receipts reports and monthly tonnage reports submitted by commercial solid waste landfills in WV.

**REAP**

The Rehabilitation Environmental Action Plan (REAP) strives to rid West Virginia of unsightly litter and illegal dumps. The REAP - The Next Generation program houses all of the state's cleanup programs including the Pollution Prevention Open Dump (PPOD), Make It Shine, Clean Streams Initiative, Adopt-A-Highway, Adopt-A-Spot, Recycling Assistance Grant, and Operation Wildflower programs. REAP focuses on statewide cleanup efforts utilizing county and local agencies and volunteers in addition to the program staff. Through these partnerships, REAP empowers citizens to take ownership of their communities by providing technical, financial and logistical assistance in cleanup efforts.

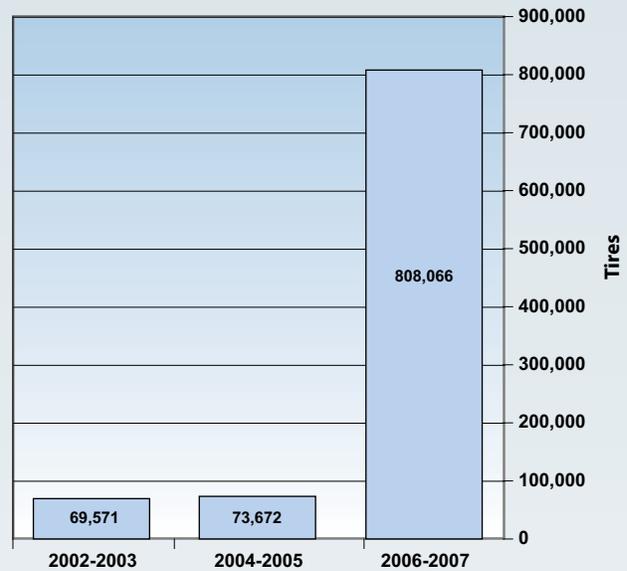
**REAP Programs**  
Waste Tires Collected  
(2002-2007)

*REAP works to educate West Virginians about the merits of pollution prevention and recycling while encouraging volunteerism in cleanup efforts.*

An important component of any environmental protection effort is education. REAP works to educate West Virginians about the merits of pollution prevention and recycling while encouraging volunteerism in cleanup efforts. Local leaders, though, must be aggressive in their approach to cleaning up the state. The REAP Standard Operating Procedure (SOP) requires local governments to adopt ordinances and implement REAP programs relating to cleanup efforts, law enforcement and outreach and education. The SOP requirements must be met in order for communities to retain eligibility to receive local economic development grants.

Three cleanup programs exist under REAP: the PPOD, WV Make It Shine and the Adopt-A-Highway/Adopt-A-Spot programs. Since 2001, these three programs have been responsible for removing 35,426 tons of solid waste, 3,629 tons of recyclable scrap metal, 26,777 appliances and 165,239 waste tires from our state's roadsides, streams and public lands. Much of the success of these programs relies on the participation of volunteers. Since 2001, 147,587 West Virginians have participated in REAP cleanup programs.

The effect that these three programs have on our environment cannot be measured by the tonnages associated with their cleanup efforts alone. The success of these programs can also be seen in the wide variety of geographic settings that these cleanups effect. Since 2001, PPOD has eradicated 6,979 illegal dumps throughout the state. PPOD and WV Make It Shine have been responsible for the reclamation of 3,647 acres of our state's public lands. Volunteers



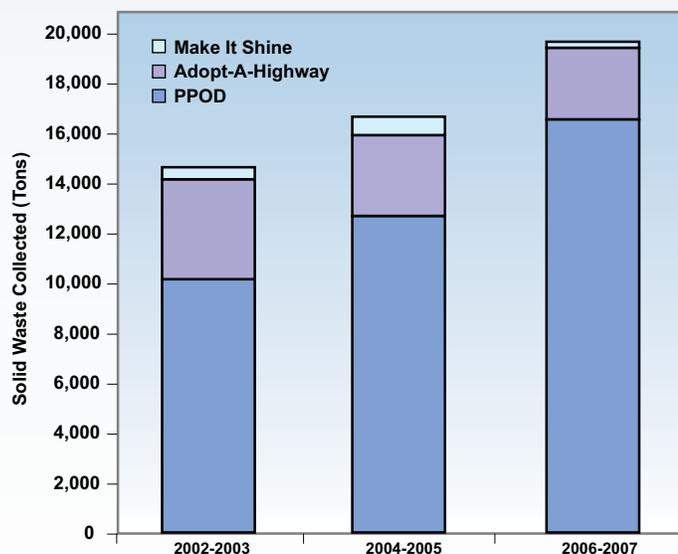
of the Adopt-A-Highway/Adopt-A-Spot programs have cleaned 19,165 miles of roadway since 2001. WV Make It Shine and PPOD have joined together in offering assistance to volunteer groups wishing to conduct stream cleanups. In the first year alone, volunteers working for the WV Clean Streams program cleaned 118 miles of stream bank, removing 177 tons of litter and recyclables as well as 969 tires from our state's waterways.

*In its first year, volunteers working for the West Virginia Clean Streams program cleaned 118 miles of stream bank, removing 177 tons of litter and recyclables as well as 969 tires from our state's waterways.*

Another of REAP's programs working toward the preservation of our environment is the Statewide Recycling Program. This program encourages recycling for businesses and individuals alike. Through education and funding opportunities, the recycling program hopes to reduce the amount of recyclables going to the landfill by half by 2010. The program offers Recycling Assistance Grants to county, municipal, public or private entities to help establish sustainable recycling operations statewide and also provides Litter Control Grants to local governments with an interest in developing and implementing litter control programs. Additionally, the recycling program oversees the State Employees Office Paper Recycling Program that has collected 2,039.89 tons of paper since its inception in 1997.

Historically there has been no mechanism to effectively collect and track data on the total amount of recyclables collected across the state. The Statewide Recycling Program is currently developing a proposal to partner with and enlist the cooperation of the state's recycling industry in order to obtain accurate data as to what and how much is being recycled in the state on a yearly basis. It is our hope that the data obtained through this partnership will allow us to effectively track trends as they relate to recycling and also allow us to determine the amount of material recycled per capita that would otherwise be deposited in our landfills.

**REAP Programs**  
Total Solid Waste Collected  
(2002-2007)





**Elizabeth Hill** before



**Elizabeth Hill** after



**Morris Creek** before



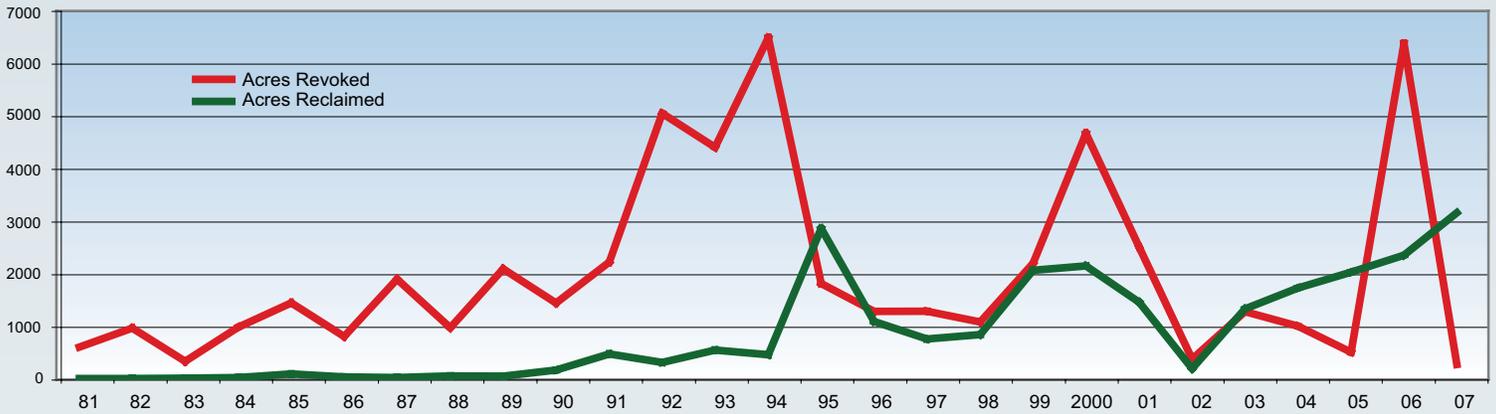
**Morris Creek** after



**Polk Creek** Cleanup



**Polk Creek** Cleanup crew



**OSR Acres Revoked and Reclaimed**  
as of 12-31-07

**Abandoned Mine Lands**

On December 20, 2006, the President signed into law amendments to the Surface Mining Control and Reclamation Act (SMCRA) making significant changes to the Abandoned Mine Land (AML) program, including dramatically increased funding through mandatory spending. The amendments extend the fee collection provisions of SMCRA until September 30, 2021. They also changed the allocation formula, making nearly 83 percent of all AML fee collections mandatory distributions to the States and Indian tribes.

The amendments provide significant opportunities for the West Virginia AML program to complete reclamation of sites posing significant health and safety threats. As an immediate result, the DEP made financial commitments to 57 AML eligible public waterline construction project applications that will provide public drinking water to 7110 residents. Additionally, DEP has new opportunities to direct more money toward fixing acid mine drainage problems. Under the new law, the state now has the option to set aside 30 percent of the grants received from the AML fund into a state account to be used to address water quality problems stemming from abandoned coal mines. This amount is an increase from 10 percent as authorized before the amendments passed.

*Many of the AML sites are impediments to economic development in our local communities. Reclamation of these dangerous sites, replacement of drinking water, and the restoration of impaired streams is a major contribution to the high quality of life offered by many West Virginia communities.*

**Special Reclamation**

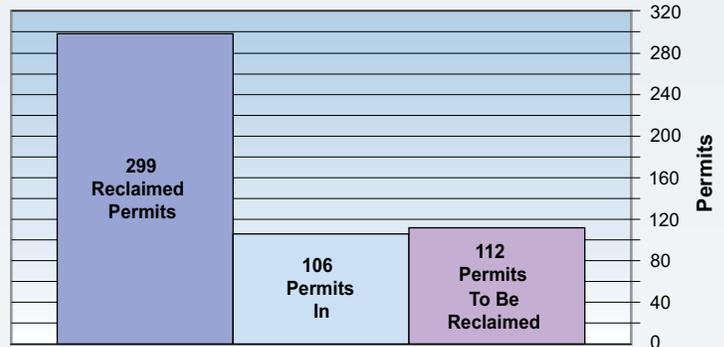
West Virginia continues to make significant progress in reclaiming sites forfeited by coal companies. This is in large part due to the Special Reclamation Fund Advisory Council (SRFAC) working diligently in its role to ensure the effective, efficient and financially stable operation of the Special Reclamation Fund.

A 2007 actuarial study contracted by the DEP, and endorsed by the SRFAC, projected that an additional 7.4 cent tax would maintain a positive balance in the fund at least through 2028. The 2008 Legislature acted on the recommendation, and implemented the 7.4 cent tax increase. Additionally, the Legislature provided the DEP authority to establish a self-sustaining trust fund for long-term water treat-

ment at forfeited sites. A follow-up actuarial study will continue to monitor the funding in relation to the land and water reclamation liabilities, and provide subsequent recommendations.

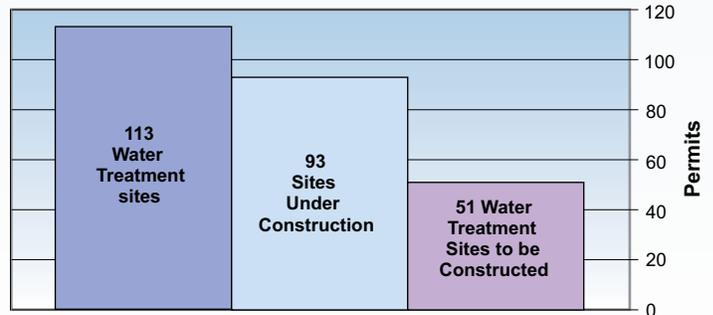
Historically, the fund has been funded on a "pay as you go" approach, whereby present revenues collected are applied to complete the present reclamation projects and to begin water treatment as needed. However, looking toward the future when coal reserves and the associated funding inevitably begin declining, this approach is problematic because ongoing water treatment liabilities will continue.

**OSR Progress for 517 Revoked Permits**  
as of 12-31-07



The SRFAC commissioned a study by Marshall University's Center for Business and Economic Research (CBER) to develop the water treatment trust concept and to present the water treatment trust concept to the 2007-2008 Legislative Interim Joint Standing Committee on Finance. Thus, the 2008 Legislature's establishment of the self-sustaining trust fund is a milestone event in assuring long-term water treatment at forfeited mines.

**OSR Water Treatment Progress for 257 Permits**  
as of 12-31-07



# Energy

## West Virginia leads the country in interstate sales of electricity.

West Virginia is well known as a leading energy producer in the United States. Although, as can be seen in the chart, most of this production is from mining bituminous coal, there is also a smaller, yet thriving oil and natural gas industry.

Permitting actions in the coal mining arena shed some light on recent trends. There has been an upswing in the number of prospect permits approved both in the state's southern and northern coalfields for the last seven years, but down in 2007, which can generally be correlated to the fluctuations in the coal market. Although down in 2007, the northern part of the state is still seeing higher levels of coal seam

core drilling activity when compared to the last several years. This increase is due, in large part, to the installation of advanced air pollution control equipment at electric-generating power plants to reduce sulfur dioxide (SO<sub>2</sub>) emissions. Efficient SO<sub>2</sub> scrubbers allow the use of lower cost, higher sulfur coals commonly found in northern portions of the state.

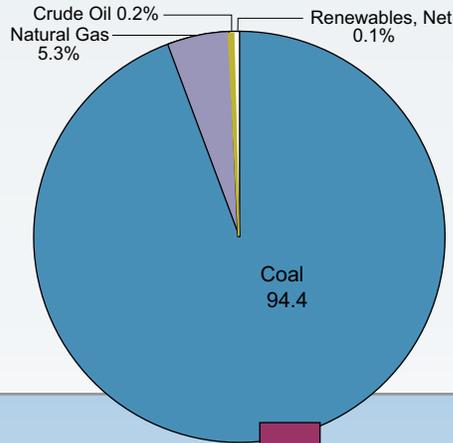
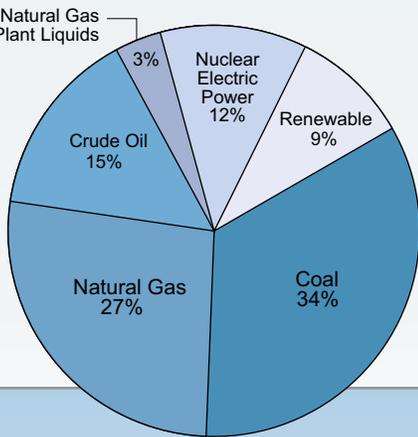
Coal refuse pile reprocessing production is still increasing and actually doubled from 2005 to 2006. This accomplishes the goal of getting old coal mine sites reclaimed and eliminating the potential for additional pollution problems. As shown in the charts, West Virginia coal production has remained steady

*Energy production requires permitting by DEP to ensure environmental impacts are minimized.*

### U. S. Energy Production in 2006

71 Quadrillion BTU Production in 2006

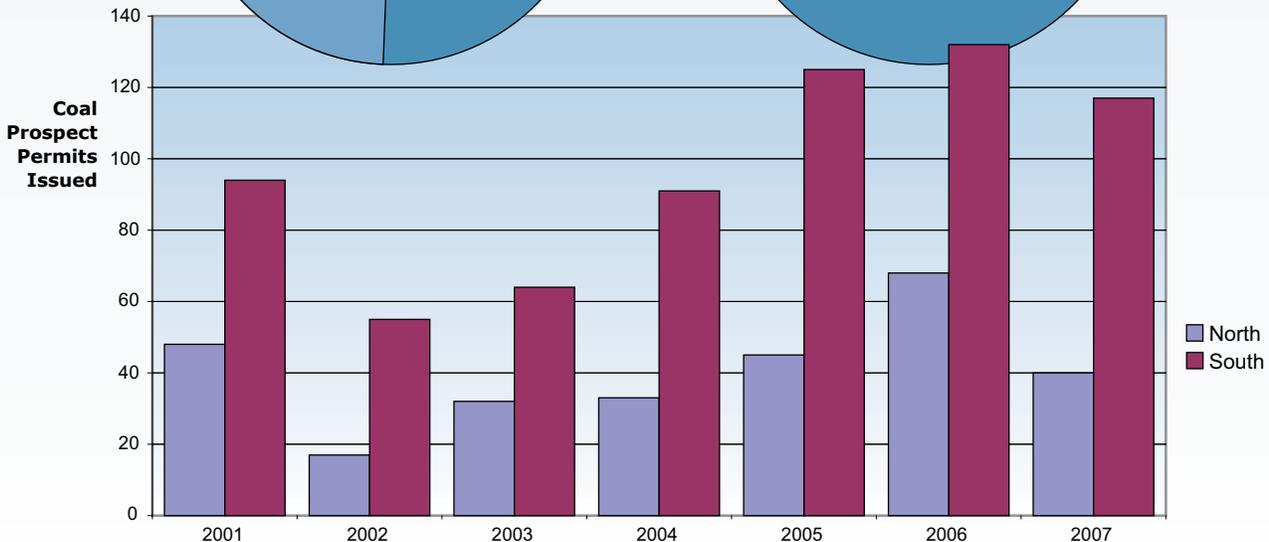
Source: U.S. Department of Energy, Energy Information Administration



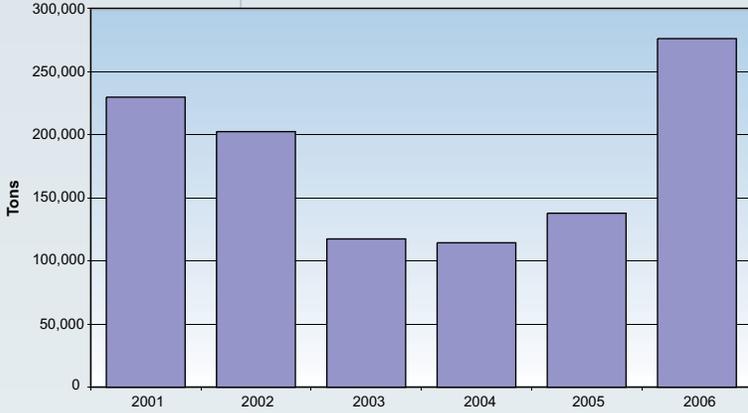
### WV Energy Production in 2006

4.4 Quadrillion BTU Production in 2006

Source: U.S. Department of Energy, Energy Information Administration & WV Office of Miners' Health Safety and Training (WV MSHT)



**Annual Production from Coal Refuse Pile Reprocessing**



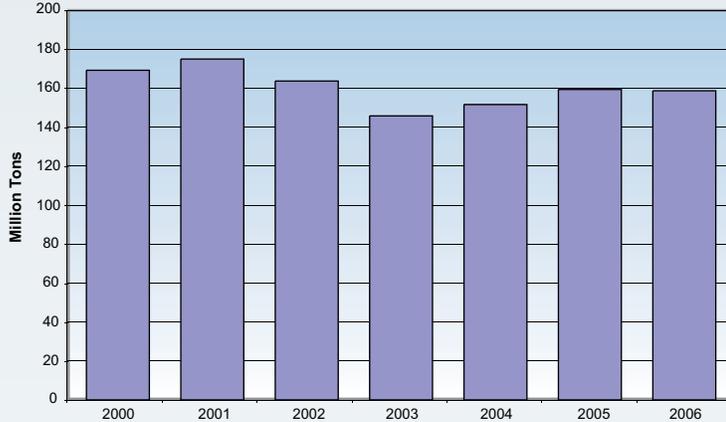
Coal Figures provided by the West Virginia Office of Miners' Health Safety and Training

for several years, while in 2006 crude oil production reached its highest level in the past decade of 1.75 million barrels.

West Virginia's natural gas production has also been trending upward in recent years as shown on the corresponding chart. Gas production in 2006 was the second highest production total in the past decade. Production in the year 2000 was the highest during this period. This was at least in part the result of a number of deeper wells coming into production, tapping into large, previously untapped reserves. Additionally, 22,003 gas producing wells have been added over the past decade.

All in all, West Virginia's energy production picture remains bright. The state will continue to be a leader in energy production and with the utilization of innovative new technologies such as coal liquefaction being considered, DEP is dedicated to ensuring that the environment is protected throughout innovations of energy production.

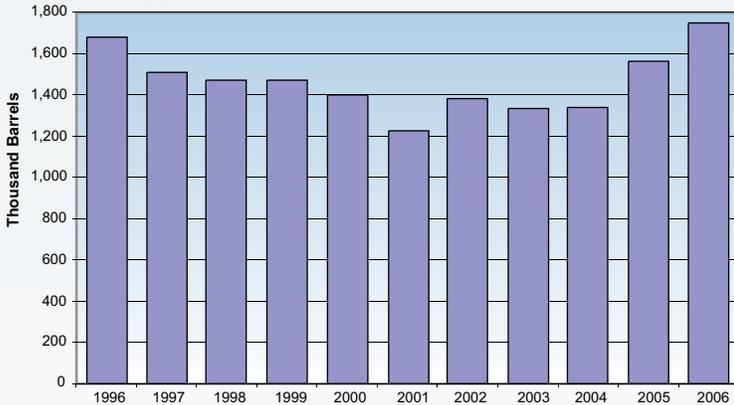
**WV Coal Production**



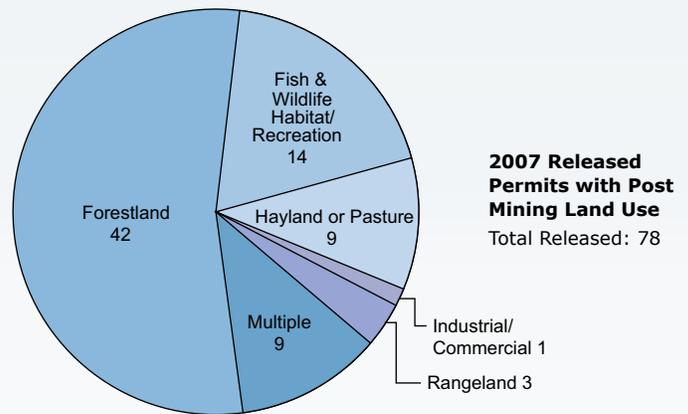
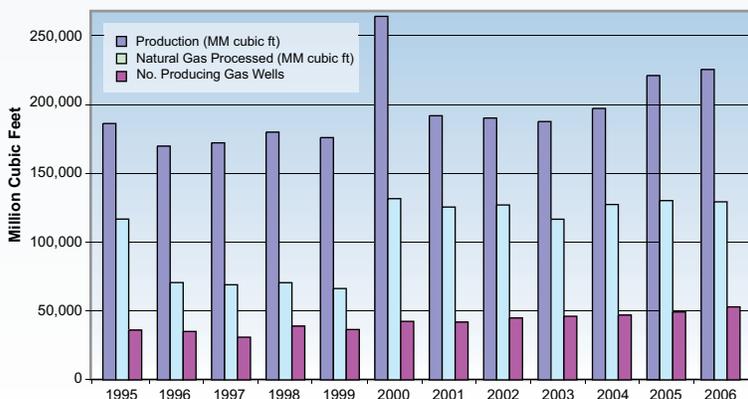
**Mining**

A factor to consider in evaluating the state of the environment is whether activities impacting the environment are likely to continue. There has been an overall increase in coal mining activity in recent years. In 2007, DEP inspected approximately 1,900 coal mining

**WV Crude Oil Production**



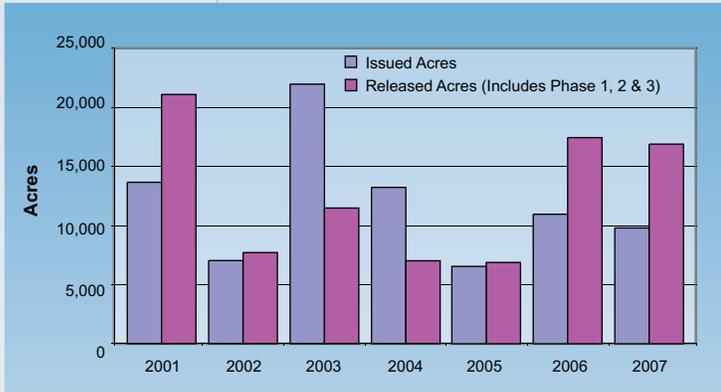
**WV Natural Gas Production (does not include Transmission)**



permits, 490 of which were active permits. As predicted in the 2005 *State of the Environment* report the overall number of active coal mining permits increased over the last two years in both the northern and southern parts of the state.

A measure of success in the mining program is the rate of reclamation of lands affected by coal mining operations. This can be determined by examining the

Oil and Gas Source: US Department of Energy, Energy Information Administration



**New Permit and Amendment Acres**  
 Issued and Released Acres  
 2001-2007

number of acres meeting the bond release standards. While new permit acres have shown a moderate increase over the last two years, the released acres have more than doubled.

Coal mining permits reclaimed and released during 2007 are being restored to productive postmining land uses compatible with surrounding environmental conditions. In 2007, 50 percent of the permits released were returned to forestland. As expected, this has increased due to the initiation of a robust reforestation initiative to encourage the return of the land to a forestland use.

**Electronic Permitting**

Electronic permitting has seen a steady increase since the first electronic submittal of a new permit in 2005. In 2006, 14 percent of new permit and amendment applications were submitted electronically with an increase to 26 percent in 2007. All applications will be required to be submitted electronically beginning January 1, 2009.

**Mitigation**

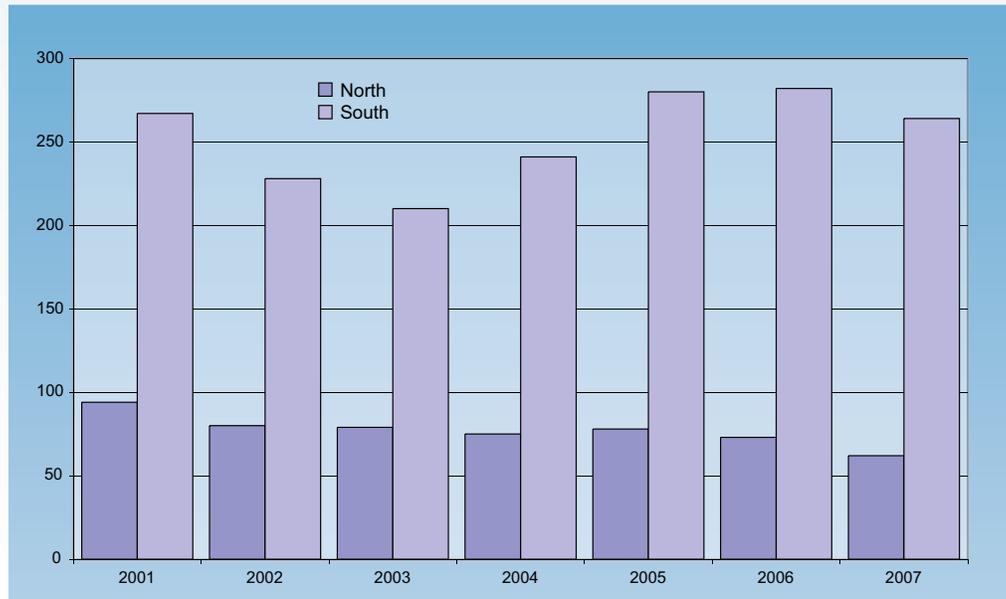
The Little Coal River is a navigable water that has been impacted by industrial and developmental projects located throughout most of its primary reach. Coal River Energy, LLC entered into a compensatory mitigation agreement with the DEP and the US Army Corps of Engineers to compensate for impacts to aquatic resources in the Little Coal River drainage watershed. The mitigation project constructed 20 structures in the Little Coal River designed to reduce the width/depth ratio that improves benthic and fish habitat by improving river morphology. The installation of the structures was designed to permanently narrow segments of the stream channel, thereby decreasing the width to depth ratio and increasing the stream power to facilitate the transport of fine sediment. The enhancement will create riffle, run pool and glide complexes in segments in the river. Other benefits include increasing macro-invertebrate and fisheries habitat, increasing the particle size of the bed material, decreasing water temperature, increasing canopy cover, and also improve recreational boating and fishing opportunities for local residents. These structures are part of a 25-mile plan to restore the Little Coal River.

*The Little Coal River mitigation project involved the construction of 20 structures designed to reduce the stream's width/depth ratio... benefiting benthic and fish habitat by improving the river's morphology.*

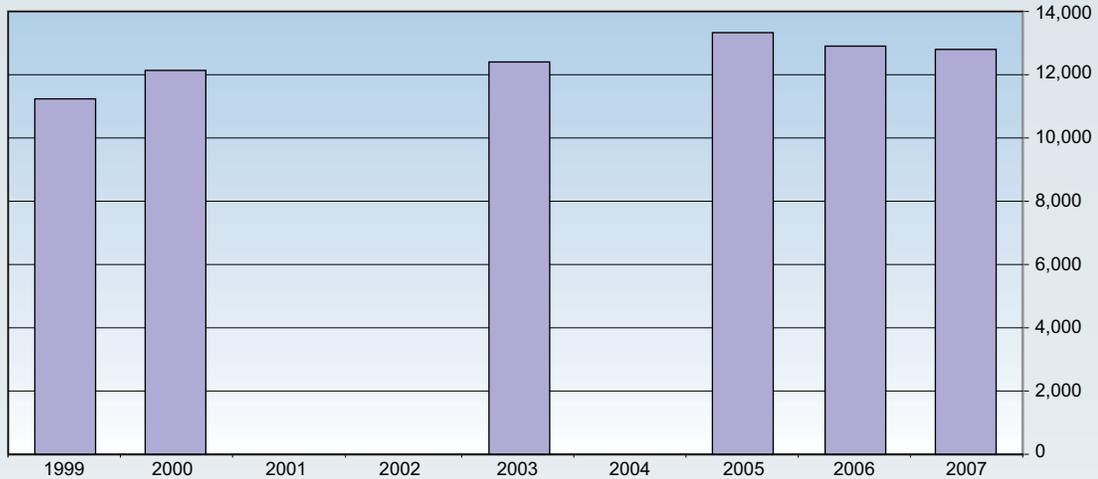
**Oil and gas**

The Office of Oil and Gas has seen a significant increase in permitting activity over the past few years. The increase in permit applications has occurred during a general increase in commodity prices.

**Active Surface and Underground Coal Mines**  
 Northern - Southern WV



**Abandoned Wells Inventory**  
 No data available for 2001, 2002 and 2004



Total well work permitting from 2005 to 2007 has increased 22 percent and 94 percent from 2002 to 2007, and the DEP projects a continued climb in permit applications.

*West Virginia currently has approximately 12,000 permitted wells that fall into the abandoned category.*

**Abandoned wells**

West Virginia law defines an abandoned well as any well that is completed as a dry hole or that is not in use for a period of 12 consecutive months. Any well identified as abandoned is required to be plugged by the operator unless the operator demonstrates that the well has bona fide future use. Due in part to the long well-drilling history and changing requirements over that period of time, West Virginia currently has approximately 12,000 permitted wells that fall into the abandoned category.

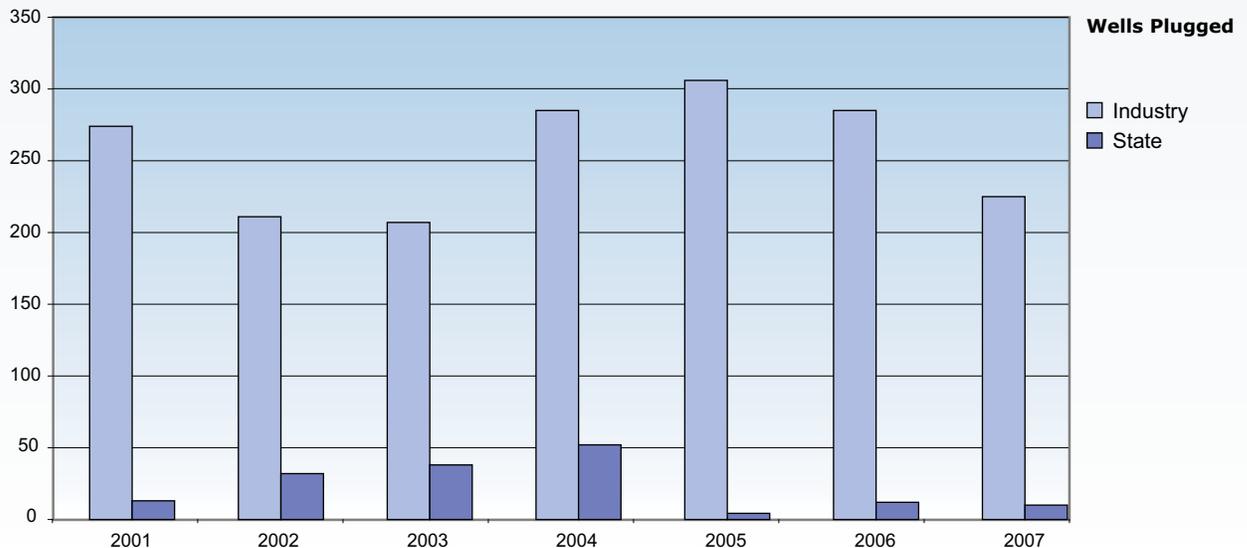
While many of these wells may actually pose little environmental threat, others are a concern. These wells may be leaking crude oil or salt water at the surface, potentially polluting nearby streams. Natural gas may also be leaking into the atmosphere. The sites themselves may also create problems due

to a lack of proper reclamation, creating sediment, and erosion control problems that consequently affect the state's surface waters.

Perhaps the greatest concern is the uncertainty of what may be occurring below the surface. Unplugged wells or improperly plugged wells can lead to groundwater contamination with crude oil, salt water and natural gas. The problem may go unnoticed for a period of time, resulting in potentially more damage to groundwater or hydrocarbon-bearing zones.

To help address the problems associated with abandoned wells, the Office of Oil and Gas administers the Oil and Gas Reclamation Fund. While the fund is limited, the resources are used to respond to the greatest environmental or safety threat. Over the past several years, the DEP has been successful in obtaining federal funding to address some of the problems associated with crude oil contamination of surface waters from abandoned wells. During the past seven years, the Office of Oil and Gas has plugged or reclaimed 195 wells and well sites at a cost of \$4.7 million.

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June 2008

FINAL NOTE

This report provides an overview of the more common indicators used by the DEP to measure the health of West Virginia's environment. This State of the Environment, and the reports that were published before it, serve as tools to measure environmental quality over time. We all have a stake in the health of the environment, so we welcome readers to share their thoughts and suggestions about the content within these pages.

We hope that future reports will provide a more detailed spectrum of environmental indicators including knowledge from other state agencies such as the Division of Natural Resources, the Department of Health and Human Resources, Division of Forestry, Division of Highways and the Division of Tourism. Please visit the DEP website at [www.wvdep.org](http://www.wvdep.org) for more information about the West Virginia Department of Environmental Protection.

A handwritten signature in black ink, appearing to read "Randy Hillman". The signature is fluid and cursive, with a large initial "R" and a long, sweeping underline.