west virginia department of environmental protection

Groundwater Programs and Activities

Biennial Report to the West Virginia 2008 Legislature

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Promoting a healthy environment.

Editor's Notes

This biennial report was compiled and edited by the Division of Water and Waste Management's Groundwater Program staff from information submitted by those agencies with groundwater regulatory authority. Copies of this report can be obtained on-line at www.wvdep.org or from:

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Copies of documents and educational information mentioned in this report can be obtained from the individual programs with groundwater regulatory responsibilities. For more program activity information, please contact the respective regulatory agency. A list of these agencies is included in Appendix A.

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GROUNDWATER BIENNIAL REPORT TO THE 2008 LEGISLATURE

I. EXECUTIVE SUMMARY

The Groundwater Protection Act, West Virginia Code Chapter 22, Article 12, Section 6.a.3, requires the West Virginia Department of Environmental Protection (DEP) to submit a biennial report to the legislature on the status of the state's groundwater and groundwater management program, including detailed reports from each agency that holds groundwater regulatory responsibility. This is the eighth Groundwater Biennial Report to the Legislature since the passage of the Act in 1991 and covers the period from July 1, 2005, through June 30, 2007.

The DEP Division of Water and Waste Management (DWWM) Groundwater Program is responsible for compiling and editing the information contained in this report. The West Virginia Department of Environmental Protection (DEP), the West Virginia Department of Agriculture (WVDA), and the West Virginia Department of Health and Human Resources (DHHR) all have groundwater regulatory responsibility and have contributed to this report. The boards and standing committees that share the responsibility for developing and implementing rules, policies and procedures for the Groundwater Protection Act are; the Environmental Quality Board, the Groundwater Coordinating Committee, the Groundwater Protection Act Committee, the Groundwater Monitoring Well Drillers Advisory Board, the Well Head Protection Committee, and the Nonpoint Source Coordinating Committee.

The purpose of this report is to provide a concise, yet thorough, overview of the programs charged with the responsibility of protecting and ensuring the continued viability of groundwater resources in West Virginia and to express the challenges faced and the goals accomplished as the agencies, programs and committees work together to protect and restore West Virginia's water resources.

One difficulty in achieving the goals of the Act has been the lack of specific hydrogeologic information about the state's groundwater, such as regional and local potentiometric surfaces (water levels), groundwater quality, groundwater flow studies, and access to statewide dedicated groundwater monitoring data. As more regulated development occurs, especially pertaining to stormwater discharge, it is hoped that the DEP will compile a database of constituents found in stormwater that can be utilized to protect groundwater resources. A centralized database linked to the geographic information system (GIS) coverages that are accessible to the various agencies and the public will greatly facilitate resolving this problem.

Also needed is continuing outreach to West Virginia citizens on issues such as nonpoint source pollution, the protection of individual groundwater and drinking water sources, and the creation of toll-free help lines to enhance statewide consistency and a unified approach to the implementation of groundwater rules. Much of this need is

addressed by five-year cooperative studies performed jointly between the Division of Water and Waste Management and the United States Geological Survey (USGS).

The Ambient Groundwater Quality Monitoring Network was established by DWWM in cooperation with the USGS in 1992 and is an ongoing project. This network provides critical data critical to the management of West Virginia's groundwater resources. The major objective of the study is the assessment of the ambient groundwater quality of major systems (geologic units) within the state and the characterization of the individual systems. Characterization of the quality of water from the major systems will help to (1) determine which water quality constituents are problematic, (2) determine which systems have potential water quality problems, (3) assess the severity of water quality problems in respective systems, and (4) prioritize these concerns. Only by documenting the present ambient groundwater quality of the major systems can regulatory agencies assess where water quality degradation has occurred and where potential degradation is a result of natural processes or human activity.

Spatial variability in water quality is determined for specific geologic units based on the annual sampling of approximately 30 wells. This sampling will continue over a five-year period and will provide a database of more than 175 wells. Wells will be sampled in specific drainage basins in given years, rotating annually to new basins, thus providing groundwater sampling in all state watersheds over the five year period. The watershed samples will correspond to those from which DWWM will be collecting stream water samples as part of its watershed initiative and will provide a linked dataset of groundwater and surface water data that can be used to assess water quality conditions throughout the state.

Upon completion of the five-year sampling program, some wells may be resampled as necessary, and then comprehensive statistical analyses of all groundwater quality data will be conducted. DWWM will prepare an interpretative report summarizing ambient groundwater quality in West Virginia, which will include an assessment of future data needs. All associated groundwater quality data for each sampled well and summaries of groundwater quality for each respective watershed will be published in the USGS Water Resources Data for West Virginia Annual Report and the results reported to the DWWM. These results will be incorporated into reports submitted by the DWWM.

The 30 sampling sites in the Group A and B watersheds that were also sampled in the ambient groundwater quality study are listed in the data tables in Appendix B and C of this report. These tables provide a detailed analysis of geochemical parameters, ionic concentrations, concentrations of metals, radon, nutrients, organic carbon, volatile organic compounds, and pesticides.

While many challenges remain, much has been done to provide protection and continued viability of West Virginia's groundwater resources. The DEP, WVDA and DHHR continue to work closely to fulfill the mission of the Department of Environmental Protection, "Promoting a healthy environment."

II. Groundwater Protection and Watershed Management

Under the guidance of the U. S. Environmental Protection Agency (EPA) and the signing of the West Virginia Watershed Management Framework Document (signed in 1997), a new approach to management of the state's groundwater has begun. Total watershed management strives to bring a holistic approach to protecting the waters of the state. The signing of this document by those agencies that chose to participate as partners indicates their understanding that, by collective agreement and cooperation, stakeholders can better achieve the goals of individual water quality programs. The DEP has chosen to participate as a partner and stakeholder in watershed management in West Virginia.

Agencies having groundwater regulatory authority and responsibility provide repositories for ground and surface water data collected about those facilities under their authority. As stated in this report's executive summary, compilation of the available groundwater data into a collective database continues as a work in progress, providing a picture of the state's groundwater protection activities and the contributions of the associated programs.

Eventually, all groundwater data that is generated by these activities and facilities will be housed in a central data repository overseen by senior scientists from each agency under the guidance of the DEP's Groundwater Coordinating Committee and Information Technology Office. We anticipate that population of the central database will be implemented using a watershed approach. Each watershed is comprised of smaller divisions called sub-watersheds from which data will be gathered and entered systematically until the larger picture emerges.

List of Watershed Groups for 2006-2007

A list of the major rivers in each watershed group appears in the following table.

WEST VIRGINIA WATERSHED GROUPS	
Group A - 2006	***Group B - 2007***
Cheat River	Coal River
Shenandoah River (Jefferson)	Elk River
Shenandoah River (Hardy)	Lower Kanawha River
Upper Kanawha River	N. Branch Potomac River
Upper Ohio River (North)	Tygart Valley
Youghiogheny River	

III. BOARDS AND COMMITTEES

The following boards and committees are responsible for developing and implementing policies, procedures and rules to ensure proper application of the Groundwater Protection Act (GWPA).

A. Environmental Quality Board

1. Appellate Activities

The board is authorized by *W.Va. Code* § 22-11-21 to hear appeals of DEP decisions concerning groundwater protection. The following administrative appeals were filed with or addressed by the board during the biennial reporting period and include issues arising under provisions of the Groundwater Protection Act:

Rissler et al
Appeal No. 05-16-EQB
Filed 7/15/05
Agreed Order 3/16/06

PPG Industries, Inc.
Appeal No. 05-18-EQB
Filed 8/16/05
Final Order 7/24/06

Cabot Oil & Gas Corp.
Appeal No. 05-19-EQB
Filed 9/1/05
Withdrawn 3/16/06

Corning, Inc.
Appeal No. 05-25-EQB
Filed 12/22/05
Agreed Order 5/23/06

Windsor Coal Company
Appeal No. 06-05-EQB
Filed 3/16/06
Agreed Order 7/21/06

Courts' Motors, Inc.
Appeal No. 06-23-EQB
Filed 9/27/06
Agreed Order 2/8/07

Go-Mart, Inc.
Appeal Nos. 06-20-EQB, 06-21-EQB and 06-24-EQB
Filed 9/1/06 and 9/29/06
Agreed Order 4/12/07

St. Marys Refining Company, Inc.
Appeal No. 06-25-EQB
Filed 10/6/06
Pending

Pennzoil-Quaker State Company
Appeal No. 06-27-EQB
Filed 10/10/06
Pending

Robert and Martha Trocin
Appeal Nos. 06-29-EQB and 06-30-EQB
Filed 10/25/06
Withdrawn 4/12/07

Fort Martin Community Association
Appeal No. 06-31-EQB
Filed 11/15/06
Final Order 7/27/07

Go-Mart, Inc.
Appeal No. 07-03-EQB
Filed 2/20/07
Agreed Order 4/12/07

B. Review of Civil Administrative Penalties

W. Va. Code § 22-12-10 establishes procedures for review of the assessment of civil administrative penalties. This provision provides for an informal hearing to review the penalty and gives the board appellate authority for review of the final decision. The board did not receive any appeals filed pursuant to this provision.

IV. DEPARTMENT OF AGRICULTURE

A. Overview of Groundwater Protection Activities

1. Groundwater Protection Goals and Principles

Environmental stewardship is a fundamental principle of the agricultural community. The protection of groundwater resources through prudent development and use and the control of contributing environmental factors are the goals of the Department of Agriculture. The maintenance and protection of current and future groundwater quality through enforcement of state and federal regulations, cooperative outreach and education programs, and support and investigation of best available technologies are continuing objectives in the promotion and expansion of agriculture in the state. The commissioner shall utilize any and all existing regulatory authority available and shall petition additional regulatory authority, if needed, to ensure the protection of groundwater resources.

The commissioner may develop chemical-specific regulations or generic mandatory best management practices (BMPs) pertaining to any and all aspects of pesticide use. The commissioner finds that the existing categorization and distribution of soils within the state, combined with the accepted properties of pesticides known or suspected to be highly mobile in the soil profile, do not warrant the promulgation of additional area-specific or regional regulations other than those required by the products registration program. Although empowered by both federal and state statute, the commissioner finds that the existing use restrictions have protected the existing quality of this resource. The WVDA has maintained a cooperative and evolving pesticide management process under the Federal Groundwater Protection Initiative. There have been no significant changes in pesticide use in the State during the current report period. Retirement, loss of profit margins and urban encroachment have resulted in some reduction in size and intensity of certain agricultural facilities.

Contamination sources not regulated by Federal statute but deemed detrimental to the current or future quality of groundwater will be addressed through educational outreach and, when possible, through cooperative implementation of BMPs. In response to the need for comprehensive strategies for the protection of groundwater and surface water quality, the WVDA has initiated and supported state-of-the-art technologies. Research and demonstration projects in the areas of biogeneration of alternate fuels and genetic identification of bacterial contamination are ongoing.

Several programs are in place at the Moorefield Agricultural Center to monitor and improve existing water quality. BMPs are utilized in an effort to reduce pollution and nutrient runoff. All poultry producers are encouraged to have nutrient management plans (NMPs) while some poultry integrators require a current nutrient management plan and provide technical assistance of a certified planner. All nutrient management plans specify cropping recommendations for all acreage to which commercial fertilizer, litter or manure is applied. Results of soil tests, coupled with specific crop yields or soil

utilization, are used to develop recommendations concerning amounts of fertilizers to be applied to each field. To further assist poultry growers, representatives of the WVDA and the West Virginia University Cooperative Extension Service (WVUCES) conduct meetings and workshops. Cost share programs from USDA-Natural Resources Conservation Service (NRCS) also provide farmers with the opportunity to install BMPs at their operations to reduce runoff of nutrients and sediment. To facilitate NMP development, Moorefield's Nutrient Management Laboratory of the WVDA routinely analyzes over 200 litter/manure samples per year.

In an effort to encourage nutrient management on all existing poultry operations, the staff of the West Virginia Conservation Agency and USDA Natural Resources Conservation Service provides technical assistance to local farmers in developing nutrient management plans. In order to participate in cost share programs, farmers must have a current nutrient management plan written by a certified nutrient management planner. There are currently over 90 certified nutrient management planners in West Virginia.

Several streams and tributaries in West Virginia's Potomac Highlands region have been identified as being contaminated with excessive amounts of fecal material. These streams are located in agricultural and non-agricultural parts of the region. Because of the ongoing efforts of the agricultural community to prevent runoff of nutrients into the streams, identification of point and nonpoint sources of contamination is being addressed by the WVDA.

The Moorefield Agricultural Center will also be participating in a study funded by the USGS, DEP and other agencies to compare various biological source-tracking techniques. The intent of the study is to document the usefulness of several methods for identifying bacterial source contamination in groundwater.

B. Pesticides Section

Purpose

WVDA is one of three state agencies recognized as a regulatory body under the West Virginia Groundwater Protection Act. The WVDA has maintained and promoted an open dialogue and cooperative efforts with the other enforcement agencies recognized under the act: the WVDEP and the WVDHHR.

Significant numbers of rural West Virginians depend on groundwater as their primary source of potable water. The WVDA is in the unique situation as having this sector of the state's population as its main area of interest and activity. The protection of the state's water resources is an essential component of the WVDA's commitment to the preservation and expansion of the agriculture in the state. The preservation of natural resources for current and future generations is the cornerstone of the environmental stewardship demonstrated by the agricultural community and the WVDA. The WVDA

shall utilize all avenues of education, outreach and enforcement in the protection of environmental resources for the benefit of agriculture and all West Virginia citizens.

Areas of Activity

On a national basis, the primary area of concern relative to adverse agricultural impacts on groundwater has been the continued and extensive use of pesticides (herbicides) for controlling weeds in the production of corn. In West Virginia the contamination of groundwater from any type of pesticides has been infrequent and non-persistent. The contamination of groundwater from fertilizer application is less frequent, although surface waters are susceptible to seasonal impacts.

The national regulatory body for pesticides is the EPA. The EPA contracts with state departments of agriculture to implement the regulation of pesticide use through federal and state law. As defined by the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), pesticide use is essentially a cradle to grave enforcement strategy addressing all aspects of use, from the sale of the pesticide to the disposal of the empty pesticide container.

In addition to changes in product labeling, a component of the EPA's program for the protection of groundwater is the State Management Plan (SMP) initiative. The SMP program was introduced in the mid-1990s to ascertain the extent of and to create a mediation program for, groundwater contamination by pesticides. Repeated detections in groundwater supplies across the nation of some herbicides used for weed control in corn production have made it evident that the existing use patterns of certain chemicals are unacceptable. Although most of the contamination events have occurred in the Midwest corn belt, the EPA initiative was made a national priority. In order to facilitate specific control measures within states, the EPA is allowing each state to develop state-specific chemical management plans, as opposed to a national change in pesticide labeling.

The EPA has directed each state to generate a state management plan for the pesticides that have been identified as posing a threat to groundwater. If a state fails to develop an EPA-approved plan, the EPA will withdraw use of that chemical in that state. The WVDA has continued to work with the EPA throughout the lengthy SMP development and approval process. During this reporting period, the WVDA has communicated its ability to fulfill the requirements of an approved plan either through its own legislative powers or those of the West Virginia Groundwater Protection Act. Components of an approved plan include:

- ❖ Interagency cooperation- The EPA requests that states identify allied agencies with interest or regulatory authority in groundwater. The West Virginia Groundwater Protection Act clearly recognizes the WVDA, DEP and DHHR as mutually supportive agencies with existing and mutually supportive groundwater protection and enforcement strategies.

- Data sharing - The WVDA utilizes and contributes to the common state water quality database (ERIS).

- Public health - Water quality programs protect human health by establishing water quality standards. The WVDA regularly consults with the DHHR to prioritize the sampling and analyses required of the state's public service districts relative to pesticide standards.

- Monitoring requirements- The WVDA has identified areas of the state in which the use patterns of agricultural chemicals and geology increases the possibility of groundwater contamination and has relayed this data to the DEP. The WVDA routinely reviews each cycle of the ambient ground water monitoring program.

Regulatory and Educational Programs

West Virginia does not require site-specific permitting for the application of fertilizers or pesticides. Site-specific pesticide applications are regulated by the product labeling which is enforceable under federal law.

Through educational and outreach programs, the WVDA promotes BMPs for the application of fertilizers and soil amendments. These BMPs are promulgated under Title 61, Procedural Rule, State Department of Agriculture, Series 22B "Best Management Practices for Fertilizers and Manures." Practices which protect groundwater include:

- Covering stored fertilizers with an impervious cover to prevent seepage or runoff into surface or groundwater.

- Not storing fertilizers within 100 feet of shallow wells, or wells not meeting standards as promulgated by 64CSR19, and not applying fertilizers within 50 feet of any well.

- Not applying fertilizers to frozen ground or in areas with less than 10 inches of soil covering fractured bedrock.

Areas in which bulk agricultural fertilizers are stored, transferred or prepared for application are regulated under 61CSR6B "Primary and Secondary Containment of Fertilizers." There were no violations during this reporting period. Facilities regulated by this rule must submit a design plan and specifications for construction to the commissioner for approval. This applies to both liquid and dry fertilizers. The operator of a storage facility shall prepare a written discharge response plan for the storage facility for each type of bulk fertilizer stored that includes procedures used in controlling and recovering, or otherwise responding to, a discharge.

In addition to groundwater contamination resulting from the use of pesticides in the field, facilities where pesticides are stored in bulk (liquid containers over 55 gallons or solids in undivided packages of 100 pounds or more) have proven to be sources of

groundwater contamination. These facilities, which are typically farm supply stores, are regulated under title 61CSR12H "Bulk Pesticide Operational Rules." Areas in which non-bulk pesticides are routinely stored, mixed or loaded into application equipment (typically farm fields and farm sheds) are regulated under 61CSR12I "Non-Bulk Pesticide Rules for Permanent Operational Areas."

These regulations were developed to specifically address groundwater concerns in areas where pesticides were held in concentrations either through storage or repeated mixing. The regulations became effective in July 1, 1993, but were promulgated by the WVDA to take advantage of its status under the West Virginia Groundwater Protection Act and in anticipation of federal regulations that would be created by the EPA under FIFRA. The EPA's Office of Pesticide Programs (EPAOPP) has been reviewing the compatibility of West Virginia regulations with the proposed federal regulations. If the EPA finds that the state regulations meet or exceed the federal regulations, the WVDA shall be allowed to claim compliance with the federal regulations through citation of the state regulations. This prudent action by the WVDA will eliminate the need to promulgate new regulations under the West Virginia Pesticide Control Act.

The EPA review process was initiated in January 2007, and a formal response was submitted by the WVDA. A response from EPAOPP is expected by January 2008. In many aspects, the state regulations meet or exceed the proposed federal regulations. Examples of areas of compliance include, but are not limited to:

- West Virginia regulations cover both commercial and private applicators (farmers). The proposed federal regulations apply only to commercial (for hire) applicators.

- West Virginia regulations cover all types of pesticides and, excluding homeowner uses, all types of applications. The proposed federal regulation applies only to agricultural applications by commercial applicators.

- The West Virginia regulations recognize the potential adverse impacts resulting from application equipment failures and equipment maintenance and require appropriate mitigation practices for these sources. The federal regulations ignore this potential contamination source.

- Construction guidelines for containment structures in the West Virginia regulations are equal to federal regulations.

- Waste liquids from secondary containment areas are treated as waste under federal regulations. West Virginia regulations provided for reuse of liquids.

- Operator safety is not addressed in the federal regulations. The West Virginia regulations require safety and emergency response plans to be in place at each site and on file with owners and emergency response personnel.

The application of pesticides as a commercial enterprise and the use of certain classes of pesticides by the producer are regulated by the WVDA under the authority of the West Virginia Pesticide Control Act and the delegated authority of the EPA under FIFRA. In addition to the enforcement of pesticide uses, as directed by the product label, commercial and private applicators must pass licensing and certification requirements established by the WVDA. The licensing and certification of pesticide applicators parallels the licensing strategy used in other agencies. The initial certification process of pesticide applicators requires that an applicant demonstrate a basic understanding of pesticide use and safety, in addition to all relative state and federal laws, including the West Virginia Groundwater Protection Act and relevant regulations promulgated by the WVDA, i.e. 61CSR6B, 12A, 12H, 12I and 22A. Approximately 5,000 applicators are certified.

In order to maintain certification, private applicators must attend 10 hours of pre-approved update training over a three-year period and commercial applicators must attend 20 hours. Updates on groundwater protection programs and revisions of pesticide use relative to groundwater protection were included in the update training programs. Two hundred and fifty applicators were recertified in 2006, and a similar number in 2007. The licensing and certification programs of the WVDA are approved under the DEP's Groundwater Certification Program (GCP).

Groundwater Protection Fees

All pesticides intended for sale in West Virginia must be registered with the WVDA prior to release in commercial channels. Under the West Virginia Groundwater Protection Act, each of these products is assessed an annual fee of $15. Approximately 10,000 pesticides were registered during each of the past two years, which generated $150,000 each year paid into the DEP groundwater protection fund. Seventy-five thousand dollars per year were then transferred to the WVDA from the DEP groundwater protection fund. Under the existing system, manufacturers registering products must remit a $100 product registration fee to the WVDA and the $15 fee to the DEP. The WVDA must then submit an invoice to the DEP to recover the WVDA's negotiated allocation of $75,000 used to support groundwater staff and related projects.

Field Investigations

The WVDA has primacy in the enforcement and investigation of all aspects of pesticide use. The DEP and the EPA may conduct additional or supporting investigations consistent with their authority. A pesticide label includes use restrictions relative to groundwater protection. A typical label direction, which is protective of groundwater, are no spray zones or setback in areas of wells and surface water. During this report period, there was one reported pesticide misuse relative to groundwater protection. The investigation conducted by the WVDA confirmed a violation of a pesticide label directive relative to groundwater protection in which pesticides had been applied to close to a well. The responsible party was fined in accordance with the WVDA's penalty schedule.

Related Programs

Pesticide use as defined by the EPA includes the disposal of damaged, outdated or surplus pesticides and pesticide containers. The disposal of waste pesticides in amounts of one gallon or less of liquid product, or five pounds or less of solids, falls under the EPA Small Quantity Disposal Guidance. This guidance is intended to address small amounts of waste pesticides that are generated by homeowners and subsequently classifies the waste material as routine household solid waste. The proper disposal of larger amounts of waste pesticides can be extremely expensive and the alternate, although illegal, practice of burying the materials is the usual remedy.

The West Virginia Department of Agriculture is one of several state agriculture departments that conduct Clean Sweep Programs for the collection of waste and surplus agricultural pesticides. The most recent collection was completed in June 2007, with a total of over 18,000 pounds of waste pesticides collected from 25 participants. The WVDA funded all aspects of the collection and disposal program. The total cost of the project was $26,000.

Liquid pesticides are routinely packaged in high density polyethylene (HDPE) plastic containers. Federal solid waste regulations classify a properly rinsed pesticide container as a household solid waste that can be disposed of in most municipal landfills. Solid waste regulations in West Virginia classify a properly rinsed pesticide container as a special waste that is not eligible for most municipal landfills. The prohibition of pesticide containers in landfills is generally not enforced and the situation is not unique to West Virginia

Since 1994, the WVDA has been participating in a recycling program to recover the plastic used in pesticide containers. The project is underwritten by the manufacturers of the pesticides and has been recognized by the EPA as an innovative step in reducing the adverse affects from improper container disposal by burial or incineration.

During this reporting period, the WVDA doubled (six as opposed to three) the collection and processing sites used in the program. The initial focus of the collection program was the agricultural sectors of Berkeley, Jefferson and Hardy counties. Since large amounts of pesticides are used in the maintenance of golf courses and urban landscapes, the collection program was extended into Kanawha, Lewis and Ohio counties.

While the participant base has doubled, the total number of containers collected appears to be static, with an average of 8,000 one-gallon containers per year collected. Pesticide manufactures are continually reformulating products into dry powders or granules to reduce the cost and hazards associated with liquids. This is reflected in the lack of a notable increase in containers collected despite a two fold increase in participants.

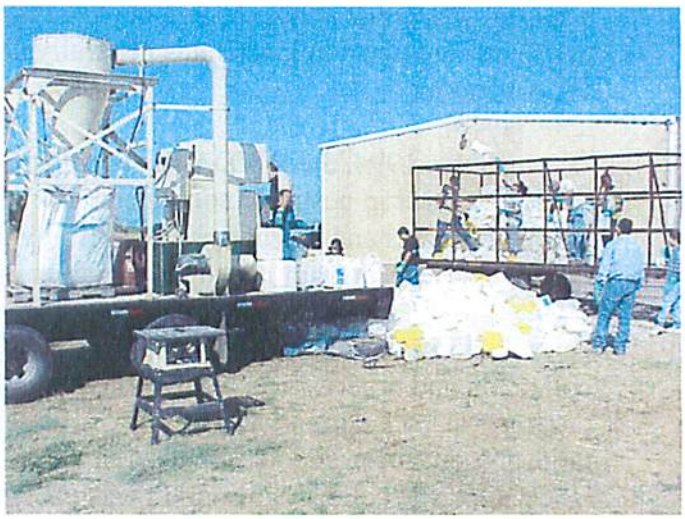
Goals and Recommendations

At times, the split billing process used in the collection of the groundwater protection fees has generated duplication or omission of invoices, inaccurate billings, and has required additional administrative attention to rectify. It is recommended that the WVDA be allowed to collect the annual registration fee and annual groundwater protection fee under one billing and transfer the $15 per product groundwater protection fee to DEP.

The WVDA is keenly aware of the trend of the EPA and state environmental and public health agencies to look at a comprehensive management strategy for all state water resources. The WVDA wishes to integrate its current water quality monitoring programs with existing programs of sister agencies.

Where site-specific groundwater monitoring may be required to support the continued use of some chemicals essential to the economic production of food and fiber, the WVDA shall utilize all advisory and material resources available.

The analytical and intellectual resources of the WVDA as they relate to pesticides, fertilizers and land use should be utilized by all agencies having authority under the Groundwater Protection Act.



Pesticide containers at collection site prior to processing, Above, a typical chipping station

A one-pound can of 99% pure strychnine was found in an unlocked out building. This amount of material is sufficient to kill over 200 adults or 400 pre-adolescent children if ingested

C. West Virginia Conservation Agency

The West Virginia Conservation Agency (WVCA) undertook the following activities that either directly or indirectly protect West Virginia's groundwater resources.

Resource conservation efforts of Conservation Agency programs focus on the maintenance and improvement of water quality relative to natural resource utilization, with a primary focus on agriculture and construction activities. The main concern is for surface water quality, but activities impacting groundwater resources directly and indirectly are addressed through conservation programs that implement best management practices, provide technical support for activities and involve education and outreach to citizens throughout the state.

Much of WVCA's work involves partnering with other state, federal and local agencies, as well as private citizens, businesses and organizations. This cooperative approach provides funding sources for projects and technical expertise and enables citizens to help the WVCA to realize and target specific problems in specific areas. This approach is and continues to be very effective in addressing concerns and brings together those resources vital for solving and preventing water quality degradation.

West Virginia has a diversity of terrain and geology that challenges natural resource conservationists with a multitude of issues that must be confronted by methods that are both effective and sensitive to the specific location and individuals affected.

1. Educational Activities Specific to Groundwater

The WVCA conducted activities that provided an awareness of ground water as a valuable resource and promoted the need to conserve and protect it. Various methods of outreach were employed and plans are to continue and expand these efforts.

- A groundwater flow model is being used to demonstrate how surface pollution can affect groundwater. It has been used in schools, reaching over 1,200 students.
- West Virginia WaterSafe individual groundwater protection program information was provided to the West Virginia Highlands Conservancy for distribution to interested persons.
- The Watershed Resource Center Waternet Resources newsletter contained an article, "Protecting Your Well and Wellhead", in the spring 2007 issue. This newsletter is mailed to over 250 and electronically distributed to over 150 individuals, organizations and agencies.
- The Monongahela Conservation District winter newsletter contained an article, "Protecting Rural Water Supplies", and is distributed to over 900 individuals in Marion, Monongalia and Preston counties.

- ❖ The Conservation Agency sponsored a seminar at the West Virginia Technology and Design Expo in March 2007, on permitting construction activities, part of which dealt with groundwater protection plans, reaching 109 attendees.
- ❖ Training sessions for the West Virginia Envirothon on aquatic issues addressed groundwater as part of the training of 60 students from 9 schools.

2. Agricultural Activities

A major emphasis with farmers is managing the amount and application of livestock manure, poultry litter, biosolids and commercial fertilizers. Storage, field placement and timing are issues with nutrient management that are addressed. Conservation planning, workshops, field days and technical advice are provided as a means of helping farmers better use plant nutrients and avoid degrading surface and groundwater. Although it appears these would have only an effect on surface water, leaching of nutrients through the soil, especially where karst geology or sandy soils exist, or leaching through porous stream beds can directly influence groundwater quality.

Nitrates and phosphates are the principle nutrients of concern with regard to water quality degradation involving chemical fertilizer use. Nutrients, as well as pathogens and bacteria, are animal manure, poultry litter and biosolid issues. Determining needed nutrient amounts through soil testing, recommending application rates in nutrient management plans, providing cost share for storage facilities and use of on-the-land conservation practices to prevent runoff or leaching into surface and groundwater is part of conservation planning and are the means by which the agriculture community is served.

Pesticide use and storage is another area of concern and one addressed in education programs for farmers and in farm planning.

- ❖ 50 nutrient management plans have been developed on over 2,600 acres and managed approximately 100,000 pounds of nitrogen and 120,000 pounds of phosphorus. The results of this planning reduce risks from runoff and leaching of nutrients and in the case of organic fertilizers, pathogen and bacterial contamination. Farmers also realize positive economic results of production by using only the amounts and kinds of fertility needed.
- ❖ WVCA staff serves in an advisory capacity to DEP in the development of confined animal feeding operations (CAFO) rules. These work to protect groundwater through requirements for storage and application quantities of animal manure and litter.
- ❖ WVCA is represented on the State Nutrient Management Committee of the Department of Agriculture. This group certifies nutrient planners, approves recommendations for fertilizer, manure and litter use, and plans continuing education training for planners.

- ❖ Over 700 farmers were educated at field days and "Pasture Walks" about soil sampling and testing to ensure appropriate fertilizer applications.
- ❖ Integrated pest management plans have been developed on 110 acres of farmland, reducing the potential for over- application of chemicals as well as the potential for leaching.
- ❖ WVCA staff is an integral part of the State Conservation District's Lime Program, providing an opportunity for involvement with farmers in their fertility programs. Nearly 1,300 individuals have taken advantage of the program and nutrient management planning is becoming a much greater concern with the farming community due to rising costs of fertilizer.
- ❖ The State's conservation districts have instituted a multiflora rose and autumn olive control program to address concerns over misapplication or improper handling of herbicides. The program requires any applications made be done by certified private or commercial applicators that have training in the proper use, storage and disposal of herbicides. Nearly 300 participants have enrolled in the program.
- ❖ WVCA staff promotes the Department of Agriculture's pesticide container recycling and unused pesticide disposal program.
- ❖ Conservation plans done by staff have provided cost share monies for practice installation on six farms providing concrete manure storage and feeding areas that eliminate leaching potential and helped farmers manage nearly 1,000 tons of manure.

3. Inter-Agency Source Water Program Cooperation

The West Virginia Bureau for Public Health invited a representative of the WVCA to be on the West Virginia Source Water Assessment/Wellhead Protection Program's Review and Liaison Committee. The committee is working to coordinate agencies and their programs in an effort to protect ground and surface water used for public drinking water.

One of the most beneficial outcomes of this recognition of technical resources available in the state is realized by the interaction of this group. This committee makes possible the availability of sensitive information about source water protection zones that can assist with watershed-based plan development. Those plans are more comprehensive and, when implemented, more effective if the knowledge that public water supply is within the watershed boundaries and consideration for their protection are made.

V. WEST VIRGINIA DEPARTMENT OF ENVIRONMENTAL PROTECTION

A. Office of Oil and Gas

The Office of Oil and Gas (OOG) regulates West Virginia's oil and natural gas industry. Protection of groundwater is of utmost importance and is achieved through the permitting, inspection and enforcement of exploration, production, plugging and injection activities of the industry. Over 47,000 active wells are maintained by the OOG. Regulations aimed at protecting groundwater have been in existence since 1929. Additional regulations have been added in the years to follow to further aid in the protection of groundwater. The OOG believes that groundwater protection is now maximized by the current regulations and practices. The following is a summary of selected regulatory functions and activities the OOG conducts in protecting groundwater.

Fresh Water Casing and Drilling Practices-35CSR4-11.3 and 11.7

The fresh water protection casing must be set at least 30 feet below the deepest fresh water horizon and cement circulated to surface prior to drilling into any oil, gas or salt water bearing strata and before extending below sea level. The operator shall use practices and procedures necessary to minimize damage or disturbance to strata, including groundwater, until the casing has been set.

Plugging Methodology-35CSR4-13 and 22-6-24

During plugging and abandonment operations of a well, the operator is required to separate oil, gas and water-bearing strata with 100-foot cement plugs to completely seal the hole and prevent communication with other zones, including groundwater bearing strata.

Water Supply Testing-35CSR4-19

Operators are required to notify landowners within 1,000 feet of a proposed well drilling site of the opportunity to test their water prior to drilling. At the request of the landowner, the operator shall sample and analyze water from any wells or springs within 1,000 feet. If no requests are made, then the operator shall choose an existing well or spring from within the 1,000 feet to sample and analyze. Results of the samples are to be submitted to the landowner as well as the OOG. Testing results are kept on file for a reference value of groundwater quality in case a problem should ever arise.

Underground Injection Control Program-35CSR4-7

The OOG administers the Class II and III injection wells under the Underground Injection Control Program. Class II wells include brine disposal and secondary recovery gas and water injection wells. Class III wells include solution mining wells. The active inventory consists of approximately 70 brine disposal wells, 550 secondary recovery

wells and 35 solution-mining wells. The primary focus of this program is the protection of groundwater from injection operations. Operators are required to submit reports monthly of each injection well's daily activity. UIC permits are issued for five-year periods and must be renewed for injection to continue. During permitting, operators are required to sample and analyze water wells, springs and surface water bodies within a ¼-mile radius of the injection well or facility. Solution mining permits require that groundwater be sampled, analyzed and charted on a quarterly basis. Mechanical integrity tests (MITS) are required to be conducted by the operator at least once every five years to ensure that injected fluid is not migrating into any underground source of drinking water. The OOG is required to conduct field compliance reviews of all injection wells.

Abandoned Well-35CSR6

Abandoned wells are the most problematic area relating to groundwater, especially for wells drilled 75 to 100 years ago when technology was not as advanced and concern for groundwater protection was not as high as today. These wells, located throughout the state, now potentially pose threats to groundwater quality. Aquifers penetrated by these wells are typically not cased to protect them from contaminants within the borehole of the well. Some of the contaminants potentially released from an abandoned well that may affect groundwater quality include hydrocarbons, chlorides and metals. The OOG works with industry and the federal government to locate, prioritize and plug or recondition abandoned wells. The OOG has a priority ranking of abandoned wells and those that pose a significant and or immediate threat to human health and or the environment are scheduled for remedial action first.

Annual Inspection-35CSR4-11.6

Operators are required to visually inspect all wells that are not plugged and that have been drilled for more than five years. Any significant leakage or well integrity failure is reported to the OOG and measures are taken to remedy the problem. Operators are required to submit written certification to the OOG that the inspections have been conducted.

General Water Pollution Control Permit

Operators applying for a permit involving the use of an earthen pit for holding wastes generated during well work must also register this site and indicate the method for treating and disposing of the pit contents. Most pit contents are land applied after proper treatment and aeration. The primary function of this general permit is the prevention of pollution to the waters of the state from the handling and disposing of these wastes.

Spill Prevention and SPCC Plans 35CSR1

All operators must have adequate containment or diversionary structures in place at each well or facility to prevent discharged oil from reaching waters of the state.

Operators are also required to have a Spill Prevention Control Countermeasure (SPCC) Plan for these facilities. This requirement was the result of the passage of the Clean Water Act, designed to protect waters of the state from contamination.

Groundwater Quality Data Collection

Groundwater quality data is primarily collected from three activities regulated by the OOG. Operators proposing a new drilling location must provide notice to every dwelling within 1,000 feet of this location and offer to sample and analyze their well water and or spring. This data then represents the groundwater quality standard for the area of proposed drilling. Parameters include, but are not limited to pH, iron, chlorides, total dissolved solids and detergents. Results are currently being submitted in paper form and kept on file with the corresponding permit.

Operators applying for an UIC permit are required to sample and analyze all water wells, springs and surface water bodies within ¼-mile radius of the proposed facility. Parameters are the same as those mentioned above. Results are submitted in paper form and kept in the corresponding UIC file.

The OOG investigates several water well contamination cases yearly. Groundwater sampling and analysis work have become routine tasks during such investigations. Parameters vary from case to case, but usually include those mentioned above. Again, the analyses are submitted in paper form and kept in the corresponding investigation file.

A computer tracking system has been established for the chloride content of streams receiving discharges of produced water associated with stripper oil wells. NPDES permits require the chloride content and stream flow be checked and submitted monthly. Under this permit, the operator of these permitted facilities must also sample and analyze the effluent every month for pH, iron, chlorides, total dissolved solids and oil and grease. The monthly analytical data is currently submitted in paper form on a discharge monitoring report. However, electronic filing will be encouraged in the near future. The point at which the effluent enters the stream has been identified by Global Positioning System (GPS) for all active facilities.

To date, the OOG has collected GPS data on over 3,000 wells. This data must first be corrected for various external degredational effects, the largest of which is intentionally imposed by the U.S. Department of Defense. After correction, this data is placed on the GIS server to allow for incorporation with other GPS data. Over time, the OOG will be able to develop a more complete and accurate (2-5 meters) location database.

Presently the GPS work is focusing on the abandoned well population, as many of these wells are not mapped and often tend to be sources of groundwater contamination. The GIS system provides the capability to relating well location information with such coverage layers like topography, roads and streams. A vast amount of other, more area

specific coverage layers are also accessible on this system. This data can be pulled together into a map to be used in the field or for environmental investigations and presentations.

All West Virginians whose supply of drinking water comes from groundwater through water wells have some risk drinking water contamination. This could be due to oil and gas activity or other unrelated surface or underground activities. An alliance should be formed between the offices within the DEP and other state and county agencies such as the DHHR, the Public Service Commission and county public service districts. This would enable pooling resources of each party to provide relief to the families whose drinking water has been adversely affected. While the offices within DEP and outside agencies may not have the funding to provide the total solution to a particular situation, some funding from each entity, as well as a review of possible alternatives, may result in a helping solution for the family. Currently, there is no such alliance, but the need for one is certainly obvious and the benefits will more effectively help the citizens of West Virginia.

B. Division of Water and Waste Management

1. Hazardous Waste Permitting Section

The Hazardous Waste Permitting Unit was established by Chapter 22, Article 18 of the West Virginia Code and the rules promulgated there under. Legislative Rule, Title 33, Series 20, known as the Hazardous Waste Management Rule (HWMR), are the regulations promulgated to regulate the storage, treatment and disposal of hazardous wastes generated and managed in West Virginia. The HWMR has incorporated by reference the Code of Federal Regulations (CFR) promulgated under the Resource Conservation and Recovery Act (RCRA) amendments of 1984. All provisions of 40CFR264 Subpart F and 40CFR265 Subpart F, which pertains to groundwater protection and any releases from a solid waste management unit (SWMU), have been incorporated by reference in their entirety.

The Hazardous Waste Section coordinates this regulatory effort with the EPA. West Virginia has authorization to assume the lead role in the groundwater protection and monitoring at the permitted units in West Virginia, while EPA has the lead for implementing corrective action activities.

Groundwater Protection Goal and Priorities

The Hazardous Waste Section identifies all permitted sites with groundwater contamination or potential for groundwater contamination due to a release, remediates the site, and returns the site to its original condition.

The priority objectives are as follows:

- ❖ Identify all sites with contaminated groundwater or potential for groundwater contamination.
- ❖ Define the contaminants, source and extent of contamination.

By 2008, 80% of all RCRA facilities will have chosen remedies and remediation and construction completion by 2020, with contamination under engineering control and stabilized to prevent additional contamination to groundwater and eliminate further migration of contaminated groundwater.

Mechanisms to Regulate and Protect Groundwater at Permitted Units

The groundwater monitoring regulations in Part 264/265, Subpart F, is one part of an overall strategy to reduce the likelihood of environmental contamination resulting from hazardous waste treatment, storage, disposal and any SWMU under corrective action program. This strategy includes restrictions on disposal of untreated hazardous waste, unit-specific standards for land-based hazardous waste management units, and monitoring groundwater below these units. The land disposal restrictions program requires the treatment of hazardous wastes before disposal to reduce the mobility or toxicity of hazardous constituents. The unit-specific standards for land-based hazardous waste management units seek to prevent the release of hazardous waste to the environment. Groundwater monitoring is the final link in this strategy to prevent environmental contamination. Owners and operators of all land-based units must institute a program that is able to detect and characterize any releases of hazardous waste or hazardous constituents to the groundwater underlying the facility. Should the other elements of the strategy fail; the program will detect the release so it can be remedied.

The regulations in Subpart F of Part 264/265 are general requirements, establishing performance-based standards that state what a successful groundwater monitoring program must accomplish; they do not dictate specific technical standards. Each facility's groundwater monitoring program is unique because no two treatment, storage, or disposal facilities (TSDF) are the same. Individual groundwater monitoring programs are based on site-specific conditions, including the underlying geology and hydrology, contaminants in the groundwater, as well as the properties of wastes managed onsite.

Regulatory authority is available to require the owner and operator of a TSDF to remediate releases of hazardous waste or hazardous constituents to the environment. All permitted facilities must comply with Part 264, Subpart F, for releases from SWMUs. There are three stages to the Part 264, Subpart F, Groundwater monitoring and followup activities:

- ❖ Detection monitoring - to detect if a release has occurred
- ❖ Compliance monitoring - to determine if regulatory standards have been exceeded once a release has occurred
- ❖ Corrective action - to remediate a release to the groundwater

Section 264.97 sets out the basic requirements that apply to all groundwater monitoring programs under Part 264, Subpart F. The specific requirements that apply to each of the three phases of groundwater monitoring are found in 264.98, 264.99, and 264.100.

The general requirements for groundwater monitoring programs at permitted facilities are found in 264.97. These general requirements apply to all three phases of groundwater monitoring: detection monitoring, compliance monitoring and corrective action. A groundwater monitoring program established pursuant to Part 264, Subpart F, must have a sufficient number of monitoring wells, installed at appropriate locations and depths, to yield water samples that:

- ❖ Represent the background conditions of the site.
- ❖ Represent the quality of groundwater passing the point of compliance.
- ❖ Detect any contamination of the uppermost aquifer at the point of compliance.

The goal of a detection-monitoring program is to detect and characterize any release of hazardous constituents from a regulated unit into the uppermost aquifer. The detection monitoring system must be installed at the point of compliance and adhere to the task requirements applicable to all groundwater monitoring systems. The owner and operator must monitor for certain indicator parameters and any other specific waste constituents or reaction products that would provide a reliable indication of the presence of hazardous constituents in groundwater at the point of compliance.

Once it is established that a release has occurred, the owner and operator must institute a compliance monitoring program. The goal of the compliance monitoring program is to ensure that the amount of hazardous constituents released into the uppermost aquifer does not exceed acceptable levels. Once those levels are exceeded, the owner and operator must initiate corrective action. The compliance monitoring program establishes routine monitoring (at least semiannually).

The goal of the Subpart F corrective action program is to bring regulated units and/or SWMU back into compliance with the required standards at the point of compliance. The Subpart F corrective action program seeks to accomplish this goal by requiring that the owner and operator either remove the hazardous constituents or treat them in place. Examples of corrective measures include excavation, stabilization, solidification and source control. The owner and, operator must also conduct corrective action to remove or treat in place any hazardous constituents that exceed the required standards between the point of compliance and the downgradient property boundary, and beyond the facility boundary where necessary to protect human health and the environment.

Mechanisms for Corrective Action

The Hazardous and Solid Waste Act of 1984 (HSWA) required corrective action for all releases of hazardous waste or constituents from any SWMU at a facility seeking a permit regardless of when the waste was placed in the unit. A SWMU is any discernible unit at which solid wastes have been placed at any time, irrespective of whether the unit was intended for the management of solid or hazardous waste. This definition includes any area at a facility where solid wastes have been routinely and systematically released. This authority is applied to any facility seeking a permit, including operating permits, post-closure permits, and permits-by-rule after November 8, 1984.

Under HSWA, Congress also gave EPA the authority to issue orders requiring cleanups at interim status facilities. Interim status TSDFs that were already in operation when the applicable RCRA standards were established, and that are operating under the standards in 40CFR P265 until they receive a permit Under 3008(h), as added by HSWA, EPA can issue an administrative order or file a civil action whenever it determines on the basis of any information that there is or has been a release of hazardous waste into the environment from an interim status facility. This applies to facilities that are currently operating under interim status, that formerly operated under interim status, or that should have obtained interim status. It also applies to any release of hazardous waste or constituents from the facility. In addition to requiring cleanup, EPA has the authority under 3008(h) to revoke or suspend interim status. Finally, as with 3004(v), EPA may use 3008(h) to require corrective action beyond the facility boundary and to require proof of financial assurance for cleanup.

One of the keys to understanding the RCRA corrective action program is knowing when a facility becomes subject to the corrective action. A facility can enter the corrective action program in one of primarily four ways. Facilities can enter the corrective action program under statutory authorities, by enforcement orders, by volunteering to perform cleanups or after detecting statistically significant increases of contamination according to the groundwater monitoring requirements in 40CFR264, Subpart F.

In the past, EPA has used the corrective action process to evaluate and document the nature and extent of contamination, identify the physical and geographic characteristics of the facility, and identify, develop, and implement appropriate corrective measures. The conditions at contaminated sites vary significantly, making it difficult to adhere to one rigid process. Consequently, the corrective action process is designed to be flexible.

The original corrective action process of investigation and remedy selection and implementation comprise several activities. These activities are not always undertaken as a linear progression toward final facility cleanup, but can be implemented flexibly to most effectively meet site-specific corrective action needs. These activities are:

- ❖ RCRA Facility Assessment (RFA) - identifies potential or actual releases from SWMUs
- ❖ Interim/Stabilization Measures - implements measures to achieve high-priority, short-term remediation needs
- ❖ RCRA Facility Investigation (RFI) - compiles information to fully characterize the release
- ❖ Corrective Measures Study (CMS) - identifies appropriate measures to address the release

Once the implementing agency has selected a remedy, the facility enters the corrective measures implementation (CMI) phase of corrective action. During the CMI, the owner and operator of the facility implement the chosen remedy. This phase includes design, construction, maintenance and monitoring of the chosen remedy, all of which are performed by the facility owner and operator with agency oversight.

A remedy may be implemented through a phased approach and phases may consist of any logically connected set of actions performed sequentially over time or concurrently at different parts of a site.

Facilities with Ongoing Corrective Action

The following chart lists the West Virginia facilities that are currently performing corrective actions. It lists the facility, if the facility has human health (HH) and groundwater (GW) under control, and where each facility stands with its cleanup status.

This chart is periodically updated and can be viewed on the Internet at:

http://www.epa.gov/reg3wcmd/ca/wv.htm

Additional information can be seen about site history and project detail by going to the Web site and clicking on the facility name.

West Virginia

RCRA Baseline Facilities

EPA Region 3

Facility fact sheets and the Environmental Indicator forms are Adobe Acrobat PDF files.

For additional facility information, go to the following links:

- Click on the facility name to view the facility fact sheet
- Click on the "YES" to view the facility's completed Environmental Indicator form
- Click on the location name to view a map of the area

	Cleanup Initiated	Done	**Complete Without Controls**
R	**Remedy Selected**	Done	**Complete With Controls**
	Construction Complete		

Facility Name	EPA ID#	Location	Environmental Indicators		Cleanup Status
			HE	GW	
AEP Kanawha River Plant (Appalachian Power)	WVD980554588	Glasgow	YES	YES	Done
Airco Welding	WVD980554760	Chester	YES	YES	
Appalachian Timber Service	WVD063461958	Sutton	YES	YES	R
Bayer Cropscience LP (Rhone Polenc,Aventis)	WVD005005509	Institute	YES	IN	
Bayer Polymers LLC (Miles)	WVD056866312	New Martinsville	YES	YES	
Beazer-Colliers (Koppers-Colliers)	WVD980707178	Colliers	YES	YES	
Crompton Corporation - South Plant (G E Specialty Chemicals 1)	WVD061776977	Morgantown	YES	IN	
Crompton Corporation - North Plant (G E Specialty Chemicals 2)	WVD980552384	Morgantown	YES	IN	
Cytec	WVD004341491	Willow Island	YES	IN	
Dupont - Belle	WVD005012851	Belle	YES	IN	
Dupont Martinsburg - Potomac River Works	WVD041952714	Martinsburg	YES	YES	
Dupont - Washington	WVD045875291	Washington	YES	YES	
Flexsys America L.P. (Solutia Inc., Monsanto)	WVD039990965	Nitro	YES	IN	R

FMC - So. Charleston	WVD005005079	South Charleston	YES	YES	Done
GE Silicones (Crompton, Witco Corp,, CK Witco, OSi)	WVD004325353	Friendly	YES	YES	Done
General Electric Co (GE Plastics, GE Chemicals)	WVD088911854	Washington	YES	YES	
General Motors Corp. (G M C Martinsburg)	WVD044145209	Martinsburg	YES	YES	Done
Great Lakes Chemicals Corp (FMC)	WVD005005087	Nitro	YES	YES	
KACC Spl. Pile (Kaiser Aluminum & Chemical Co. - Spent Potliner Pile)	WVD988766127	Ravenswood	YES	YES	
Koppers-Follans (Beazer East)	WVD004336749	Follansbee	YES	YES	
Koppers - Green Spring (CSXT)	WVD003080959	Green Spring	YES	YES	
Occidental Chem Corp	WVD005010277	Belle	YES	IN	
P P G Industries	WVD004336343	New Martinsville	YES	YES	
Pechiney Rolled Products Inc. (Century Alum., Ravenswood)	WVD009233297	Ravenswood	YES	YES	
PTO-UCC-Dow (Union Carbide - PTO)	WVD000739722	Nitro	YES	IN	
Quaker State-Congo	WVD057634776	Newell	YES	IN	
SMR Technologies (BF Goodrich)	WVD980555395	Fenwick	YES	YES	Done
St. Mary's Refining (Quaker State)	WVD004337135	St. Mary's	YES	YES	
UCC-South Charleston (Union Carbide-So. Charleston	WVD005005483	South Charleston	IN	IN	
UCC Tech Center (Union Carbide Tech Center)	WVD060682291	South Charleston	YES	IN	
Weirton Steel	WVD000068908	Weirton	IN	IN	
Wheeling - Pittsburgh Steel	WVD004319539	Follansbee	IN	IN	
XSYS Print Solutions, LLC (BASF - Huntington)	WVD000068601	Huntington	YES	YES	

DEFINITIONS:

HE = Current Human Exposures Under Control Environmental Indicator (CA725)
GW = Migration of Contaminated Groundwater Under Control Environmental Indicator (CA750)
YES = YES, The Environmental Indicator has been met
IN = More information is needed Cleanup Started - Initiation of a facility-wide investigation and cleanup.
Cleanup Initiated = Initiation of a facility-wide investigation and cleanup.

Remedy Selected = The regulator has selected final cleanup objectives to address contamination and exposures.
Construction Complete = All components of the final remedy are in place and operating as designed.
Complete without Controls = Final cleanup objectives are met for all media, and no further activity or controls are necessary.
Complete with Controls = Final cleanup objectives are met but but on-going operation, maintenance and/or monitoring of controls are necessary to ensure protection of human health and the environment.

Groundwater Data Collection and Management

Most groundwater data is collected by facilities or environmental firms on the facilities' behalf. Occasionally samples are collected by Division of Water and Waste Management personnel for the purpose of comparison. Regardless of who is collecting groundwater samples, sampling methodology and analytical testing procedures must comply with the protocols prescribed by the appendices to 40CFR261. All samples must be analyzed by laboratories certified by the Division of Water and Waste Management.

The Hazardous Waste Permitting Unit does not have a database for the management of groundwater data. Currently, facility groundwater data is submitted in paper form and reviewed by hazardous waste personnel assigned to the facility. In the future, groundwater data will be submitted electronically and managed in EQuIS. EQuIS will allow data to be stored, managed and shared among the divisions of DEP and other agencies with groundwater certification. Some access will be available to the public as well. In addition to data screening and management, EQuIS links to a wide variety of other scientific software such as GIS. During the reporting period, the Hazardous Waste Permitting Unit has acquired groundwater modeling software and a GPS unit and associated software. The Hazardous Waste Permitting Unit needs GIS software such as ArcView.

The Division of Water and Waste Management as a whole needs more GPS units and the necessary training to obtain accurate locational data.

Program Consideration and Needs

There are difficulties inherent with trying to clean areas to pristine levels where industry has been associated with business activities for decades. There are economic and technical obstacles that need to be considered in areas that will probably never be utilized for drinking water. However, that must be balanced with the ideal that our groundwater is a valuable resource not to be taken for granted. There are many who have a stake in the decisions on how best to manage the environment. In the future, policy and decision making must be addressed by the administration in a manner that each operating unit is clear as to the direction and in the manner these issues are to be decided.

2. Environmental Enforcement

The Environmental Enforcement (EE) office is primarily responsible for inspection and enforcement of the state and federal solid waste, hazardous waste, underground storage tank and water pollution control laws. EE's groundwater objective is to investigate all reports of contamination that fall within its jurisdiction and to refer all reports of contamination which are not under its jurisdiction to the appropriate authority.

EE's Compliance Monitoring unit has been assigned the responsibility to conduct groundwater sampling inspections (GSIs) at various facilities throughout the state. Primarily, these facilities are active and inactive municipal and industrial landfill sites. The sites selected for sampling comes from requests from DEP's permitting staff, regional inspectors/supervisors and the discretion of the Compliance Monitoring unit.

At present, only one position has been funded to do groundwater sampling inspections. Additional staffing is needed to adequately address all the groundwater sites within the state. DEP's present grant commitment is for six GSIs per year. With the low level of staffing in the Monitoring unit, it will be hard to do any more than the commitment numbers with all the other job responsibilities assigned to this unit.

The Department of Environmental Protection's Quality Assurance/Quality Control Plan for Standard Operating Procedures for Groundwater Sampling 2000 is used by the Monitoring unit as a guide when conducting GSIs.

Generally, all landfill sites will have a minimum of four groundwater monitoring wells. The number of wells per site will depend on the size of the landfill and could be as high as 20 or more. Data collected from these wells depend upon whether it is an industrial or a municipal landfill. All municipal landfills generally have the same parameters (Phase I) as outlined in 33CSR Appendix I.

Collection of groundwater samples is accomplished by compressed air operated bladder pumps as well as bailers. All organics are collected by Teflon bailers. All samples are collected, preserved and analyzed in accordance with 49CFR. Groundwater samples are analyzed by state-certified laboratories.

The pre-closure program continues the review of industrial facilities that are in the process of ceasing operations. The review process allows EE to ensure that all known contamination is remediated. All groundwater wells present at the sites are sampled during this process. When any contaminated soil is identified at the facility, remediation is required under the Groundwater Protection Act.

Training that focuses on the complex interaction of groundwater, geology and chemistry must be provided to EE staff. This training must include all staff, but prioritize newly hired inspectors. Classroom style training accompanied with ample practical (hands on) training exercises with a focus on sample collection and preservation would

be most beneficial. This training program will result in environmental inspectors that are both effective and safety conscious in their field work.

EE recognizes the need for a centralized database system that is accessible to all inspectors and other agency staff. EE maintains hard copy files on groundwater complaints, investigations, notice of violations (NOVs), enforcement actions, spills, wellhead protection areas, reports on groundwater flow mapping, groundwater quality data, and monitoring well data for landfills and industrial sites. Due to storage limitations, this information cannot be maintained in accessible files for extended periods of time. Currently, the only utilization of the ERIS database is for permit information.

Both the Hazardous Waste Management Act and the Underground Storage Tank Act are, in part, groundwater protection acts. The Hazardous Waste Management Act requires long term groundwater monitoring at permitted disposal sites and EE personnel periodically evaluate these facilities and monitoring wells to determine the quality of groundwater at these locations.

Additionally, in fiscal year 2007, EE personnel investigated 572 spills and 2,503 complaints that had the potential to impact groundwater.

Environmental Enforcement's Underground Storage Tank (UST) Unit

The Underground Storage Tank (UST) Unit of the Division of Water and Waste Management, Environmental Enforcement is responsible for the implementation of the provisions of the Underground Storage Tank Act (USTA), Chapter 22 Article 17, of the West Virginia Code.

The UST Unit regulates tanks that are included in the federal UST law and maintains a database with a total of 24,687 registered USTs, 18,909 of which have been permanently closed. The remaining 5,778 are either active or temporarily out of service.

The UST inspectors perform UST installation, closure and compliance monitoring inspections. The UST Unit also administers the UST worker certification program to certify those who install, repair, retrofit, upgrade, tightness test, or permanently close UST systems and install, repair, or test UST cathodic protection systems.

Goals

The UST Unit's goal is to protect human health and the environment by requiring UST systems to have release detection, corrosion protection, overfill protection and spill prevention. The federal Energy Bill that became effective on August 8, 2005, increases the requirements for USTs to include secondary containment, delivery prohibition to noncompliant USTs and mandatory operator training.

The Energy Bill also requires states to perform onsite inspections at every facility by August 8, 2007, that has not undergone a compliance monitoring inspection since December 22, 1998. It then requires that all facilities be inspected once every three years.

Staffing

There are currently six inspectors in regional offices throughout the state with a vacancy in the Northern Panhandle and a program manager.

Public Outreach

The USTA created an UST Advisory Committee consisting of petroleum industry representatives, the insurance commissioner, the DEP secretary, and a citizen at large that meet to discuss UST related issues.

The UST inspectors provide one-on-one training to the UST owners/operators during their compliance monitoring inspections.

An *O & M Manual for West Virginia UST Owners and Operators* has been developed and distributed to the regulated community. The UST Unit has in the past held owner/operator seminars to inform the regulated community of the UST regulations. The unit also has mailed instructional manuals, pamphlets and fliers on UST regulations and the effects that a release can have on the environment and the public. Two videos, *LUST in A Small Town* and *Tank Time*, were mailed to all of the public libraries in West Virginia several years ago.

3. Solid Waste Permitting Unit (SWPU)

The SWPU regulates solid waste facilities under the Solid Waste Management Rule, 33CSR1. This includes the review of applications for various permitting activities for new and existing facilities such as permit issuance, renewal or closure. The SWPU reviews applications to accept special waste, to alter groundwater monitoring systems, and also reviews statistical groundwater monitoring reports, conducts construction quality assurance and quality control inspections, and compliance assistance to waste generators.

Description	Permitted Facilities
Active Municipal Solid Waste Landfills (Class A & B)	19
Closed Municipal Solid Waste Landfills (Class A & B)	32
Construction/Demolition Waste Facilities (Class D and D-1)	12
Yard Waste Composting Facilities	23
Transfer Stations	19
Waste Tire Facilities	3
Recycling Facilities (Class E)	0
Sewage Sludge Processing Facilities	0

Mixed Waste Processing Facilities	0

Permitted landfills must sample groundwater monitoring wells twice each year and perform statistical tests to determine whether groundwater has been contaminated. The statistical reports are reviewed by the SWPU, and Environmental Enforcement takes any necessary enforcement action.

In an effort to protect groundwater, the Solid Waste Management Rule requires an impermeable liner system for municipal solid waste landfills. This multiple layer liner system includes a leak detection zone, which will alert the facility should be a failure in the liner. If contamination has been detected by routine detection monitoring, the landfill may be required to begin corrective action to clean up the groundwater. There are currently two facilities (one operating and one closed) that are in assessment monitoring due to detection of potential contamination.

Although some releases have been detected, the statistical groundwater-monitoring program is in need of improvement. The Division of Water and Waste Management has prepared a guide to groundwater sampling, but no state training or certification of groundwater samplers exists. As improved statistical methods are introduced, contamination caused by poor sampling techniques will become more apparent. Currently, the SWPU does not have regulatory authority to address the problem of inadequate sampling. To remedy this problem, 33CSR1 would need to be modified to require adherence to the American Society for Testing Materials (ASTM) Standard D 6312-98 "Standard Guide for Developing Appropriate Statistical Approaches for Groundwater Detection Monitoring Program."

Groundwater monitoring wells must sometimes be replaced because they have caved in, gone dry or are located where the disposal area is expanding. The SWPU reviews well replacement plans to ensure that the new wells are properly placed to detect potential groundwater contamination as soon as possible.

Groundwater monitoring reports are submitted to the SWPU on paper. The Environmental Quality Information System (EQuIS) will accept groundwater monitoring data electronically and provide an interface to statistical and mapping software that will allow the SWPU to check statistical calculations.

The proper management of waste reduces the likelihood of groundwater contamination by reducing the amount and controlling the types of contaminants in leachate. This is achieved by special waste requests that are reviewed by the SWPU, and either approved or denied for disposal.

The SWPU is responsible to ensure that facilities are properly designed by reviewing plans and granting permit modifications for expansion. During construction at these facilities, the SWPU conducts quality assurance/quality control (QA/QC) inspections to assure that facilities are built according to specifications and accepted industry practices.

Oil and other chemicals, primarily from vehicles, and leachate can contaminate stormwater flowing from solid waste facilities. Plans for structures and procedures for managing stormwater are a part of the detailed plans reviewed by the SWPU. Proper design, construction, and management prevent contaminated stormwater from infiltrating into the groundwater.

Through the Landfill Closure Assistance Program (LCAP), the DEP is currently monitoring the 29 closed solid waste landfills in West Virginia. Under this program, the emphasis is upon the capping of these facilities to minimize groundwater impact. Active solid waste landfill facilities have an ongoing program to identify and address any groundwater releases. The LCAP Program utilizes consultants who follow the procedures outlined in 33CSR1 to sample, analyze and identify groundwater and any associated problems. The SWPU has assisted LCAP by providing geological assistance on program priorities.

4. Groundwater Program

a. SUMMARY OF GROUNDWATER QUALITY IN WEST VIRGINIA
Prepared by the Division of Water and Waste Management - Groundwater Program in conjunction with the U.S. Geological Survey

1. Background

Water quality data from locations in the Group A and B Watersheds were collected in 2006 - 2007 from the ambient groundwater quality network. The report also summarizes groundwater quality data stored in the USGS National Water Information System (NWIS) water quality database for West Virginia.

Water quality data for the 30 sites in the West Virginia ambient groundwater quality network and for wells in the U.S. Geological Survey NWIS database for West Virginia were analyzed statistically to identify any water quality trends and relations and to compare data from the two datasets. Site selection was concentrated in areas of high priority or special interest to the DEP's Groundwater Program.

2. Parameters

Data for selected properties and constituents were grouped by geologic unit, topographic setting, geologic age, well depth and season. The constituents include field and laboratory parameters such as specific conductance, pH, oxidation-reduction potential, turbidity, dissolved oxygen and other gases, bacterial counts of fecal coliform, total coliform, and E. coli, organic carbon, hardness, and acidity, ionic concentration of calcium, magnesium, sodium, potassium, bicarbonate, alkalinity, chloride, fluoride, bromide, sulfate, and dissolved solids, nutrients such as nitrogen including nitrate plus nitrite, and phosphorus, concentration of metals such as aluminum, antimony, arsenic, barium, beryllium, cadmium, chromium, iron, lead, manganese, mercury, nickel, selenium, thallium, zinc, radon, a variety of hydrocarbons, volatile organic compounds, and 51 pesticides.

Data from the ambient network did not show any significant seasonal variations in groundwater quality.

3. Abundance of Groundwater

Although there seems to be adequate supplies of groundwater for public and private use, industry must usually rely on other sources of water. Groundwater quantity is highly variable throughout the state. Yields range considerably, even from location to location within the same water-bearing formation. Water-bearing formations in areas of fractured limestone in the southeastern and eastern part of the state and wells drilled in alluvium along the Ohio River tend to have the greatest yields. Water-bearing formations produce from a few gallons per minute (gpm) to more than 2,300 gpm in some sand and

gravel aquifers along the Ohio River. Average yields throughout the state are around 260 gpm.

4. The Geochemistry of West Virginia's Water

Groundwater quality is affected by human activities and can be degraded as a result of industrial waste disposal, coal mining, oil and gas drilling, agricultural activities, domestic or municipal waste disposal, transportation, and rural development. Waters sampled at the 30 locations show that background levels of pesticides, hydrocarbons, volatile organic compounds, and other chemicals that were tested occur at concentrations far below action levels set by groundwater quality standards, with a few exceptions.

5. Concerns

Two major concerns are the high concentrations of radon in certain watersheds and the presence of pharmaceuticals and endocrine disrupting chemicals in groundwater. Radon is a naturally occurring element found in many soils and rock types. The EPA has set a maximum contaminant level (MCL) for radon at 300 pico-Curies/Liter (pCi/L).

Data collected by the USGS for the ambient groundwater quality study show concentrations of radon above the 300 pCi/L were found in 17 of the 30 sites sampled in Group A watersheds and six out of the 30 sites sampled in Group B watersheds. These high concentrations of radon were found in diverse geological settings and well depths. Concentrations exceeding the MCL of 300 pCi/L ranged from 430 to 3,330 pCi/L in Group A watersheds and 300 to 3,330 pCi/L in Group B watersheds

The discovery of the presence of pharmaceuticals and endocrine- disrupting chemicals in groundwater has raised concerns regarding their effects on human health and the continued viability of antibiotic medications. Endocrine disrupting chemicals are found in a wide variety of products; their presence appears to be ubiquitous in the environment. Bioassays of fish in the Potomac River found intersex characteristics in the fish sampled. One such mutation is the presence of eggs in the testes of male fish. Another concern is the presence of certain antibiotics in ground and surface waters. As many of these compounds are known endocrine disruptors, their presence even at low concentrations warrant additional scrutiny.

Data collected by the USGS for the ambient groundwater quality study show concentrations of iron above the 300 µg/L Secondary Drinking Water Regulation (SWDR) limit were found in 13 of the 30 sites sampled in Group A watersheds and 20 out of the 30 sites sampled in Group B watersheds. The study also found concentrations of manganese above the 50 µg/L SWDR limit in 14 of the 30 sites sampled in Group A watersheds and 17 out of the 30 sites sampled in Group B watersheds. Although not a threat to public health, high concentrations of iron and manganese may render groundwater unsuitable for domestic use due to aesthetic reasons in some locations. These concentrations of dissolved iron and dissolved manganese are naturally occurring and are found sporadically throughout the state.

This study also noted an increase in concentrations of aluminum above the 200 µg/L (max.) SWDR limit in five of the 30 sites sampled in Group A watersheds and three out of the 30 sites sampled in Group B watersheds. Exceedences of the maximum contaminant level for arsenic were also found at one site in Group A watersheds, and at two sites in Group B watersheds. There was one exceedence of the maximum contaminant level for barium in Group A and Group B watersheds, and one exceedence of the maximum contaminant level for zinc in the Group B watersheds. No other exceedences of the MCLs or SWDRs for any other metals were found.

Bacterial contamination continues to be a concern in many areas, especially in the Eastern Panhandle and other areas where large poultry farms, feedlots and the practice of maintaining manure ponds may be found. However, the most likely source of bacterial contamination is failing or inadequately sited septic systems. Some improvement in reducing bacterial contamination has been noted.

This study also noted an increase in volatile organic compounds (VOCs). There are two reasons for this: a lower detection limit, and increasing atmospheric contamination. Specifically, an increase was seen in four tri-halomethanes, bromoform, chloroform, bromodi-chloromethane, and chlorodi-bromo methane. These compounds can be products of chlorinated hydrocarbon breakdown, or may be disinfection byproducts from chlorinization of wells. Also noted was an increase in concentration of BTEX compounds (benzene, toluene, ethylbenzene, and xylene) and the gasoline additive MTBE (methyl tertiary butyl ether) in groundwater. These are most likely from gasoline residues, and are attributed to local land use or atmospheric contamination. As recent sampling studies are now detecting the presence of these compounds in groundwater for the first time, it is prudent that their presence be monitored closely.

Only two sampling sites in Group A watersheds showed pesticides above detection limits, and these concentrations were extremely low; no watersheds in Group B showed pesticide above detection limits.

b. Groundwater Quality Standard Variances - Title 47 Series 57

Title 47 Series 57 established procedures for facilities to petition the secretary for a variance from groundwater protection standards for an individual source or for a class of sources. If the secretary agrees that a variance is appropriate, the rulemaking procedures will be initiated in accordance with Chapter 29 Article 3 of the W. Va. Code. The secretary may deny a variance; however, only the legislature may grant a variance.

Variances may be granted by the legislature to allow groundwater quality standards to be exceeded for a single source or class of sources, which by their nature cannot be conducted in compliance with the requirements of W. Va. Code 22-12-5. The benefits of granting the variance must outweigh the benefit of complying with existing groundwater quality standards and demonstrate that there is no technologically feasible alternative

available. The request must also show that granting the variance is more in the public interest than adherence to existing groundwater quality standards.

During this reporting period, there have been no new requests for any groundwater quality standard variances. The five-year variances granted to American Electric Power and Allegheny Energy have expired and are currently under review.

c. Groundwater Protection Regulations - Title 47 Series 58

Groundwater protection plans (GPP) for 106 facilities in West Virginia have been received (103 approved) by the Groundwater Program. Memoranda identifying their deficiencies or approving the GPP were prepared and sent to the Permits Section where these deficiencies will be addressed during the permitting process. Facilities that do not have permits were mailed letters identifying the deficiencies in their GPPs, or letters approving the document. These 106 facilities are listed in the table at the end of this section.

Underground storage tank (UST) facilities that distribute only gasoline or diesel fuel are adequately regulated by the Underground Storage Tank Section of the Division of Water and Waste Management. Therefore, some facilities have received a waiver from the requirement to develop and maintain GPPs. In lieu of a site-specific GPP, the facility must complete and submit a registration form certifying that it does not have service bays, does not provide mechanical service, does not have above ground storage tanks, and does not have outside bulk storage of materials with the potential to harm groundwater.

Guidance documents have been developed to aid in the preparation and implementation of groundwater protection plans. The title and a short description of each document are presented below.

Groundwater Protection Plan Guidance Document

This document summarizes and explains all of the elements required in a GPP for an industrial facility.

Groundwater Protection Plan for Small Businesses

This document is a fill in the blank style GPP for small businesses that are unfamiliar with environmental regulation. It helps them be in compliance with and understand groundwater protection measures as required by 47CSR58.

Salt Storage Guidelines

This is a guidance document to enable consistency in the environmental regulation of salt storage facilities, which includes sections on salt pile configuration,

storage pad construction, covering salt during storage periods, runoff handling, best management practices, groundwater monitoring, and permitting.

Above Ground Storage Tank Guidance

This guidance outlines the groundwater protection requirements for Above Ground Storage Tanks (ASTs). It also includes sections on AST construction, operation, safety, closure procedures, and post fuel storage use.

Site Evaluation for Land Application of Industrial Sludge

This is a manual designed to evaluate sites that may be capable of receiving land applied industrial sludge. Chapters include soil evaluation, geology and hydrogeology, hydrology, climate, vegetation, application method and rate, and land ownership.

Groundwater Sampling QA/QC/SOP

This is a guidance document intended to standardize groundwater sampling practices in West Virginia. It includes chapters on equipment, field data collection, well purging, filtering, preservation, and sampling monitoring and drinking water wells.

Vulnerable Groundwater Use Areas

Two areas of the state have been identified as areas which are "areas of karst, wetlands, faults, subsidence, delineated wellhead protection areas or other areas determined by the director to be vulnerable based on geologic or hydrogeologic information." These areas are the Berkeley – Jefferson area in Berkeley and Jefferson counties, and the Deer Creek Valley area around Green Bank and Boyer in Pocahontas County.

Groundwater Protection Plans Issued July 1, 2005 through June 31, 2007

Site Number	Project Name	Location	Date Received	Date Approved
1	Opequon Overlook	Baker Heights		9/27/05
2	Tabler Station Manor, Section 4	Tablers Station		8/28/05
3	Pebble Ridge Phase 3	N Central Berkeley Co.		7/20/05
4	Willowby Estates	SE of Inwood		7/8/05
5	Blackbird Village Townhomes	Lewisburg		10/11/05
6	Yorkshire Glen Phase 1-Section2	Martinsburg		8/26/05
7	Townes of Ridgeway	Ridgeway		8/28/05
8	Four Oaks	Martinsburg		02/06

Site Number	Project Name	Location	Date Received	Date Approved
9	Elizabeth Station, Section F	Bunker Hill		8/31/05
10	The Gallery Subdivision	Martinsburg		10/7/05
11	Otterbein UM Church	Martinsburg		10/3/05
12	Village Makers	Baker Heights (E of Martinsburg)		
13	Stonebrook Village–Phase 2	Hedgesville		02/06
14	Sader Point	Inwood		01/06
15	Potomack Mews Neighborhood	N. Berkeley Co.		01/06
16	Honeywood South	N. Berkeley Co.		12/05
17	Brookside Subdivision	Nollville, W of Martinsburg		10/13/05
18	Universal Forest Products	Ranson		12/05
19	Flowing Springs North Basin	Ranson		01/06
20	Shallow Creek Acres	Shanghai – Third Hill Mtn.		
21	Rock Spring Church	Leetown, Jefferson Co.		
22	Flowing Springs Subd. Sect. 1	Jefferson Co.		01/06
23	International Mill Service	Weirton		12/05
24	Tackley Mill Neighborhood	Jefferson Co.		01/06
25	Moorefield Crossing	Moorefield		01/06
26	Lorraine's Hair Salon	Berkeley Springs		01/06
27	Townes at Oakhurst	Berkeley Co.		01/06
28	Spring Hill, Section 6	Berkeley Co.		01/06
29	Dodd General Contractors Corp.	Clarksburg		01/06
30	Pick-Up City Auto & Truck Recycler	Fairmont		01/06
31	Tungste-Met	Fairmont		01/06
32	Bowden Fish Hatchery	Bowden		01/06
33	Republic Paperboard	Berkeley Co.		01/06
34	Reeds Creek Hatchery			01/06
35	Willow Ridge	Berkeley Co.		01/06
36	Laurita Excavating	Fairmont		01/06
37	Leslie Equip. Co.			02/06

Site Number	Project Name	Location	Date Received	Date Approved
38	WJ Clark, Inc.			02/06
39	A&R Transport, Inc.			02/06
40	Sheetz Car Wash	Martinsburg		02/06
41	AMI Class D	Clarksburg		02/06
42	Rooster's Hydraulic Service			02/06
43	TDT, Inc.			04/06
44	Comet Compressor Station			04/06
45	Spencer Veneer	Spencer		04/06
46	Independence Coal Cp.	Revolution Mine		04/06
47	Mills Farm Section VI	Berkeley Co.		04/06
48	DuPont Class D	Belle		04/06
49	Durbin Outfitters	Durbin		06/06
50	Pratt WTP	Pratt		06/06
51	Petroleum Products			07/06
52	Lake Lumber and Fence Co.	Hacker Valley		07/06
53	Rural Garbage and Refuse			08/06
54	Brenntag Mid-South, Inc.	Clarksburg		08/06
55	Creo Manufacturing	Inwood		08/06
56	Gauley Robertson			08/06
57	D&D Enterprises			09/06
58	City of Clarksburg Class D	Clarksburg		09/06
59	Rhodes Trailers & Trucks			10/06
60	Tecumseh Redevelop.			10/06
61	Technology Park			10/06
62	Coffman's Metals			10/06
63	Appalachian Forest Products			11/06
64	DeBarr Trucking			11/06
65	US Mulch			11/06
66	Ben's Auto Salvage			11/06
67	Kessler Excavating Class D			11/06
68	Newsome & Son Class D			12/06
69	Quad Graphics	Martinsburg		12/06
70	Savin Lumber	Buckhannon		12/06
71	Interstate Machinery			12/06
72	Hurricane Gas Processing			12/06
73	Grant County Mulch			12/06
74	Longview Power			12/06
75	Miller's Pallets			01/07

Site Number	Project Name	Location	Date Received	Date Approved
76	Boxley Trucking			02/07
77	River Valley Campground	Parkersburg		02/07
78	Mt. Storm Ready Mix	Mt. Storm		02/07
79	JP Geary Class D			02/07
80	CeramX Products, Inc.	Bolt		03/07
81	Sharp's Garage	Spencer		03/07
82	Oak Ridge Trenching & Excavating			03/07
83	Kingsford Corp.	Beryl		03/07
84	Davis Creek Nazarene Church Class D	Kanawha Co.		03/07
85	Joe Blosser Construction Class D			03/07
86	T and S Auto Recycling			03/07
87	Jefferds Corp.	St. Albans		03/07
88	Arrow Concrete			03/07
89	PW Eagle/Uponor	Clarksburg		06/07
90	R and B Recycling	Fairview, Mon. Co.		06/07
91	Jim C. Hamer Co.			06/07
92	Plastic Coatings Corp.			06/07
93	Charleston W. Travel Center	Hurricane		06/07
94	Valley Proteins			06/07
95	FedEx Freight East			06/07
96	J.F. Allen Co.	Elkins		06/07
97	ALCON, Inc.			06/07
98	Clearon Corp.	South Charleston		06/07
99	Key Energy Services	Dunbar		06/07
100	Fern Ridge			06/07
101	Spring Heights Education Center			06/07
102	Garretson's Machine and Fabrication, Inc.			06/07
103	Augusta Lumber, LLC			06/07
104	New Parks Division of Zinsser Co., Inc.	Parkersburg		06/07
105	Rish Equipment	St. Albans		06/07
106	Charles Pointe Road A-4 Project	Morgantown		06/07

d. Monitoring Well Driller Certification/Recertification Program

The Monitoring Well Driller Program (MWDP) instructs and certifies monitoring well drillers in the design, construction, alteration and abandonment of monitoring wells and boreholes. This program, as authorized by 47CSR59 Monitoring Well Regulations, was established to ensure industry, well owners and the regulatory community that all monitoring wells installed or abandoned meet a minimum set of standards.

Although the DEP is responsible for the certification of monitoring well drillers, the Bureau for Public Health's Office of Environmental Health Services (OEHS) conducts the training and testing for certification of these drillers. The OEHS has a long established water well driller certification program and is ideally suited for providing these services to DEP, eliminating the need for increased staffing.

As of June 30, 2007, the MWDP has certified 448 monitoring well drillers. There are currently 231 active monitoring well drillers, 56 of which were certified during this reporting period.

The monitoring well driller certification information is available on the Internet at http://www.wvdhhr.org/bph/monwell/. This site provides information on testing requirements and testing dates, and an application for the testing and training. The recertification of the monitoring well drillers is handled directly by the MWDP. Recertification requires a fee and the completion of an address verification form.

To track the driller certification and recertification process, the DEP's Information Technology Office developed a monitoring well driller module to the Environmental Resource Information System (ERIS). ERIS is a flexible client/server system of Windows programs that allows DEP offices to track and manage a wide variety of environmental information.

At this time, the environmental information that can be tracked includes permitting activities, complaints, violations, inspections and the licensing of technical capabilities, e.g. the monitoring well driller modular. The driller database contains a listing of drillers who are currently certified and those whose certification has expired. As of June 30, 2007, there are 231 active drillers and 178 drillers that have been placed on inactive status. This database is capable of generating invoices for the recertification fees, related certification and recertification correspondences, certification cards, and address verification forms. Reports can be generated from this database containing all drillers' addresses, initial certification date, certification expiration date, driller registration numbers, and fee invoicing information.

e. Monitoring Well Installation and Abandonment

Concerns from the drilling industry, the desire to protect well owners, and an overwhelming need by groundwater regulatory agencies for quality control of data from monitoring wells led to the enactment of 47CSR60, *Monitoring Well Design Standards,* in May 1996. This rule established the minimum acceptable documentation and standards for the design, installation, construction and abandonment of monitoring wells and the abandonment of boreholes. This rule does not eliminate nor supersede the more stringent aspects of well design criteria as established by federal programs such as RCRA or CERCLA, but only stipulates that, at a minimum, monitoring wells must be constructed and abandoned in accordance with 47CSR60.

As is the case of any rule, there are unforeseen circumstances that require alternatives and exceptions when compliance with the rule is infeasible or unnecessary. The alternatives and/or exceptions are handled through written variance requests on an individual basis.

The rule has resulted in the need for electronic files to capture the well installation and abandonment and high-risk borehole abandonment information. The electronic submission of the Monitoring Well Construction Documentation Forms and Abandonment Documentation for Monitoring Well/Borehole Forms became available as of 2003. The format for the electronic submission consists of drop-down menus for choices of materials and procedures and areas for written comments. The information is now being stored in EQuIS along with water quality and site information.

During this reporting period the following documentation forms were received and reviewed:

Forms Received and Reviewed Between July 1, 2005, and June 30, 2007	Totals
Monitoring Well Construction Forms	911
Monitoring Well Abandonment Forms	277
High Risk Borehole Abandonment Forms	7

The forms were reviewed for completeness and correct information. The major deficiencies noted were incomplete or incorrect latitudes and longitudes, incomplete physical site information, incorrect or missing installation materials and procedures. The electronic submission of the forms has eliminated several of these problem areas.

The following table details the number of wells constructed and abandoned and high-risk boreholes abandoned by county during this reporting period.

Monitoring Well & Borehole Count from July 1, 2005, through June 30, 2007			
Counties	**MW Installed**	**MW Abandoned**	**Boreholes Installed and Abandoned**
Barbour	3	10	0
Berkeley	15	5	0
Boone	3	0	0

Monitoring Well & Borehole Count from July 1, 2005, through June 30, 2007			
Counties	**MW Installed**	**MW Abandoned**	**Boreholes Installed and Abandoned**
Brooke	9	7	0
Cabell	72	13	0
Calhoun	6	0	0
Clay	0	0	0
Doddridge	4	0	0
Fayette	11	0	0
Gilmer	0	0	0
Grant	20	0	0
Greenbrier	22	2	0
Hampshire	0	0	0
Hancock	85	6	0
Hardy	0	0	0
Harrison	39	22	0
Jackson	6	1	0
Jefferson	24	0	0
Kanawha	159	31	0
Lewis	3	3	0
Lincoln	0	3	0
Logan	5	6	0
Marion	26	14	0
Marshall	25	8	0
Mason	26	0	4
McDowell	5	4	0
Mercer	5	0	0
Mineral	48	11	0
Mingo	18	7	0
Monongalia	24	7	0
Monroe	0	0	0
Morgan	6	2	0
Nicholas	7	0	0
Ohio	3	8	0
Pendleton	3	0	0
Pleasants	41	0	3
Pocahontas	11	0	0
Preston	11	0	0
Putnam	35	3	0
Raleigh	28	10	0
Randolph	2	0	0
Ritchie	2	4	0
Roane	4	0	0
Summers	0	0	0
Taylor	9	20	0

Monitoring Well & Borehole Count from July 1, 2005, through June 30, 2007			
Counties	**MW Installed**	**MW Abandoned**	**Boreholes Installed and Abandoned**
Tyler	1	0	0
Upshur	5	5	0
Wayne	33	0	0
Webster	0	4	0
Wetzel	1	1	0
Wirt	0	0	0
Wood	29	5	0
Wyoming	6	55	0
TOTALS	**911**	**277**	**7**

f. Complaints and Calls

The Division of Water and Waste Management's Monitoring Well Drillers Program responded to approximately 950 calls/requests for information concerning monitoring well driller's certification and recertification, monitoring well design standards, documentation, variances, and enforcement. This does not include minor telephone call requests for basic information.

g. Public Outreach

Training and assistance is provided to county health department sanitarians and staff members on the use of their Global Positioning System (GPS) for the location of septic tanks.

The GPS information, septic tank system permit number, septic tank seal number, owner's mailing address and written directions to the site where the septic tank is located, is maintained in ERIS. For those septic tank registrations with GPS data in ERIS, there is now a link to West Virginia Geographic Information System that generates a map showing the location of the septic tank selected.

County health departments issued a total of 8,033 septic tank permits from July 1, 2005, through June 30, 2007. The following table details the number by county that have been issued septic tank registrations.

Septic Tank Registration from July 1, 2005, to June 30, 2007	
County	**# of Registrations**
Barbour	114
Berkeley	781
Boone	19
Braxton	124
Brooke	64
Cabell	350
Calhoun	68

Septic Tank Registration from July 1, 2005, to June 30, 2007	
County	**# of Registrations**
Clay	75
Doddridge	7
Fayette	28
Gilmer	18
Grant	175
Greenbrier	196
Hampshire	508
Hancock	24
Hardy	371
Harrison	6
Jackson	127
Jefferson	19
Kanawha	40
Lewis	109
Lincoln	110
Logan	1
Marion	141
Marshall	21
Mason	25
McDowell	140
Mercer	178
Mineral	242
Mingo	3
Monongalia	310
Monroe	106
Morgan	733
Nicholas	250
Ohio	2
Pendleton	170
Pleasants	50
Pocahontas	159
Preston	327
Putnam	89
Raleigh	321
Randolph	130
Ritchie	85
Roane	124
Summers	112
Taylor	82
Tucker	90
Tyler	53
Upshur	200

Septic Tank Registration from July 1, 2005, to June 30, 2007	
County	**# of Registrations**
Wayne	100
Webster	95
Wetzel	55
Wirt	71
Wood	231
Wyoming	4
Totals	**8033**

h. Underground Injection Control (UIC) Program

The federal Safe Drinking Water Act of 1974 established the UIC program to ensure that fluids injected underground will not endanger drinking water sources. Applying the UIC regulations (47CSR13) promulgated under the authority of Chapter 22, Article 11 of the state code, the Division of Water and Waste Management's UIC program mainly regulates the subsurface emplacement of effluents into or above underground sources of drinking water by permitting the sitting, construction, operation, and abandonment of Class 5 shallow injection wells.

The Class 5 category includes 32 types of injection wells ranging from high-tech aquifer remediation wells to low-tech septic systems. UIC permits for Class 5 wells fall into four broad categories:

- Industrial/Commercial
  This includes groundwater remediation re-injection wells, where contaminated groundwater is pumped out, treated to meet groundwater quality standards, and then re-injected. It also includes various industrial/commercial facilities that dispose of certain types of wastewater into subsurface distribution systems, including facilities that inject sanitary waste from restrooms co-mingled with other wastewater constituents into a septic tank and leachfield system.

- Stormwater
  Disposal of stormwater into a well or directed into a naturally occurring sinkhole may be permitted if it can be reasonably demonstrated that no underground sources of drinking water will be adversely impacted.

- UIC Septic Permits
  These Class 5 wells typically dispose of solely sanitary waste into a septic tank and leachfield system (solely sanitary waste not co-mingled with any other fluid).

- UIC Mining
  These Class 5 wells typically dispose of fluids associated with mining into underground mine pools.

Most all non-residential facilities injecting fluids into the subsurface fall under the regulation of the UIC Program. This includes small business injecting fluids into the subsurface through a septic tank and leachfield system, or other such subsurface waste disposal system. This includes any place other than a private residential home, even if the waste stream is comprised of solely sanitary waste, provided the system has the capacity to serve 20 or more persons per day. Residential dwellings are exempt from UIC regulations, with the exception of residential multiple dwellings. Examples of residential multiple dwellings include garage apartments not connected to the residence, mobile homes, trailer parks, apartment complexes, campgrounds, etc., or two or more single family residences sharing a common septic system.

The Underground Injection Control Program takes great pride in pointing to the many improvements made in the last two years. Although the UIC Program operates with minimal staffing, tremendous progress has been made in clearing the backlog of UIC permit applications. Currently, the only bottleneck in the permitting process comes from the occasional lack of information submitted by applicants, resulting in placing the application on hold pending information submittal. Integration of UIC data into the ERIS database has commenced and will enhance the efficiency of the permitting process, fee tracking and sharing of data with other DEP programs and the public.

In addition to the greatly improved flow of the actual permitting process, and perhaps of greater importance, is the refining of the UIC permit itself. UIC industrial permits have been improved to assure a higher level of regulatory oversight in terms of compliance, fee collection and reporting. UIC industrial permits require that constituents of the waste stream are identified, and each permit stipulates that the appropriate EPA-approved testing method is used in the analysis of the injected fluids. Discharge limits are set to ensure that all injected fluids meet DEP groundwater quality standards, maximum concentration levels established by the federal EPA, health advisory limits, or other risk-based limits as appropriate. Improvements to the UIC industrial permit also include greater regulatory control over sampling, reporting schedules, construction details regarding the subsurface distribution system, and how the subsurface distribution system is to be properly closed. These refinements in UIC permits ensure the greatest degree of protection to human health and the environment.

One of the greatest challenges faced by the UIC program continues to be in designing environmentally sound methods of permitting stormwater disposal in karst and other environmentally sensitive areas. During the past two years, the UIC Program has seen a large increase in the number of permit applications for disposal of stormwater underground. The UIC program has worked closely with state and local government officials to develop best management practices that keep potential contamination from entering the subsurface distribution systems to the greatest extent possible. This has included the development of an emergency response plan to close off the injection point in case of fuel spills or other accidents. The emergency response plan is integrated with local emergency response personnel. UIC stormwater permits ensure groundwater protection by requiring adequate monitoring, sampling and the routine cleaning and maintenance of the injection points.

The UIC program continues to refine and improve its role in the protection of the state's water resources. Works in progress include the development of environmentally sound methods of permitting wastewater disposal from smaller commercial/industrial operations in unsewered areas that depend on subsurface injection of wastewater. The UIC program is regarded among its peers in other states and the EPA as a model of excellence in spite of challenges faced by lack of staff and funding. The UIC staff consists of two geologist permit writers, one Environmental Resources Specialist permit writer, and two UIC field inspectors for the entire state.

1. Groundwater/UIC Program – Mining and Quarrying

Environmental Goals of the Groundwater Protection and Underground Injection Control Programs for Mines and Quarries

Because, as stated in Chapter 22 Article 12, Groundwater Protection Act, "Over 50 percent of West Virginia's overall population, and over 90 percent of the state's rural population, depend on groundwater for drinking water" (§22.12.2.a.2), and because mineral mining, both coal and non-coal, is ubiquitous in West Virginia, protecting the quality and quantity of the groundwater from adverse impacts due to these activities is imperative both to the environment and to human health and safety. These programs' goals are identical and twofold: to ensure the future chemical and biological quality of the groundwater of the state, and to prevent adverse changes in the quantity of the groundwater, *e.g.*, the dewatering of existing aquifers or the excessive flooding of underground mine voids.

Protecting Private and Public Water Supplies

Groundwater protection at mine sites started 13 years ago in West Virginia with the passage of 38CSR2F, Groundwater Protection Regulations for Coal Mining Operations, and the policies and practices established by DEP's DWWM and DMR to enforce it. The resulting changes in the management of surface activities and substances at mine sites have protected many public and private water sources, both present and potential, from damage due to mining, and have mitigated many of the impacts that occurred prior to or despite those changes.

Today, the Groundwater Protection Program is an integral part of DEP's permitting/inspection/enforcement procedures for mine sites. Groundwater protection plans are incorporated in and are essential to mining permits, both Surface Mining Control and Reclamation Act (SMCRA) (Chapter 22 Article 3) and National Pollutant Discharge Elimination System (NPDES) (Chapter 22 Article 11); further, all such permits contain terms and limits that provide for protection of the subsurface environment. Violators of the groundwater protection conditions of a permit can incur penalties ranging from administrative to criminal and can even result in revocation of the permit.

The Underground Injection Control (UIC) Program, as established under 47CSR13, Underground Injection Control, applies to mining primarily through the permitting of Class 5 Type X13 injection wells, typically for the disposal of coal preparation plant slurry or acid mine drainage treatment sludge into abandoned underground mine voids. The UIC 5X13 permitting process is designed to ensure that the injectate meets federal Safe Drinking Water Standards at the point of injection and that the additional volume of fluid will not endanger human safety or the environment.

Additionally, all UIC – Mining draft permits are submitted to the West Virginia Geologic and Economic Survey, West Virginia University Hydrology Research Center, and the federal Mine Safety and Health Administration (MSHA) for review and comments.

Challenges

Mining operations are typically remote, not easily accessible by the public, and usually involve large surface areas. These factors can impede the monitoring of small details, rendering scrupulous enforcement of the Groundwater Protection Act and UIC permit terms difficult. The programs are constantly adjusted to provide as much control as possible for ensuring compliance on a day-to-day basis.

Because no two mine sites are exactly alike, each UIC permit application is approached as a unique entity. Development of a general permit for these operations, such as the NPDES general permits for mines and quarries, is not a viable option.

As the universe of mine sites involved with underground injection expands, time allotment for the geologist/permit writer becomes increasingly problematic. Furthermore, recent developments resulting from formal inquiries into possible effects of underground coal slurry injection on human health will necessitate considerable amounts of time devoted to the research and collaboration necessary to answer these concerns.

Proposed Programs and Projects

UIC – Mining is anticipating the completion of the development of electronic application procedures in the near future, thus streamlining and standardizing the submission of data for review. Additionally, the electronic submittal of discharge monitoring reports from UIC – Mining permits is in the process of being established, since reviewing and tracking the 17 or 18 parameters plus mine pool levels for every injection point for every month is excessively labor-intensive.

Mapping of all UIC – Mining sites using various sets of data points is being conducted utilizing GPS coordinates and ArcView/GIS software. These maps will provide overviews and details according to several types of criteria for documenting the extent and concentration of injection activity in the state.

Achievements

The injection of mine wastes into abandoned mine voids has been practiced for decades. A continuing challenge has been to locate and identify pre-existing injection sites and either bring them into the permitting process or stop the injection activities. Assistance from the DEP's DMR field office personnel (permit writers, geologists, engineers and inspectors) has been invaluable in this endeavor. In the eight years since UIC – Mining began as an independent permitting program, virtually all such sites in the state have been identified and are now at some stage of the permitting process or have ceased injecting. Because of efforts to educate the inspectors in the enforcement of UIC permit conditions, undocumented injection activities are now virtually eliminated.

As inevitable concerns arise from the public, the industry or other agencies, discharge monitoring reports from issued permits and chemical analyses submitted in applications are re-examined and data collected to confirm that Safe Drinking Water Standards for the parameters in question are being met and that this program is succeeding in its goal of protecting public health. In 2005, monitoring reports were assessed for mercury, antimony, and silver, and found to be consistently within required limits.

In 2005, the question arose of allowing the use of D002 RCRA-listed products in some of the processes producing injectate. Since the chemicals are listed due to corrosivity, as opposed to toxicity, the injectate is still capable of meeting all required standards. However, DWWM GW/UIC personnel worked closely with the EPA and established a protocol for such sites ensuring full compliance with all regulations.

In 2006, a systematic method of entering analytical results reported in accordance with the monitoring requirements of the UIC – Mining permits onto Excel spreadsheets was developed as a precursor to the incipient database that will result from the electronic submittal of discharge monitoring reports. All pre-existing data was entered from hardcopy and is continually updated as results are submitted. These spreadsheets have already been invaluable for assessing violation patterns and for research data-mining.

Sources of Data Collection

Applicants proposing to inject underground initiate the permitting process by providing basic details about the site prior to receiving an application number and form. Initial information about an existing injection site usually comes from the DMR inspector assigned to the mine; he or she will require the operator to begin the process of obtaining a UIC permit or cease injection activities at the site. Applicants must be Bureau of Employment Programs (BEP) compliant and current with all DEP fees, or the process is halted until compliance is achieved and proven.

Further information about the proposed injection activity comes from the operator or consultant via the 10-page UIC – Mining application form. This required data includes maps, drawings, narratives and laboratory analyses, plus other information. A

field inspection by the geologist/permit writer, along with the DMR inspector and representatives of the applicant, confirms the submitted material.

Input from the public via the 30-day public comment period and from WVGES, MSHA, and WVU completes the data necessary to issue the permit. After issuance, continued monitoring as required by the permit plus, observations by the DMR inspector, assures a continuous influx of information about the site.

Use of the ERIS Database

Every UIC – Mining application, as soon as the tracking number is assigned, is entered into the ERIS database. As information is received, especially that in the completed application, it is added into the database. Tracking the activities on the application is thereby available to all DEP personnel and other interested parties, such as the applicant. Also, the UIC geologist/permit writer may access information about the mine site and/or applicant from entries made by DMR field office and headquarters personnel.

What the Programs Need to Protect/Remediate Groundwater

The most critical need, at present, is for assistant personnel to take over some of the time-consuming logistical or clerical tasks that increasingly burden the geologist/permit writer. A full-time file clerk serving DWWM would alleviate wasted man-hours for all professionals. Electronic permit application and, especially, the electronic submittal of discharge monitoring reports will allow time for more technical activities, such as unannounced field inspections and the tracking of trends in permit violations.

Statistics:

Mine sites known, suspected or proposing to inject underground 80

Injection points known, suspected, or proposed 649

Sites presently in the application/permitting process 27

Permits (or modifications) issued or reissued 38

Injection points permitted 114

Permits closed/abandoned 5/32

Permits/injection points denied 5/34

Permits/injection points invalidated 0

Applications voluntarily withdrawn 2

Applications/injection points presently on hold (pending resolution of groundwater problems) 3/6

2. UIC Industrial/Commercial permitting

Without abundant resources of clean groundwater, there will be no economic growth, no industrial base and no preservation of the quality of life that is the foundation of our culture. Limiting and controlling underground injection ensures that groundwater and underground sources of drinking water will remain viable for future use. Once groundwater becomes contaminated, it is very difficult or even impossible to remove the pollution. The cost of groundwater remediation can be enormous, with no certain outcome of how effective the final results will be. Since the water moves so slowly, the pollutant is able to stay very concentrated in higher levels in certain areas instead of dispersing over the entire area as surface water does. The pollutants could remain in an area, making the water unusable for a period of many years. After a period of time, the contamination in the groundwater will spread to the surface water as well through its natural outlets.

The permitting of UIC wells provides for minimum standards and technical requirements for the proper sitting, construction, operation, monitoring, and abandonment of injection wells. When UIC permit applications are received and reviewed, they are accepted, accepted with modifications, or denied. Upon acceptance, an individual permit is issued in draft form and placed in public notice for a 30-day comment period. If no significant comments are received, a final permit is issued 30 days after the end of the comment period. Public hearings are held if necessary. Permits for facilities at 143 locations have been issued during this reporting period. Permits for facilities at 15 locations have been closed during this reporting period.

Significant improvements to UIC industrial/commercial permits continue to be made by close scrutiny of each application in regards to injection well design and maintenance, potential toxicity of proposed injectates, fate and transport of the injectate, site hydrogeology, and a careful attention to monitoring the site's discharge reports on an ongoing basis. All such sites are currently the responsibility of one hydrogeologist. As the number of industrial/commercial permits continues to increase, support for this portion of the UIC Program must also increase to keep pace with growing development and the need for oversight to ensure responsible methods of fluid injection into the subsurface. Thirty eight industrial/commercial permits have been issued during this reporting period, in addition to 27 rule authorizations for injection of subsurface releasing compounds at groundwater remediation sites.

UIC Industrial / Commercial permits issued July 1, 2005 – June 30, 2007				
Watershed	**stormwater**	**aquifer remediation**	**industrial / commercial**	**other**
Group A Watersheds				
Upper Ohio River North				
Cheat River				
Youghiogheny River				
S. Branch Potomac River				
Shenandoah River	3	1	2	
Upper Kanawha River		1		
Group B Watersheds				
N. Branch Potomac River				
Tygart Valley River				
Lower Kanawha River				
Elk River				
Coal River				
Group C Watersheds				
Middle Ohio River North				
Potomac River Drains	4	2		
Middle Ohio River South				1
Lower Guyandotte River				
Gauley River			2	
Tug Fork River			1	
Group D Watersheds				
Monongahela River			1	
Little Kanawha River		1		
Greenbrier River	6		1	1
James River				
Lower New River				
Upper New River				
Group E Watersheds				
Upper Ohio River South		2		
Dunkard Creek				
Cacapon River				
West Fork River				
Lower Ohio River		1		
Big Sandy River				
Twelvepole Creek				
Upper Guyandotte River				1

Rule Authorizations

In addition to issuing UIC permits, rule authorizations for the injection of fluids into the subsurface are granted for situations where coverage under a UIC permit is not needed. Typically, these rule authorizations, issued for one year, are issued to permit the injection of subsurface releasing compounds (SRC) used in the bioremediation of contaminated groundwater.

The most common application of SRC is in remediation of hydrocarbon-contaminated waters where oxygen-releasing compounds, sometimes mixed with a microbial agent, is injected into the shallow subsurface. The addition of oxygen is often necessary to enhance the natural chemical and biological processes that break down hydrocarbons and certain other compounds *in situ*. In many situations, there is no need for the addition of other microbial agents, as the native bacteria in the soil are sufficient for bioremediation purposes as long as there is sufficient oxygen to fuel this process. In other situations, active bioremediation is enhanced by the addition of sulfate, magnesium and ferric compounds. Other sites are treated with injections of food grade molasses, or other nutrients may be used.

In addition to remediating hydrocarbons, other subsurface releasing compounds may be used to remediate chlorinated hydrocarbons, other metals and chlorinated biphenyls using hydrogen-releasing compounds. Rule authorizations for 27 sites have been granted during this reporting period.

Oxygen-releasing compounds are being pumped into several injection points at a facility in Institute in an effort to clean up carbon tetrachloride, chloroform, and fluorocarbons.

3. UIC Sewage permitting

The UIC program promotes new technology to make onsite wastewater cleaner, more efficient and environmentally friendly. UIC staff works closely with the county health departments and the Office of Environmental Health to achieve this goal. If a UIC permit is needed for a facility, UIC staff assists applicants in the completion of the UIC permit application process. All sewage tanks involved with sewage systems, with the exception of holding tanks and receptacles, privy vaults and self-contained excreta disposal facilities, must be registered with DEP. The agency has a program that offers county health departments the option of processing registration fees under a contract and receiving a portion of the money back to the county.

UIC staff participates and interacts with the state Sewage Advisory Board, which makes recommendations to the Bureau for Public Health on technical and procedural issues relating to West Virginia's Sewage Disposal Program, mediates unresolved issues between the sewage industry and regulatory agencies, and makes recommendations in other areas of policy modification or development as so directed by the Director of the Bureau for Public Health.

In accordance with 47CSR13.23, Public Access to Information, the UIC program notifies the State Historic Preservation Office of the Department of Culture and History and the Division of Natural Resources of UIC permits applications. This helps protect endangered species and artifacts by placing the information on a website for public review, and a copy of the draft permit is mailed to the Bureau for Public Health for public comment period review.

Seventy-six UIC sewage permits were issued during this reporting period.

4. Inspections

The UIC inspections are conducted at all business facilities and multiple dwellings (trailer parks, campgrounds, schools and apartment complexes) not serviced by public sewage disposal plants. These inspections are conducted in selected watershed areas, which rotate on a five-year basis. The county sanitarians in selected watersheds are contacted for the areas that are not serviced by a public sewage disposal plant. Inspections are focused on wellhead-protected areas. The regional Environmental Enforcement is given notice that UIC inspections will be made in the area. Currently, two Environmental Resources Specialists conducts all UIC inspections and UIC enforcement actions.

In addition to the routine inspection of permitted facilities, suspected Class 5 Wells are inventoried and inspected to determine proper classification. Information on suspected disposal wells comes from the Class 5 inventory and database, complaints, request for permits, referrals from other agencies, or routine inspections. During the

inspections, which are sometimes multimedia with other programs or agencies, a UIC inspection form is completed onsite. The owner/operator is verbally informed of the status of the well. If the facility has a Class 5 well that is not permitted, the owner/operator is given the option to apply for and obtain a permit for the well, or a closure plan will be implemented. If there are other environmental concerns, the owner/operator is given guidelines to obtain compliance. The UIC inspector reviews best management practices with the facility owner/operator for groundwater protection. BMP implementation not only helps protect the environment, it also enables the facility to operate more efficiently by reducing the amount of waste generated.

The UIC program collected locational data on underground storage tanks and above ground storage tanks for the local health department and DEP's UST Section regarding information on wellhead protection areas. UIC inspections also review the facility's groundwater protection plan or collects information for the facility to obtain a GPP. Information was collected for 140 groundwater protection plans during this reporting period.

As part of the inspection process, GPS locational data is downloaded and databases are updated. Even though a facility may not have a UIC well, other programs or agencies are notified if other environmental concerns exist. The permitting process or enforcement actions are initiated as necessary.

During this reporting period, 440 UIC inspections were conducted. Information was collected for 124 Class 5 UIC permits. The UIC program collected data on 124 USTs and 223 ASTs at 104 facilities. Information was collected for 12 NPDES permits.

The UIC Program also closed 197 floor drains in vehicle service areas by plugging with cement, and closed 39 high priority Class 5 wells identified in community water service areas.

5. Enforcement

The enforcement of UIC regulations is primarily dependent on UIC staff, with some assistance from DEP's Office of Environmental Enforcement. Although the major enforcement steps are outlined in 47CSR13, "Underground Injection Control," the Division of Water and Waste Management will often informally deal with problems on an individual basis to achieve a quick solution based on characteristics unique to the situation, with a success rate of nearly 100%. When an informal enforcement does not result in a satisfactory outcome, DEP has other enforcement tools at its disposal. One hundred thirty verbal enforcements were given to owners/operators of facilities, and follow up inspections were conducted to ensure compliance. No written notices of violations were written during this reporting period.

6. UIC Outreach

The UIC program personnel provide technical assistance to all facility owners/operators, DEP, OEHS, and Department of Agriculture personnel through out the state. UIC program personnel are working with county sanitarians and educating them on the types of injection wells that require oversight by the UIC program.

i. Groundwater Program Remediation Activities

Since 1991, the remediation section of the Groundwater program has worked on 230 sites, 96 of which were active during this reporting period.

These sites vary between equipment yards, above-ground tank releases, petroleum bulk terminals and refineries, railyards, and manufacturing plants. Some of the sites are active facilities, but many are physically abandoned (as opposed to legally abandoned) and are nothing more than empty lots or fields. Most of the contamination is some type of hydrocarbon, usually diesel fuel or fuel oil; however, other sites have benzene, salt or chlorinated solvent problems.

The Groundwater program is the lead office at many of these locations, while advice is given to other DEP programs at others. In general, the Groundwater program handles those sites with subsurface contamination that do not fit under some other regulatory authority. Of the sites worked on during the reporting period, 54 required some kind of remediation or soil removal, 43 have continued groundwater monitoring, 18 were issued no further action letters, and 22 were sites where the Groundwater program only gave advice.

The sites worked on between July 1st, 2005, and June 30th, 2007, includes:

ACME WOOD PRODUCTS: (Mercer County) The Groundwater program provided advice to the Hazardous Waste program regarding the groundwater flow direction at this site.

AEP KRAMMER SWITCH YARD: (Marshall County) The oil spill was contained, and the contaminated soils were removed. The Groundwater program is presently waiting on a report from the company.

A.E. INC OF BUCKHANNON: (Upshur County) The company was sampling (for hydraulic fluid) an unnamed tributary of Ratcliff Run, which is a tributary of the Buckhannon River.

AEP MORGANTOWN SERVICE CENTER: (Monongalia County) The hydrocarbon-contaminated soils were successfully removed, with the proper sampling, and a no further action letter was issued on August 2, 2005.

AEP POINT PLEASANT SERVICE CENTER: (Mason County) The company could not remove all the hydrocarbon-contaminated soils, as this would have compromised the foundation of its garage and office building, and a regular groundwater monitoring plan was initiated to determine if the contamination has been adequately addressed.

ATF-IRS-GSA BUILDING MARTINSBURG: (Berkeley County) The GSA submitted its groundwater protection plan, and a no further action letter was issued on May 2, 2007.

BEACON CAVE: (Mercer County) The Groundwater program provided advice to Environmental Enforcement regarding potential contamination to the cave's stream.

BIG SPRING FORK SPRING: (Pocahontas County) The Groundwater program provided advice to Construction Assistance regarding the geology at a proposed sewage treatment facility.

BOND (LOLA) WELL: (Mason County) The Groundwater program sampled a resident's drinking water well for possible contamination. A large number of parameters were analyzed, but only significant concentrations of iron were found.

BRAXTON COUNTY LANDSLIDE: (Braxton County) The Groundwater program provided advice to Environmental Enforcement regarding the silt in the creek below the landside.

BROOKE COUNTY AIRPLANE CRASH SITE: (Brooke County) The hydrocarbon-contaminated soils were successfully removed from the crash site, with the proper documentation and groundwater monitoring, and a no further action letter was issued on October 6, 2006.

BROOKFIELD DEVELOPMENT: (Berkeley County) The Groundwater program provided advice regarding the geology in the area of a proposed housing development.

CHARLES TOWN CAVE: (Jefferson County) The Groundwater program provided advice to Environmental Enforcement regarding the hydrocarbon contamination in the water in the cave.

CLAY-704 OIL WELL: (Clay County) The Groundwater program provided advice to the Office of Oil and Gas regarding crude oil spillage at this well.

COLUMBIAN CHEMICALS COMPANY: (Marshall County) The oil-contaminated soils were successfully removed at this facility, with the proper documentation, and a no further action letter was issued on May 9, 2006.

CRAIGSVILLE FUEL OIL SITE: (Nicholas County) The fuel oil-contaminated soils were successfully removed at this site, with the proper documentation, and a no further action letter issued on February 3, 2005.

CSX ELKINS RAILYARD-UNNAMED SITE: (Randolph County) This part of the old railyard was re-evaluated and no significant contamination was found. A no further action letter was issued on February 10, 2005.

CSX FAIRMONT RAILYARD: (Marion County) The removal of the hydrocarbon-contaminated soils was completed at this inactive railyard, and groundwater monitoring continues.

CSX GRAFTON RAILYARD OLD LOCOMOTIVE SHOP (SOLVENT CONTAMINATION): (Taylor County) Groundwater monitoring continues at this active railyard with sulfate application and bioremediation.

CSX GRAFTON RAILYARD REFUELING AREA (HYDROCARBON CONTAMINATION): (Taylor County) Groundwater monitoring continues at this inactive railyard with oxygen enhancement and bioremediation.

CSX HANDLEY RAILYARD (SOLVENT CONTAMINATION): (Kanawha County) Groundwater monitoring continues at this part of the inactive railyard with sulfate application.

CSX HANDLEY RAILYARD (HYDROCARBON CONTAMINATION): (Kanawha County) Groundwater monitoring continues at this part of the inactive railyard with soil vapor extraction and oxygen application.

CSX HUNTINGTON RAILYARD: (Cabell County) A vacuum system was successful in removing the last of the hydrocarbon contamination at this active railyard, and a no further action letter was issued on February 4, 2005.

CSX KEYSER RAILYARD: (Mineral County) Sulfate application, natural attenuation and groundwater monitoring for solvent contamination continues at this inactive railyard. In addition, several additional subsurface investigations have been competed and several new groundwater monitoring wells installed.

CSX MARYLAND JUNCTION RAILYARD: (Mineral County) The removal of the hydrocarbon-contaminated soils has been completed at this inactive railyard, and groundwater monitoring continues with oxygen enhancement and bioremediation.

CSX PARKERSBURG RAILYARD: (Wood County) A vacuum system was successful in removing the last of the hydrocarbon contamination at this active railyard, and a no further action letter was issued on August 9, 2006.

CSX PEACH CREEK RAILYARD: (Logan County) Groundwater monitoring continues at this active railyard with free product (diesel fuel) recovery and additional subsurface investigations.

CSX RAINELLE RAILYARD: (Greenbrier County) The soil removal is complete at this active railyard, but some groundwater hydrocarbon contamination remains, and groundwater monitoring continues.

CSX ROWLESBURG RAILYARD: (Preston County) The air sparge system has been dismantled at this inactive railyard, but the hydrocarbon contamination persists and groundwater monitoring continues.

CUMMINS FAIRMONT SERVICE CENTER: (Marion County) The company's proposed work plan has been approved, and the Groundwater program is waiting for the work to begin in the field.

DIVISION OF HIGHWAYS (DOH) GLEN DALE EQUIPMENT YARD: (Marshall County) The first two excavations for oil-contaminated soils has been completed at this active equipment yard, but significant contamination remains and the DOH is planning a third excavation.

DOH GREENWOOD EQUIPMENT YARD: (Doddridge County) The surface stream water sampling continues for chloride contamination at this active yard, but the proposed soil excavation has not yet taken place and the groundwater monitoring wells have not yet been installed.

DOH NEW MARTINSVILLE EQUIPMENT YARD: (Wetzel County) The DOH is planning an additional environmental assessment for chloride contamination at this active property, as well as installing additional groundwater monitoring wells.

DOH OAK HILL EQUIPMENT YARD: (Fayette County) The second excavation of the chloride-contaminated soils at this inactive yard is complete, and groundwater monitoring continues.

DOH SISTERSVILLE EQUIPMENT YARD: (Tyler County) The DOH is planning an additional environmental assessment of this active property (for chloride contamination), as well the installation of additional groundwater monitoring wells.

ERGON CRUDE OIL SPILL: (Hancock County) The Groundwater program provided advice to Environmental Enforcement regarding how this oil spill should be cleaned up.

GOFF CARRY OUT SOIL PILE: (Kanawha County) A soil pile was constructed up the Davis Creek valley from the store using the hydrocarbon-contaminated soils excavated from the area beside the store.

GOFF CARRY OUT STORE: (Kanawha County) The excavation of the hydrocarbon-contaminated soils has been completed at this convenient store; however, it did not resolve the problem and the requested no further action letter was denied.

GRIFFITH CONSUMERS: (Jefferson County) The second excavation of hydrocarbon-contaminated soils has been completed at this active bulk terminal, and the Groundwater program is currently waiting on the company's report.

HINKLEVILLE GENERAL STORE: (Upshur County) The hydrocarbon-contaminated soils have been excavated at this convenient store and the Groundwater program is presently waiting on the results of additional monitoring.

J&N COAL AT BOLT: (Raleigh County) The Groundwater program provided advice to Environmental Enforcement about the hydrocarbon contamination at this old coal mine site.

KIDDE FIRE FOUNDRY: (Jefferson County) The Groundwater program provided advice to Environment Enforcement about the geology at this site.

KODAK: (Jefferson County) This was a long-term Groundwater program site with solvent contamination that has both ongoing groundwater monitoring and remediation; however, the facility (a manufacturing plant) was purchased by a Kodak and the site moved into the Voluntary Remediation program.

KOPPERS INDUSTRIES: (Hampshire County) The Groundwater program provided advice to DWWM's permitting staff regarding the creosote contamination at this wood-treatment plant.

LITTLE WHITESTICK CREEK: (Raleigh County) The Groundwater program collected both pre- and post-construction samples from the creek, and no hydrocarbon contamination was found.

MARATHON-ASHLAND BULK TERMINAL: (Kanawha County) The onsite vacuum system has been discontinued, but natural attenuation and groundwater monitoring for hydrocarbon contamination is continuing.

MARATHON-ASHLAND BULK TERMINAL: (Wayne County) The Groundwater program provided advice to Environmental Enforcement.

MARATHON KRAUTS CREEK SPILL: (Wayne County) The Groundwater program is providing advice to Environmental Enforcement at this spill site regarding the benzene groundwater contamination and the ongoing groundwater monitoring.

MARATHON KENOVA OHIO RIVER SEEPS: (Wayne County) The removal of the pipes in the Ohio River has been completed, along with some hydrocarbon-contaminated soils, and a new line of in-shore groundwater wells installed.

MARLINTON ELECTRIC BULK TERMINAL-BARTOW: (Pocahontas County) New groundwater monitoring wells have been installed and a regular groundwater monitoring program initiated to investigate hydrocarbon contamination.

MARLINTON ELECTRIC BULK TERMINAL-MARLINTON: (Pocahontas County) Hydrocarbon-contaminated soils have been removed and new groundwater monitoring wells have been installed and a regular groundwater monitoring program initiated.

MARMET LOCKS: (Kanawha County) The Groundwater program provided advice to Environmental Enforcement regarding the disposal of the hydrocarbon-contaminated soils encountered at the site by the U.S. Army Corps of Engineers.

MATTHEW BROTHERS BULK PLANT: (Harrison County) The company is continuing to turn and oxygenate the excavated hydrocarbon-contaminated soils.

MERCER COUNTY RARE PROJECT: (Mercer County) The Groundwater program provided advice to the Watershed Assessment Branch regarding the PCB contamination in the streams in Mercer and Tazewell counties.

MICHAEL SPRING PROBLEM: (Marion County) Personnel from the Groundwater program made several trips to this site and the surrounding area, but ultimately could not attribute the fecal groundwater contamination to any point source.

NORFOLK SOUTHERN (NS) BLUEFIELD RAILYARD (FUEL TRANSLOADING AREA): (Mercer County) Free product collection and groundwater monitoring continues at this active railyard for hydrocarbon contamination.

NS BLUEFIELD RAILYARD (LOCOMOTIVE AREA): (Mercer County) Free product collection and groundwater monitoring continues at this active railyard for hydrocarbon contamination.

NS DICKINSON RAILYARD: (Kanawha County) Additional subsurface investigations were completed at this active railyard, and free product recovery and groundwater monitoring for hydrocarbon contamination was initiated.

NS KENOVA RAILYARD: (Cabell County) The soil removal was successful at this active railyard, and a no further action letter was issued for the hydrocarbon contamination on July 22, 2006.

NS MULLENS RAILYARD: (Wyoming County): The company installed a new free product recovery system at this inactive railyard, and groundwater monitoring continues for hydrocarbon contamination.

NS WILLIAMSON RAILYARD: (Mingo County) All of the groundwater monitoring wells have been properly abandoned except for two and groundwater monitoring and free product recovery continues for hydrocarbon contamination at this active railyard.

ORPHANED GROUNDWATER MONITORING WELL: (Jefferson County) The Groundwater program provided advice that determined that this previously unknown groundwater monitoring well was part of a RCRA cleanup site (that is about to be developed).

PACE CARBON PROCESSING FACILITY: (McDowell County) The Groundwater program issued a no further action letter on March 26, 2007, after it was determined that the company's removal of a small amount of contaminated soil had resolved the problem.

PANTRY STORE ANMORE (BENZENE CONTAMINATION): (Harrison County) The Groundwater program asked the company for a more aggressive remediation strategy for

the contamination at this convenience store, and groundwater monitoring and vacuum recovery continues.

PANTRY STORE ANMORE (DIESEL FUEL CONTAMINATION): (Harrison County) The company requested a no further action letter after it removed contamination at the convenience store; however, some contamination remains and the Groundwater program has denied the company's request.

PRINCETON PETROLEUM BULK PLANT: (Mercer County) The hydrocarbon-contaminated soils were successfully removed, with the proper sampling, and a no further action letter was issued on February 3, 2005.

REYNOLDS BULK TERMINAL LEWISBURG: (Greenbrier County) A consent order was issued on October 18, 2005, for this hydrocarbon-contaminated site; however, the owner has not completed any additional remedial or spill prevention work.

R. M. ROACH BULK TERMINAL MARTINSBURG: (Berkeley County) A consent order was issued on October 18, 2005, for this hydrocarbon-contaminated site; however, the additional work has stalled.

R.T. ROGERS BULK TERMINAL HINTON: (Summers County) Post-remedial groundwater monitoring found continued hydrocarbon contamination and the company is re-evaluating its options.

RYDER TRUCK HUNTINGTON: (Cabell County) The hydrocarbon-contaminated soils were successfully removed, with the proper sampling, and a no further action letter issued November 7, 2005.

SEARS AUTO MERCER MALL: (Mercer County) The Groundwater program confirmed that the contaminated soils had been successfully removed, and a no further action letter was issued on April 25, 2007.

SHEPHERDS COVE DEVELOPMENT: (Berkeley County) The Groundwater program provided advice regarding the geology at this proposed housing development.

SPEEDWAY NITRO: (Putnam County) The company attempted to remove all the soil hydrocarbon contamination at this convenience store site, but was not successful. It has since installed groundwater monitoring wells and has initiated a regular groundwater monitoring program.

STANDARD LIMESTONE QUARRY: (Jefferson County) The Groundwater program provided advice on possible contamination at this site.

SWAN POND: (Berkeley County) The Groundwater program provided advice regarding the geology and underground water flows in this area.

TCGC BOARD RUN METHANOL TANK: (Kanawha County) The hydrocarbon-contaminated soils were successfully removed, with the proper sampling, and a no further action letter was issued on August 26, 2005.

TOWN OF FRANKLIN SPRING: (Pendleton County) The Groundwater program provided advice to Environment Enforcement on the geology of this site and surrounding area.

UNOCAL CABIN CREEK EAST SITE: (Kanawha County) Phytroremediation, free product recovery and groundwater monitoring continues for hydrocarbon contamination at this old refinery site.

UNOCAL-SPEEDWAY CABIN CREEK SITE: (Kanawha County) This is an old hydrocarbon spill site that is waiting on the installation of a bio-vent system. Groundwater monitoring continues.

UNOCAL CABIN CREEK WEST SITE: (Kanawha County) Both phytroremediation and groundwater monitoring continues for hydrocarbon contamination at this old bulk terminal.

VA HOSPITAL MARTINSBURG: (Berkeley County) Groundwater monitoring continues for fuel oil contamination at this spill site, but the proposed soil remediation is stalled by a lack of federal money.

VANDERNICK DRINKING WATER WELL: (Gilmer County) The Groundwater program provided advice to the Office of Oil and Gas, as an unknown gas was blowing the well cap off the resident's drinking water well.

VEPCO MOUNT STORM POWER PLANT: (Grant County) Free product recovery and groundwater monitoring continues for hydrocarbon contamination at this site.

VERIZON PENNSYLVANIA AVENUE: (Kanawha County) The hydrocarbon-contaminated soils were successfully removed, with the proper sampling, and a no further action letter was issued on April 12, 2006.

WALKER MACHINERY: (Kanawha County) The hydrocarbon-contaminated soils were successfully remediated, with the proper sampling, and a no further action letter was issued on July 7, 2006.

WARREN (D.H.) BULK TERMINAL: (Raleigh County) The Groundwater program provided advice to Hazardous Waste on the hydrocarbon contamination at this facility.

WEIRTON STEEL-LOCOMOTIVE SERVICE AREA: (Hancock County) The hydrocarbon-contaminated soils have been excavated from this old spill site.

WEIRTON STEEL-OIL HOUSE: (Hancock County) The hydrocarbon-contaminated soils have been excavated from this old spill site.

WEIRTON STEEL-SCALE PIT: (Hancock County) The hydrocarbon-contaminated soils have been excavated from this old spill site.

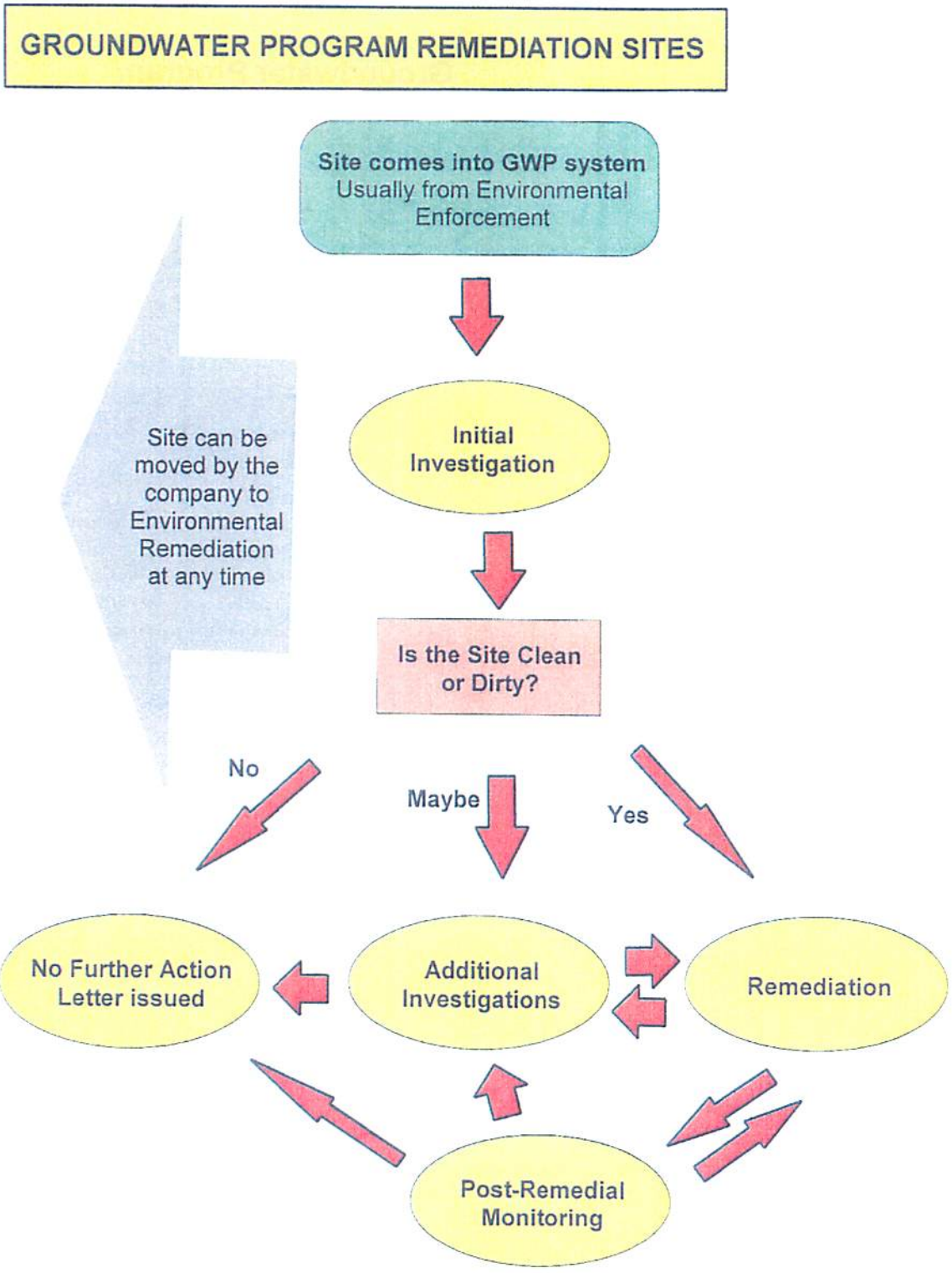
WEIRTON STEEL-WALNUT STREET (TRACK 222): (Brooke County) The soil excavation was not successful in removing all the hydrocarbon-contaminated soils at this old spill site, and groundwater monitoring wells have been installed and a regular groundwater monitoring program initiated.

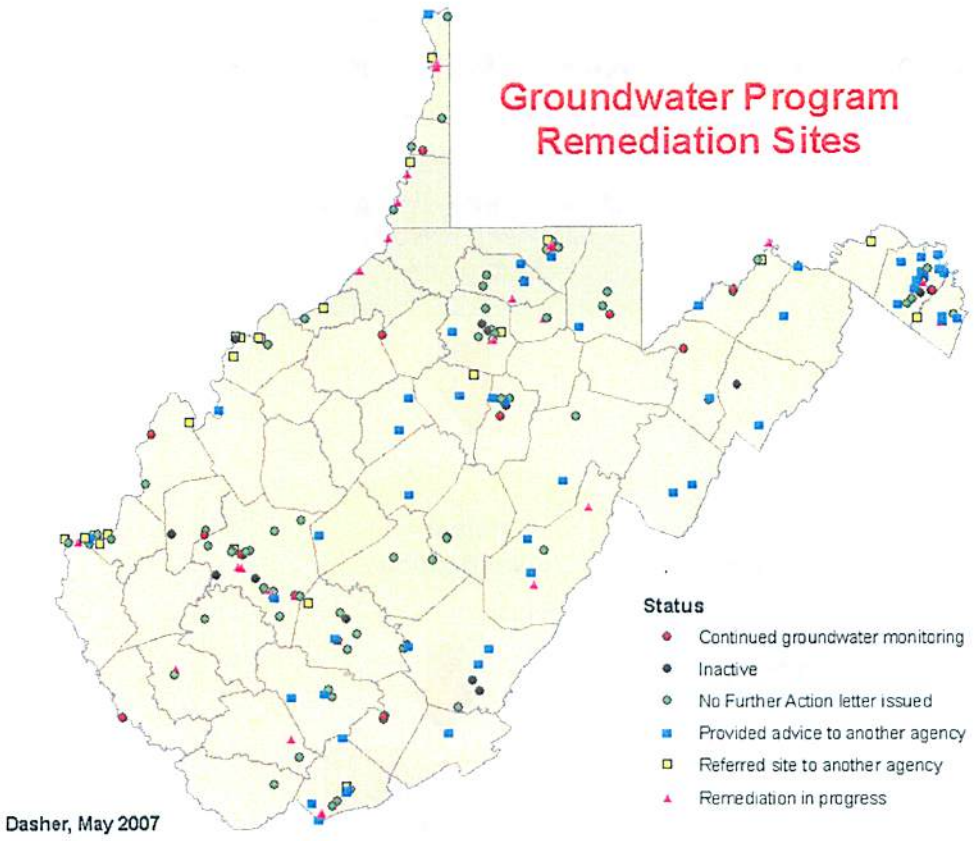
WESTERN GREENBRIER CO-GENERATION: (Greenbrier County) The Groundwater program provided advice on the proposed groundwater usage at this proposed facility.

WVU-PRT-ARBORETUM: (Monongalia County) West Virginia University continues to make long-term repairs to leaking propylene glycol pipes in this area.

WVU-PRT-BEECHURST STATION: (Monongalia County) West Virginia University continues to make long-term repairs to leaking propylene glycol pipes in this area.

WVU-PRT-TOWERS SITE: (Monongalia County) West Virginia University continues to make long-term repairs to leaking propylene glycol source pipes in this area.


GROUNDWATER PROGRAM REMEDIATION SITES
Site comes into GWP system
Usually from Environmental Enforcement
Initial Investigation
Is the Site Clean or Dirty?
Site can be moved by the company to Environmental Remediation at any time
No
Maybe
Yes
No Further Action Letter issued
Additional Investigations
Remediation
Post-Remedial Monitoring


Groundwater Program
Remediation Sites
Status
Continued groundwater monitoring
Inactive
No Further Action letter issued
Provided advice to another agency
Referred site to another agency
Remediation in progress
Dasher, May 2007

Groundwater Sampling

Employing air sparging, left and a bio-venting, right, at groundwater cleanup sites

At left, a Geoprobe unit injects oxygen release compounds at a bio-remediation site. At right, a high vacuum pump truck extracts hydrocarbons.

Hydrocarbon sheen on a stream with absorbent pads being used to keep the contamination from entering the stream.

A sinkhole filled with trash - a direct conduit for contamination to enter groundwater in Karst areas.

5. Project WET (Water Education for Teachers) Program

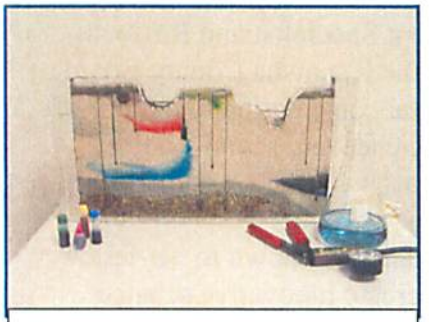
Introduction

The DEP accomplishes its mission to foster understanding and appreciation of groundwater through the Project WET program and a variety of events that reach educators, students, and adults throughout the state. Project WET (Water Education for Teachers) is a national program that provides all educators with effective classroom materials through training workshops. The program is sponsored in West Virginia by the DEP.

Project WET hands-on, interdisciplinary activities are included in publications such the *Project WET Curriculum and Activity Guide, Healthy Water Healthy People Educators Guide* and *WOW! The Wonders of Wetlands*. Project WET workshops provide the opportunity to discuss water issues through the activities contained in those publications. The training workshops are free. The publications are also provided at no cost to the education community.

Interactive models, such as the groundwater flow model and a watershed model (the EnviroScape), help workshop participants to recognize the value and vulnerability of groundwater resources.

Highlights for this reporting period include a two-day training workshop conducted in Charleston for 38 Kanawha County high school teachers. The training provided information about dioxin seeping into the Kanawha River from past improper waste disposal sites. During the reporting period, Project WET trained 458 teachers. In addition, 33 educational events reached almost 3,000 people with information and water-related materials.



The groundwater flow model demonstrates the underground movement of water.

A summary of education and outreach events is provided in Table 1 and Table 2.

Groundwater Flow Model and Watershed Model Loan Program

The models are effective teaching tools that are used at outdoor events and at every Project WET workshop to increase understanding of groundwater and watersheds. The models are loaned out to schools, organizations and individuals.

New Initiatives

Project WET and Duck's Unlimited *Project Webfoot* established a partnership with the goal of reaching educators of students in grades 4, 5, and 6, through combined teacher training

workshops. Attending educators receive pertinent materials from both organizations.

The Bureau for Public Health launched a groundwater flow model loan program in January to motivate educators and community members to get involved in the source water assessment and protection process. Participating teachers were identified through collaboration with the Project WET program.

www.wvdep.org/dwwm/projectwet

Project WET Web Page
New artwork and extensive re-writing of the Project WET Web page provides information about the program's mission and available services.

Environmental Stewardship Awards
The awards' environmental education leadership category recognizes Project WET facilitators and community leaders who promote water education in their community by publicizing, scheduling or organizing water education workshops.

The 2006 award recipients were Margaret Miller, Social Studies Development Specialist and Rosie Rhodes, Science Curriculum Development Specialist with the Kanawha County Board of Education. Margaret Miller and Rosie Rhodes made a special contribution to the Project WET program by working to infuse water education into science and social studies curricula.

The 2007 award recipient was Ruthanne Cole. Ruthanne is known to her fellow teachers at Pikeview High School for her unique ability to create innovative science adventures that inspire students and fellow teachers alike to appreciate science and the environment. Her dedication to water education is evident in her drive to create and deliver inservice training opportunities for Mercer County teachers, including environmental education programs such as Project WET.

Children's Water Festivals – 2005 and 2006

Over 1,000 enthusiastic young people in 4th and 5th grades attended water festivals during the reporting period. Water festivals consist of structured learning stations and exhibits where students engage in hands-on water activities and investigations. Biologists, geologists, engineers and park rangers conducted activities lasting approximately 30 minutes per session. The topics ranged from water conservation, aquatic species, groundwater and nonpoint source pollution. Every participating class attends seven sessions encompassing an entire school day.

Marshall University Graduate College, South Charleston. Students compete in a stormwater obstacle course at the 2006 Children's Water Festival.

TABLE 1. PROJECT WET WORKSHOPS

Location of training workshops	*Date*	No. of Participants	Participant Breakdown B Oct
West Virginia State University, Institute	August 3, 2005	18	Teachers and Resource Agency
DEP Headquarters, Charleston	August 15-17, 2005	39	Classroom Teachers
Pikeview High School, Princeton	August 24, 2005	34	Classroom Teachers
New River Community and Technical College, Lewisburg	October 21, 2005	10	Classroom Teachers and Volunteers
West Virginia University, Morgantown	October 25-26, 2005	55	Preservice Teachers
New River Community and Technical College, Lewisburg	October 28, 2005	13	Classroom Teachers and Volunteers
Concord University, Athens	November 8, 2005	14	Preservice Teachers
South Branch Inn, Romney	February 17, 2006	10	Preservice Teachers
West Virginia University, Morgantown	March 22, 2006	15	Preservice Teachers
West Virginia State University, Institute	April 24, 2006	9	Girl Scout Leaders
Camp Sandy Bend, Elizabeth	May 6, 2006	7	Classroom Teachers
River Valley Child Development Services, Huntington	May 10, 2005	12	Classroom Teachers
Putnam County Board of Education, Winfield	June 3, 2005	26	Classroom Teachers
Sissonville High School, Sissonville	July 20, 2006	9	University and non-formal teachers

Location of training workshops	*Date*	No. of Participants	Participant Breakdown By Oct
West Virginia State University, Institute	August 2, 2006	5	Classroom Teachers
City of Fairmont Conference Center, Fairmont	August 16, 2006	5	Master Naturalist Program Participants
Cedar Creek State Park, Glenville	September 17, 2006	9	Preservice Teachers
Shepherd College, Shepherdstown	September 30, 2006	14	Preservice Teachers
WVU, Morgantown	October 17-18, 2006	50	Preservice Teachers
Pikeview High School, Athens	December 11&18, 2006	10	Preservice Teachers
Shepherd University, Shepherdstown	February 24, 2007	18	Non-formal educators
Spencer, Roane County	February 27, 2007	8	Non-formal educators
Scouts Camp, Capon Bridge	March 3, 2007	18	Preservice Teachers
University of Charleston, Charleston	March 5, 2007	4	Non-formal educators
Chapmanville, Logan County	March 10, 2007	9	Preservice Teachers
West Virginia University, Morgantown	March 14, 2007	18	Natural Resources Agency Personnel
North Bend State Park, Cairo	May 18, 2007	9	Non-formal educators
FLOC Outdoor Education Center, Harpers Ferry	June 15, 2007	7	2 classroom, 2 non-formal
Shawnee Park, Dunbar	June 26, 2007	4	Classroom Teachers
Total 28 workshops		458	

TABLE 2. EDUCATION OUTREACH EVENTS

Location	Date	Event	Participants
Shawnee Community Center, Dunbar	July 13, 2005	Soil & Water Education Week	45 K-2nd graders
Snowshoe Institute, Snowshoe	July 30, 2005	Snowshoe Institute - Presentation	30 2nd to 5th graders
NCTC, Shepherdstown	Sept. 15, 2005	Conference, Growing Communities on Karst. - Presentation	100 6th graders
Marshall University Graduate College, South Charleston	September 23, 2005	Water Festival – Make a Splash with Project WET	250 students – 20 adults
New River Gorge National Park, Grandview	September 30, 2005	Water Festival (organized by the National Park Service)	220 students, 10 teachers
Riverside High School, Quincy	October 6, 2005	Groundwater flow model Presentation	35 - 9th grade students
Aurora Elementary, Terra Alta	October 21, 2005	Water Festival (organized by Friends of the Cheat)	100 students 3rd, 4th and 5th grades
Lewisburg, Greenbrier County	October 18, 2005	Conference, Growing Communities on Karst - Presentation	90 – general public
State Capitol, Charleston	Feb.23, 2006	DEP Day at the WV Legislature	150 – general public
State Capitol, Charleston	Feb. 28, 2006	Wildlife Heritage Day	200 – general public
Eastern Greenbrier Middle School, Lewisburg	March 24, 2006	School Presentation – 3 groups	96 – 7th grade students
Third Ward School, Elkins	April 14, 2006	Earth Day Celebration	23 students
Shepherdstown, Jefferson County	May 1-2, 2006	Jefferson County Science Olympiad	64 – 6th graders
Elizabeth, Wirt County	May 5, 2006	Wetlands Field Day	50 – 6th graders

Location	Date	Event	Participants
North Bend State Park, Cairo	May 20, 2006	Youth Environmental Day	Approx. 100 people
P. A. Denny (Sternwheeler), Charleston	May 26, 2006	ORSANCO Education Event	26 students
George Washington Middle School, Eleanor	June 30, 2006	Summer Academy	110 – grades 2-6
Coonskin Park, Charleston	July 12, 2006	Summer Education Event	30 students
North Bend State Park, Cairo	August 5, 2006	Adopt-A-Highway – Set up display	Approx.100 people
Marshall University Graduate College, South Charleston	Sept. 22, 2006	Water Festival – Marshall University	280 4^{th}&5^{th} graders
New River Gorge National Park, Grandview	Sept. 29, 2006	Water Festival at Grandview	277 4^{th}&5^{th} graders
National Fish Hatcheries, White Sulphur Springs	Oct. 7, 2006	Freshwater Folk Festival	120 general public
Bruceton Mills, Preston County	Oct. 27, 2006	Water Festival In Preston County	80 – 5^{th} graders
Lubeck Elementary, Lubeck	Dec. 12, 2006	Presentation	20 – 4^{th}&5^{th} graders
Pinch Elementary, Pinch	Dec. 15, 2006	Presentation	50 – 5^{th} graders
Pinch Elementary, Pinch	Dec 15, 2006	Presentation	25 – 4^{th} graders
DEP headquarters, Charleston	February 13, 2007	Presentation for WV Sustainable Communities Program	10 interns
State Capitol, Charleston	February.21, 2007	Display, DEP Day at the WV Legislature	150 – general public
Jackson's Mills, Jane Lew	March 21, 2007	Presentation. 1^{st} annual Conference of the WV Environmental Education Association	25 educators
Elizabeth, Wirt County	May 4, 2007	Wetlands Field Day	50 – 6^{th} graders

Location	Date	Event	Participants
Shepherdstown, Jefferson County	May 21-22, 2007	Jefferson County Science Olympiad	64 – 6th graders
Camp Virgil Tate, Charleston	May 24, 2007	Richmond Elementary, Outdoor Education	36 – 3rd graders
Confidence Elementary, Confidence	May 29, 2007	Presentation	24 – 3rd graders

6. West Virginia Nonpoint Source Program

The Nonpoint Source program (NPSP) is funded by Clean Water Act Section 319 grants administered by the EPA. The program supports the efforts of four West Virginia state agencies to reduce nonpoint source pollution from various land use activities: the Department of Environmental Protection, the Conservation Agency, Department of Health and Human Resources and the Division of Forestry. The programs' goals are to:

- Provide technical assistance in the proper installation and maintenance of best management practices.
- Educate the public and land users on nonpoint source issues
- Support citizen-based watershed organizations
- Support enforcement of nonpoint source water quality laws
- Restore impaired watersheds.

Management Plan 2000.

The mission of the NPSP is to both support efforts to prevent nonpoint source pollution and to restore watersheds impaired by such pollution. This requires a wide range of activities, and so there are two types of CWA 319 funds used in the program, base and incremental. The base funds are used for supporting education, outreach, technical support, volunteer monitoring, and support for the statewide watershed management stakeholder process. Activities supported by base grant funds include agricultural workshops, logging workshops, oil and gas workshops, volunteer monitoring training sessions, and general nonpoint source education. The NPSP staff supported by the base grant have become an integral part of the entire watershed management effort. West Virginia relies heavily on the base program to foster watershed groups and agencies to prepare them for, and support them through, the challenging process of developing and implementing watershed-based plans. In addition the NPSP has used some of the base funding to support special projects in watersheds that are threatened, but not part of a TMDL.

In watersheds with a TMDL, the NPSP's incremental funds are used on water quality restoration of impaired waters. Choosing priority watersheds to target these funds and other resources is the role of West Virginia's Watershed Management Framework

(WMF). When the WMF chooses a priority watershed, a project team is established which includes all interested parties. The basin coordinators of the NPSP facilitate or lead these teams.

The NPSP and its component programs, Section 319 Nonpoint Source program, Save Our Streams program, Chesapeake Bay program and Stream Partners program, are funded primarily through federal funds from EPA with the exception of the Stream Partners program, which is funded by the Legislature. The challenges of protecting or restoring state waters from nonpoint source pollution are many, but the lack of funding from state sources makes matching the federal grant funds difficult. The NPSP's activities are focused on protecting or restoring the surface waters of the state. None of the program's projects are focused on groundwater, although indirect groundwater improvements are assumed. No monitoring of groundwater occurs in the program to determine any benefits. The national goals of the program set by EPA focus on TMDL implementation and removal of impaired streams from the 303(d) list. There is no documentation of the effects of these activities on public or private water supplies, but restoring the designated use of drinking water is a part of TMDL implementation.

7. National Pollutant Discharge Elimination System (NPDES) Permit Program

The NPDES Individual Permit program is continuing its efforts in implementing the requirements of its recently-adopted combined sewer overflow policies (CSO). The new policies provide specific requirements and direction to the CSO communities in developing and implementing their nine minimum controls and long-term control plans. New requirements are being implemented in permits and administrative orders.

For groundwater-related issues at industrial facilities, the staff members closely work with the groundwater section personnel to provide necessary technical assistance. For discharge of groundwater generated because of groundwater clean-up activities, the section issues the required permit modifications or permits.

The General WV/NPDES Water Pollution Control Permit for Discharges Associated with the Remediation of Petroleum Contaminated Sites was reissued in 2003 and expires in August of 2008. It helps expedite groundwater cleanup by providing permit coverage.

The General WV/NPDES Water Pollution Control Permit for Discharges from Water Treatment Plants was issued in 2000 to provide permit coverage for discharges from water treatment plants. The general permit requires submission of groundwater protection plans from the applicants.

NPDES permits for industrial facilities also require submission of groundwater protection plans, which promote improved housekeeping practices, improved diking for storage facilities, improved loading/unloading practices for chemicals etc. Thus, groundwater protection plans help protect groundwater at industrial sites. Similarly, in

case of stormwater discharges from industrial sites, stormwater pollution prevention plans (SWPPP) are required in NPDES permits and in the Stormwater general permit. These plans also help indirectly to protect groundwater at industrial sites.

The statistical data for the Permit Section for the 2007 fiscal year (July 1, 2006 - June 30, 2007) is as follows:

1. Number of individual WV/NPDES permits issued: 95
2. Number of general permit registrations issued: 1,230
3. Number of modifications of Individual WV/NPDES permits and general permits registrations issued: 177

8. Watershed Assessment Branch

The Watershed Assessment Branch was created in March 2002 from the joining of two existing programs, the Watershed Assessment section (WAS) and the Total Maximum Daily Load (TMDL) section.

The WAS was designed to study tributaries, drainage areas and entire watersheds instead of specific streams or stream segments. WAS has chosen a specific combination of physical, chemical and biological variables to help determine the streams' health and what types of stressors may be operating on the benthic (aquatic bottom-dwelling) community.

The streamside and instream habitats, and the benthic macroinvertebrates (bottom-dwelling animals that do not have backbones) are the center of the ecological assessment. Habitat evaluations are important to the assessment because they reflect the physical conditions that support the benthic community. The benthic community is crucial because it reflects environmental conditions over an extended period of time. Other parameters, like dissolved oxygen concentration, are important, but may reflect recent fluctuations in environmental conditions. A contaminant that flowed through the reach a week ago, for example, would be reflected by the impaired benthos, but probably would not be revealed in a water sample.

Assessments are performed on a watershed basis. To better manage the state's water resources, West Virginia has been divided into 32 watersheds, or hydrologic regions. Each watershed is assessed every five years, according to the state's Watershed Management Framework.

Each year WAS assesses the water quality in approximately one-fifth of the watersheds in West Virginia. All 32 watersheds will be assessed in a five-year period (see table below). These assessments will be used to develop and modify plans for protecting and enhancing West Virginia's water quality.

From July 1, 2005, through June 30, 2007, WAS personnel collected 7,265 samples from 1,441 sites that are on 918 distinct streams and rivers.

In September 2005, the program completed its second five-year cycle. A "state of the streams" report is currently being developed using data collected during the second five-year cycle of probabilistic or 'random' sampling. This effort consists of sampling computer-selected sites and allows the development of statewide estimates of water quality conditions of first through fourth order wadeable streams.

West Virginia Watershed Assessment Schedule				
Group A-2006	**Group B-2007**	**Group C-2008**	**Group D-2009**	**Group E-2010**
Cheat River	Elk River	Tug Fork River	Greenbrier River	Cacapon River
Shenandoah River 1 & 2	Coal River	Lower Guyandotte River	James River	Upper Guyandotte River
South Branch of Potomac River	Lower Kanawha River	Gauley River	Little Kanawha River	Twelvepole Creek
Upper Kanawha River	North Branch of Potomac River	Middle Ohio River North	Upper New River	Upper Ohio River South
Northern Upper Ohio River	Tygart Valley River	Middle Ohio River South	Lower New River	Lower Ohio
Youghiogheny River		Potomac River Direct Drains	Monongahela River	Big Sandy River
				West Fork River
				Dunkard Creek

A number of sites are selected for duplicate sampling to provide for quality assurance/quality control checks on sampling techniques, sample handling procedures and sample analysis procedures. In addition, WAS holds a spring refresher training session before the sampling season each year to ensure all field staff are obtaining water quality and biological samples in a consistent manner at all sites. WAS tries to identify the source, both regulated and non-regulated, and the severity of impacts on streams in watersheds throughout the state. For instance, fecal coliform bacteria from open pipe discharges, failing septic systems, failing sewer lines, inappropriate animal waste management techniques, and "collect and dump" sewage treatment activities are major stressors on the groundwater and surface waters in West Virginia. By identifying streams with violations of the criteria for fecal coliform bacteria, WAS has identified sub-watersheds with groundwater that is likely impaired by fecal coliform bacteria. Since fecal coliform bacteria is usually filtered out by groundwater seeping through dirt, sand and rock, additional studies must be conducted to confirm the potential impairment of groundwater. However, in karst areas, where groundwater is not subjected to as much

filtering, the presence of fecal coliform bacteria in streams is a clear indicator that groundwater pollution has occurred upstream.

By identifying streams impacted by acid mine drainage, WAS has identified areas where the groundwater also is likely impaired. By helping identify these areas, WAS has made it possible to target remediation efforts lessening the negative effects on fish and benthic communities.

The WAS has developed and maintains the 303(d) list of impaired waters. These impaired waters have, in some cases, been linked to contaminated groundwater. This, perhaps, is the single greatest contribution to groundwater protection by WAS. For example, dioxin found in the Lower Kanawha River has been traced to groundwater seeping through abandoned hazardous waste dumps. The Environmental Protection Agency completed a TMDL for dioxin on this river segment in September 2000.

TMDLs are required by the federal Clean Water Act. In simple terms, a total maximum daily load is a plan of action used to clean up streams that are not meeting water quality standards. The plan includes pollution source identification and strategy development for contaminant source reduction or elimination. Additionally, TMDLs are being conducted under the 1997 settlement of the lawsuit, *Ohio Valley Environmental Coalition, Inc., West Virginia Highlands Conservancy, et. al. v. Browner, et. al.*, which sought state and federal aid to improve and maintain West Virginia's water quality. The lawsuit resulted in a consent decree between the plaintiffs and the EPA. The consent decree established a rigorous schedule for TMDL development, requiring the federal agency to develop over 500 TMDLs from West Virginia's 303(d) list of impaired streams by March 2006 (extended to March 2008).

After settlement of the lawsuit in 1997 and the resulting consent decree, the EPA began developing TMDLs for West Virginia streams, with the DEP providing onsite logistical and technical support. However, beginning with the Upper Kanawha River in 2001, the DEP took the lead in developing TMDLs for state waters.

The DEP secured an initial appropriation of $195,000 from the legislature for the TMDL program. This appropriation enabled the DEP to hire a core staff of professionals to oversee the transition of TMDLs from the EPA to the state. The most recent appropriation from the legislature for TMDLs (FY2006) was $1.4 million. This level of funding will enable the DEP to complete TMDLs that were mandated by the 1997 consent decree, as well as initiate future TMDLs on impaired waters in accordance with Clean Water Act requirements.

In future years it is likely that additional cases of stream contamination documented on the 303(d) list will be traced back through groundwater to their original sources. WAS will then be able to suggest remediation and restoration activities to improve groundwater and surface water quality in West Virginia.

Currently all targeted, probabilistic, and TMDL monitoring data is managed in an Access database that was developed in-house. WAPBASE stores all water quality, habitat, watershed characteristics, and macroinvertebrate data – both raw data and calculated metrics. Most data is entered manually, though some laboratory-derived water quality results are available electronically, and all DEP- certified labs will be providing results electronically in the future. WAS currently also uses EPA's STORET database to store surface water quality information.

WAS uses ESRI/ArcView software to identify the location of sampling sites, geologic and land use patterns upstream from the sampling sites, and similar data. WAS also uses this program to print maps showing the geographic distribution of violations in a watershed.

Data collection and management could be improved by developing a series of shared "read-only" databases on the internal network accessible to all DEP employees. Development of separate databases available only to selected programs or selected people within programs will never be an acceptable option.

WAS is cooperating with the rest of DEP in the development and implementation of a database (EQuIS) that will provide a clear picture of the water quality based on the physical and chemical characteristics and the biological life existing in all of West Virginia's waters, both groundwater and surface waters.

9. State Water Pollution Control Revolving Fund (SRF)

The SRF program environmental goals are to reduce and/or eliminate water quality violations caused by sanitary wastewater and nonpoint sources in surface waters and groundwater. In FY2006 and FY2007, approximately $66 million was expended from the SRF program to build and replace wastewater collection and treatment systems. In many of these projects, unsewered areas of West Virginia were provided with central sewer collection systems that eliminated direct wastewater discharges and failing or marginally functional onsite septic systems. The failing systems and direct discharges contribute to polluting the groundwater in the state. For example, Union Williams Public Service District (Wood County) provided central sewer service to an area that the Mid-Ohio Valley Health Department estimated had an 85%-90% septic tank failure rate.

Design standards for the SRF program are included in the Legislative Rules, Title 47 Series 31 and include restrictions on constructing sewer lines within 10 horizontal feet of a drinking water reservoir, 50 feet of any well or spring utilized for a public drinking water system, 50 feet of a private or individual homeowner's drinking water system, or within 10 feet of a homeowner's well. The enforcement of these regulations help protect public and private water supplies.

The DEP's Agriculture Water Quality Loan Program is also administered through the SRF program and expended $237,220 in FY2006, and $ 617,137 in FY2007. This program was established in 1997 and continues to provide loans to correct nonpoint

source pollution. Most of the loans are made to the poultry industry in the Eastern Panhandle to assist in alleviating groundwater pollution from poultry farms. The SRF will provide $700,000 as a set-aside for this program for FY2008.

A pilot program was started in 2000 called the Onsite Systems Loan Program. The purpose of this nonpoint source program is to eliminate existing health hazards and water quality problems due to direct sewage discharges from houses and malfunctioning septic tank systems. Many problems and barriers have prevented this program from being successful to date, but program revisions have been made to make it a more viable program. During the 2007 legislative session, the SRF statute was amended to allow other entities to act as an intermediary lender for this program. The West Virginia Housing Development Fund will be the first entity to enter into an agreement with the SRF to provide low interest loans to homeowners to correct failing onsite sewage systems. The SRF will provide $1,200,000 as a set-aside for this program for FY2008.

C. Division of Land Restoration

1. Office of Environmental Remediation

The Office of Environmental Remediation (OER) was created in 1997 to consolidate the agency's remediation programs. The organizational structure allows the office to focus its energy and technical talent on the remediation sciences and procedures used to restore contaminated sites. The office is primarily organized along a project management function, which oversees site activities, and a technical support function, which provides specialized technical support.

OER operates five sections:

Voluntary Remediation/Brownfield –

This section encourages voluntary remediation activities and brownfield revitalization. The Voluntary Remediation and Redevelopment Act (VRRA) was one of the first voluntary cleanup or brownfield laws in the nation. The VRRA section is characterized by uniform, predictable processes with flexible cleanup standards based on future land uses that are protective of human health and the environment.

Leaking Underground Storage Tanks (LUST) –

This section provides oversight of the cleanup from leaking underground storage tanks, including release from the tanks, their piping, spills or overfills. This section also administers the federal and state leaking underground storage tank response funds. These funds enable state cleanups where the responsible party is unwilling or does not have the financial means to respond to the leak. The agency received authorization from the EPA in 1997 to assume the regulatory lead for the leaking underground storage tank program in West Virginia.

Superfund –

This section coordinates with the EPA, and, as applicable, the U.S. Department of Defense, at Superfund cleanups. Recent Federal efforts have also focused on recognizing and supporting the successful state brownfield and voluntary cleanup programs.

Rehabilitation Environmental Action Plan (REAP) –

This was a strategic initiative signed into law by Governor Joe Manchin in 2005. The governor's bill combined elements of the Department of Environmental Protection and the Division of Natural Resources into a more effective and streamlined system for

the direction of environmental remediation programs. The program provides oversight of litter removal, statewide recycling and open dump cleanups.

Landfill Closure Assistance Program (LCAP) –

The program provides landfill closure assistance to owners/permittees of landfills that were required to cease operations pursuant to certain statutory closure deadlines for non-composite lined facilities. The program designs and constructs all closure-related activities necessary to provide sufficient leachate management, sediment and erosion control, gas management, groundwater monitoring and a final cover cap on non-composite lined landfills.

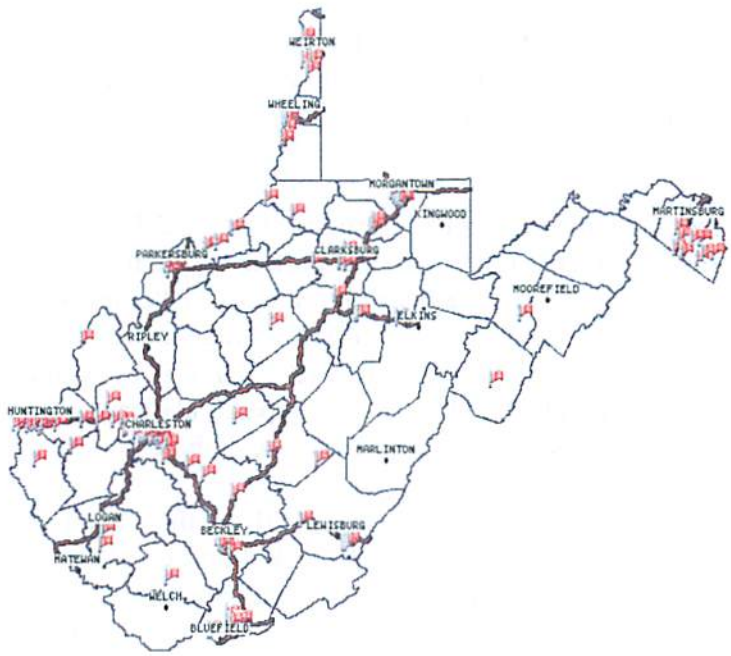
OER accomplishments in FY06 and FY07:

- (REAP) The West Virginia Public Employees Office Paper Collection Program collected 779.85 tons of paper from state offices.
- (REAP) The Litter Control Grant Program, which provides grants to cities, counties and municipalities for litter control and cleanup programs, funded 31 projects totaling $65,256.
- (REAP) The West Virginia Recycling Assistance Grant program, which provides grants for recycling and recycling related programs to public and private entities and supports environmental sustainability, awarded 70 grants totaling $3,162,280.
- (REAP) Produced and aired 3,760 radio spots promoting recycling, cleanup projects and other environmental concerns, and in cooperation with the Division of Natural Resources, continued the annual Christmas tree recycling event to prevent trees from being land-filled, with most used for fish habitat in states lakes.
- (REAP) The Pollution Prevention Open Dump Program (PPOD) cleaned up over 208 miles of streams and 2,027 open dumps covering over 1,338 acres of land, resulting in 2,025 tons of materials recycled and 15,591 tons of waste properly disposed, as well as 633,268 tires.
- (REAP) Volunteers working with the West Virginia Make It Shine Program were responsible for the cleanup of 110 illegal dumps, over 300 miles of streambank, 417 acres of our state's parks and 67 miles of recreational trails. In doing so, these 5,416 volunteers collected an estimated 303 tons of litter and recyclables and 2,767 waste tires.
- (REAP) Over 24,000 volunteer members of the Adopt-A-Highway Program collected 1,140 tons of litter and recyclables while cleaning nearly 4,000 miles of our state's roadways.
- The Voluntary Remediation and Redevelopment Act (VRRA) program accepted 18 new applications for properties to participate in the program, and issued Certificates of Completion for 16 voluntary remediation sites, which opened 536.48 acres of land for reuse.
- OER continued the brownfield targeted site investigation work at the former Nitro Sanitation landfill in Nitro, in collaboration with FMC and the City of Nitro, and at the JG Bradley Campground in Clay. OER also initiated brownfield targeted site assessments at an additional six sites, including Elite Glass in Cameron, the

Wood Choppers Village in Webster Springs, Sandy Ridge Orchards at Shenandoah Junction, Quality Glass in Morgantown, the Barboursville Brickyard, and the former W. E. Sizemore Store in Clay. The latter two are petroleum brownfield sites.

- OER provided oversight of the investigation and cleanup of 152 new leaking underground storage tank sites and completed investigations and closed the active files on 262 leaking underground storage tank sites. OER is continuing to initiate actions to reduce the backlog of active cleanups at leaking underground storage tanks.
- OER removed 22 abandoned underground storage tanks from 11 different sites that posed unacceptable risks and/or inhibited community development projects. OER also provided alternative water supplies to 11 homes where drinking water was contaminated by leaking underground storage tanks.
- OER continued working with EPA Region III and ExxonMobil Corp. on the Sharon Steel/Fairmont Coke Project XL Superfund cleanup, while ExxonMobil and the City of Fairmont continued to work collaboratively on redevelopment plans to return the site to productive use.
- OER continued working with EPA Region III on the Superfund removal action at the Big John's Salvage site near Fairmont and on Superfund remedial actions at Morgantown Ordnance Works, the Fike-Artel Chemical site in Nitro, Allegheny Ballistics Laboratory in Mineral County, the Vienna wellfield in Wood County, the Pantasote site in Pt. Pleasant, the Ravenswood PCE site, and at the Olin-Hanlin Chemical site near New Martinsville.
- OER continued working collaboratively with EPA Region III and the U.S. Army Corps of Engineers on Superfund remedial actions at West Virginia Ordnance Works at Pt. Pleasant.
- OER initiated site assessment activities at 12 priority hazardous substance sites and continued site assessment activities at 19 other sites.
- OER continued negotiations regarding additional investigations for the former Marshall Army Chemical plant, a Formerly Used Defense Site (FUDS) at Natrium.
- OER completed closure construction at the Hampshire County Landfill and initiated closure construction at Don's Disposal and Jackson County landfills under the Landfill Closure Assistance Program (LCAP).
- OER has become a member of MISS Utility of West Virginia and is participating in the One-Call notification system so as to provide protections from uncontrolled exposures at properties with established environmental covenants under the Voluntary Remediation and Superfund programs.

Voluntary Remediation and Redevelopment Act Sites



2. Office of Abandoned Mine Lands and Reclamation

In reviewing surface mining legislation in the mid -1970s, Congress found that more than 1.5 million acres of land had been directly disturbed by coal mining and more than 11,500 miles of streams were polluted by sedimentation or acidity from surface or underground mines. In response to the problems associated with inadequate reclamation of coal mining sites, Congress enacted the Surface Mining Control and Reclamation Act of 1977 (SMCRA).

The two main purposes of SMCRA are (1) to establish a nationwide program to protect society and the environment from the adverse effects of surface mining operations while assuring that the coal supply essential to the nation's energy requirement is provided, and (2) to promote the reclamation of mined areas left without adequate reclamation before SMCRA was passed. Title V of SMCRA deals with active mining, Title IV deals specifically with the problems associated with inadequate reclamation of abandoned mine lands (AML).

In Title IV, Congress established the Abandoned Mine Reclamation Fund to be used for the reclamation and restoration of areas affected by past mining. The fund is derived from a reclamation fee collected from coal mining operators on each ton of coal mined since SMCRA was enacted.

West Virginia received primacy of the AML program February 21, 1981, and the DEP was designated by the governor to operate this program with funding provided from the AML Reclamation Fund. The Office of Abandoned Mine Lands and Reclamation (AML&R) was established within the DEP.

The mission statement of the Office of Abandoned Mine Lands and Reclamation is "to protect public health, safety, and property from past coal mining and enhance the environment through reclamation and restoration of land and water resources."

The program's vision is to efficiently and effectively use all available resources to achieve a long term benefit to public health, safety, property and general welfare while restoring the environment to pre-mining conditions.

AML&R Organizational Structure

AML&R is divided into groups: Administration and Financial, Realty, Planning, Design and In - House Design, Construction and Emergency. The state is divided into northern and southern regional offices. The responsibilities of those groups are:

1. Administration and Financial - This group performs the accounting function for the office. The group tracks expenditures as they relate to administrative and construction functions responsible for management of grants, budgets and financial administration of AML&R. Furthermore, the group oversees the Stream Restoration section that is mandated to perform all program, pre-construction, post-construction, compliance, and water monitoring functions.

2. Realty - This group gains rights of entry from property owners so that exploration and construction can be conducted to address abandoned mine land problems. Also, the group's responsibility includes determining if before and after appraisals are necessary for the purposes of lien actions.

3. Planning - The Planning group identifies abandoned mine land problems. Each requires preparation of environmental assessments to be in compliance with the National Environmental Policy Act (NEPA), creation of a description of each project, and development of a preferred alternative for correcting the problem. The group also maintains the West Virginia Abandoned Mine Land Inventory.

4. Design and In - House Design - This group approves all consultant plans and specifications involving abandoned mine land projects. It also evaluates and selects a design consultant to perform all necessary preparation of plans and specifications for projects. This group also administers exploratory drilling, aerial mapping, surveying contracts, and prepares plan and specifications on selected projects in – house.

5. Construction - The main task of the Construction group is contract administration and oversight of abandoned mine land construction projects. This

includes site inspections during construction. The group conducts pre-bid and pre-construction conferences and performs final inspections.

6. Emergency - This group administers and conducts the Emergency Reclamation program.

AML Public Health and Safety Issues

SMCRA defined eligible sites under Title IV as those sites that were mined for coal and left in an inadequate state of reclamation prior to August 4, 1977, and for which there is no continuing reclamation responsibility under state or federal law. The definition of eligibility was extended in 1992 to sites mined for coal after August 4, 1977. These sites were abandoned before the date the secretary of the U.S. Department of the Interior approved a regulatory program for the state in which the sites are located.

The expenditures of monies from the fund on lands and water eligible shall reflect the following priorities stated in Section 403 (a) in the Surface Mining Control and Reclamation Act Amendments of 2006:

1. (A) The protection of public health, safety and property from extreme dangers of adverse effects of coal mining practices;

   (B) the restoration of land and water resources and the environment that -

      (i) have been degraded by the adverse effects of coal mining practices; and

      (ii) are adjacent to a site that has been or will be remediated under subparagraph (A)

2. (A) The protection of public health and safety from adverse effects of coal mining practices;

   (B) the restoration of land and water resources and the environment that -

      (i) have been degraded by the adverse effects of coal mining practices; and

      (ii) are adjacent to a site that has been or will be remediated under subparagraph (A); and

3. The restoration of land and water resources and the environment previously degraded by adverse effects of coal mining practices including measures for the conservation and development of soil, water (excluding channelization), woodland, fish and wildlife, recreation resources, and agricultural productivity.

The SMCRA Amendments of 2006 stated that any state or tribe may extend funds allocated to such state and tribe in any year through the grants for the purpose of

protecting, repairing, replacing, constructing, or enhancing facilities related to water supply, including water distribution facilities and treatment plans, to replace water supplies adversely affected by coal mining practices.

The U.S. Office of Surface Mining maintains an inventory of abandoned mine problems known as the Abandoned Mine Lands Inventory System (AMLIS). OSM maintains the system to provide information to meet the objectives of Title IV specified in Section 403(a).

When a problem area is entered into AMLIS along with the estimated cost of repairing the area, not including design, inspection, and program administration costs, the estimated cost is entered in the unfunded category. When a problem area on the inventory is funded, it is moved to the funded category. Later, when the actual construction is completed, the problem is again moved, this time to the completed category. In this manner, a complete history of the abandoned mine land problems are maintained in AMLIS. The total unfunded costs of all priorities in West Virginia as of June 1, 2007, are $1,388,729,805.

AML&R Accomplishments

AML&R has completed the problem areas (PA) and the associated problem types. The PA and the problem type accomplishments have been entered into AMLIS and moved from the funded to completed category.

Summary of Accomplishments

Problem Type	Total Accomplishment
Clogged Streams (Miles)	1.0
Dangerous Highwall (Feet)	1800
Dangerous Impoundments (Count)	58
Dangerous Piles & Embankments (Acres)	72.5
Dangerous Slides (Acres)	17.5
Hazardous Equipment & Facilities (Count)	13
Industrial/Residential Waste (Acres)	0.8
Portals (Count)	87
Polluted Water: Agriculture & Industrial (Count)	7.2
Polluted Water: Human Consumption (Count)	1114
Subsidence (Acres)	23.4
Surface Burning (Acres)	2.1
Vertical Opening (Count)	3

D. Information Technology Office (ITO)

Technical Applications and Geographic Information Systems (TAGIS) Application Development and Support (ADS)

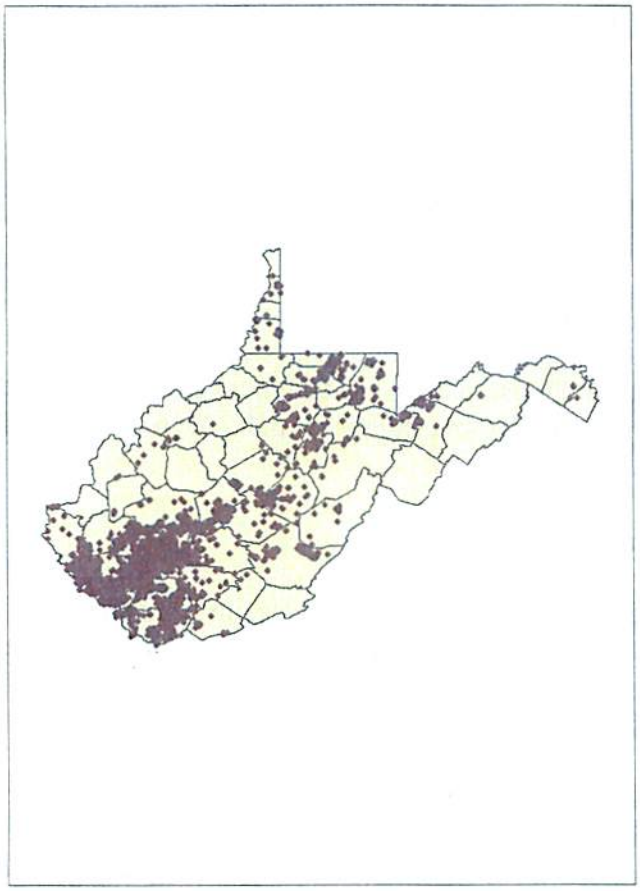
EarthSoft's Environmental Quality Information System (EQuIS -- written for the Microsoft Windows operating system) provides an integrated suite of applications and a common database management system for all organizations involved in the data collection, processing, management and evaluation aspects of environmental project work. EQuIS has historically resided on a desktop platform. EQuIS is now an Enterprise system residing on an Oracle platform. EarthSoft's EQuIS is the world's most widely used environmental sample data management system.

Currently, all data collected and analyzed by DEP resides in a myriad of places and formats. By developing a central repository and a uniform format for the data collected, DEP's goal is to expedite the transfer of information and data between DEP personnel and DEP data providers. For the first time in the history of the agency, all of the environmental programs will be able to evaluate or cross reference each program's data for a given facility or project. This will increase efficiency by allowing DEP data providers to fully understand DEP requirements and communicate the requirements to its employees and contractors.

Along with being a central repository for data and information, EQuIS acts as an interface with many third party software packages. Frequently, effective management does not occur due to poor communication between parties involved or the disparity of tools they employ (or do not employ) to get their work accomplished. The EQuIS system uses ESRI's ArcView as a 'data broker' to serve data to several different analysis applications within a GIS environment. The EQuIS ArcView GIS Interface provides a flexible yet simple means of accessing, analyzing and viewing geology and environmental chemistry from within ESRI's ArcView GIS. EarthSoft's EQuIS Chemistry and EQuIS Geology extensions make available many options for 1D, 2D, and 3D visualization and modeling, as well as reporting and enhanced labeling options. The EQuIS interface will allow management to make effective and timely decisions without the complication of needing to process data for the modeling programs used.

A new feature of the Enterprise version is the EQuIS Dashboard. The Dashboard allows users to load data via an Internet interface. The Dashboard also allows users to subscribe to facilities they wish to keep updated about. It will notify the user of when new data is added and push predefined reports to the user when scheduled or triggered.

The size of the database is expected to grow exponentially as more users are brought online. To date, 603 facilities are registered in the database. The facilities have a total of 9,704 sampling locations, a mixture of surface and groundwater locations. There have been 1,600,707 test results recorded in the EQuIS database. This will be one of the largest databases in the agency accessible to DEP employees and the public. The map below shows EQuIS locations.



To date, the Division of Mining and Reclamation has the most data stored in EQuIS. One project, OMR Trendstation, is the single largest facility in EQuIS. Data has been collected at 231 locations monthly since October 2002, and currently has 302,184 test results. Other groups within the Department of Environmental Protection storing data in EQuIS are the Landfill Closure Assistance program and the Voluntary Remediation program.

VI. DEPARTMENT OF HEALTH AND HUMAN RESOURCES

Office of Environmental Health Services

A. Public Health Sanitation Division

Two groundwater protection programs are operated by the Public Health Sanitation Division. These include the permitting and approval of individual water supplies and individual sewage systems. The goal of the individual water supply program is to ensure that individual water wells are properly constructed and located at the required distances from potential pollution sources. This program is carried out through local health departments and includes permitting, inspections, and water sampling. The Public Health Sanitation Division provides technical assistance to local health departments by assisting with complaint investigations and design of remedial systems for the correction of failures.

Individual Water Supply Program

Local health departments collect water samples upon request to determine bacteriological and chemical conditions of individual and public water groundwater supplies. Complaints related to groundwater protection that are not regulated by state or local health departments are referred to the appropriate agency for response.

The Office of Environmental Health Services, after several years of hard work, has revised the water well regulations and design standards and have submitted the rules to the Legislature for approval during the 2008 session. The current regulations and design standards have been in effect since the 1980s.

Individual Sewage Program

The individual on-site sewage program involves the plan review, site evaluation, inspection, and complaint investigation of on-site sewage systems in West Virginia. The goals of this program are threefold: 1) protect the groundwater, 2) insure all new building sites utilizing on-site sewage disposal have a suitable on-site sewage disposal reserve area that will accommodate the initial system and have space for future repairs, and 3) correct failing systems to prevent a public health hazard. Local health departments are responsible for on-site systems up to 3,000 gallons per day (plan review, site evaluation, permitting, inspection, and approval). The Public Health Sanitation Division issues permits for surface discharge systems (under 600 gallons per day) that qualify for an NPDES permit, conducts training and certification of septic installers, develops and interprets rules and design standards, develops operating procedures and guidelines, investigates complaints, and reviews new technology.

The Public Health Sanitation Division revised the individual sewer system design standards, which were approved by the legislature. These design standards became effective on July 1, 2003, and include the following groundwater protection measures:

- ❖ Eliminates homemade septic tanks and metal septic tanks, which are prone to leaking into the groundwater.

- ❖ Prohibits standard soil absorption systems in rapidly permeable soils, which would not properly filter the effluent before discharging to groundwater.

The Individual Sewage program will be faced with many new challenges in the coming year. The use of new treatment technologies continues to grow, and in conjunction with the West Virginia Sewage Advisory Board, has started a pilot project for a product verification protocol, which put procedures into place for new technologies to receive state approval.

B. Well Head Protection Program

Groundwater Protection Goals

As of June 30, 2005, the Source Water Assessment and Protection (SWAP) / Wellhead Protection (WHP) program has completed assessments for 100% (delineation through public availability) of the community and non-community public water supply systems. It is our hope that this work accomplished in West Virginia and across the United States will be a valuable tool to a public water supply/community and will help in planning and building future capacity for economic growth.

Moving from the initial assessment phase to a protection phase will require a multifaceted approach that must have continued financial support within West Virginia. The SWAP/WHP programs target water systems for protection on a county or localized basis. The Office of Environmental Health Services (OEHS) relies on participation and involvement of federal, state, and local agencies, industry, agriculture, environmental groups, public water supplies, and the public at many levels to protect the surface and ground waters of the state and the health of the people of West Virginia.

Results of the SWAP/WHP assessments conducted to date are used as a priority-setting approach for protection. Systems with higher susceptibility rankings are primarily targeted first, especially in higher population centers. Implementation of the SWAP/WHP builds on other environmental assessment and protection programs and requires integrated linkage and cooperation with many associated entities. Availability of initial assessments alone is not likely to drive local action to the protection phase. Follow-up assistance and a continuing source of funding for activities will likely be required for sustainability.

The overall goal of the SWAP/WHP programs is to gather and utilize meaningful information to assist source water protection efforts and the overall drinking water program in the state. There are approximately 1,279 surface and groundwater intakes serving the state's public water systems. Efforts to identify significant potential sources of contamination will focus on the greatest threats to drinking water and guide future

source water protection efforts. The SWAP/WHP programs maximize the use of existing information, require integration with existing state and federal programs and use the Geographic Information System to map delineations and assessments and emphasize local partnerships.

Program Milestones and Future Priorities

During this reporting cycle, the SWAP/WHP programs continued to pursue the following:

1. Building Partnerships-Inter-agency cooperation and other alliances:

   - ❖ In 2006 and 2007, SWAP/WHP stakeholder meetings were held to review the status of the SWAP/WHP programs. Representatives from various state, federal and local agencies/groups attended these meetings to provide insight concerning the programs.
   - ❖ Continuation of the SWAP/WHP Memorandum of Understanding (MOU) that has been signed by a number of state groundwater regulatory agencies, establishes a coordinated effort by all agencies to protect groundwater in delineated SWAP/WHP areas. The MOU enhances the SWAP/WHP programs ability to protect groundwater utilized by public water systems.
   - ❖ Continue to participate and build voluntary protection efforts by prioritizing efforts, program resources, education and outreach efforts in developing and implementing voluntary protection measures not only to the local water systems but also to local governments, councils, planners, and other stakeholders.
   - ❖ Provide funding for the DEP Underground Injection Control Class 5 program to locate UIC Class V wells in source water protection and sensitive hydrological areas within West Virginia. This work also includes an inventory of underground and above ground storage tanks in the SWAP/WHP area.
   - ❖ Continue participation and provide funding for the Potomac Drinking Water Source Protection Partnership. This partnership is composed of water utilities and the various governmental agencies responsible for drinking water protection in the Potomac River basin.
   - ❖ Continuing a working relationship between the federal *Safe Drinking Water Act* and the *Clean Water Act* programs within the state to provide the most accurate and representative assessment of source waters, based on available data which the state believes best reflects the quality of the resources.
   - ❖ Continue to work with the West Virginia Rural Water Association, under an EPA grant through the National Rural Water Association, working with the local SWAP and WHP areas within the State.

- ❖ Continue to use hydrogeologic information provided from the U.S. Geological Survey to help define SWAP/WHP delineation areas.

Public Outreach/Educational Activities:

- ❖ For the past seven years, the SWAP program has participated in the annual Children's Water Festival. Approximately 250 Kanawha County students in fourth and fifth grade attend this festival that consists of structured learning stations where students actively engage in hands-on water activities and investigations.
- ❖ The West Virginia Bureau for Public Health Web site continues to provide information on the SWAP/WHP programs and guide municipalities, water suppliers or other groups through developing a local SWAP program. Future projects include the development of a secure web site that will provide the wellhead and source water areas and potential contaminant sources for use by other utilities, state, emergency management and federal agencies.
- ❖ Information on the SWAP/WHP assessments is included in the annual Consumer Confidence Report prepared by each community water system and reviewed by the WVBPH staff.
- ❖ Provide educational materials, posters and brochures concerning the SWAP/WHPP program.

Other Actions for Protection of Sources of Drinking Water

- ❖ Source Water Protection Grants Program, providing funding that will allow municipalities and water suppliers to enhance local protection programs. Specifically, grant money will be available to implement programs to protect existing groundwater sources of public drinking water.
- ❖ Continue to evaluate new public water wells or intakes to assure they are located in areas where contamination threats are minimal. Permits for new public water wells now require an initial survey for potential sources of contamination within 2,000 feet of proposed well location with site-specific information used when available.
- ❖ The Alternative Monitoring Strategy Program (AMSP), which determines future monitoring frequency reductions, is dependent on having a SWAP/WHP program in place, which requires consistent revisions and updates.
- ❖ Continue to participate in the development of regulations and design standards for water supply wells, private water wells and monitoring wells for the protection of groundwater contamination.
- ❖ Continue to evaluate public water supply wells to determine whether ground water sources are under the direct influence of surface water.
- ❖ Continue to support the efforts of the DEP and the U.S. Geological Survey with its groundwater ambient water quality studies. This program has strived to benchmark raw water quality data for West Virginia aquifers. West

Virginia is trying to identify the impacts of various land uses on water quality. This information will help West Virginia avoid future contamination events.

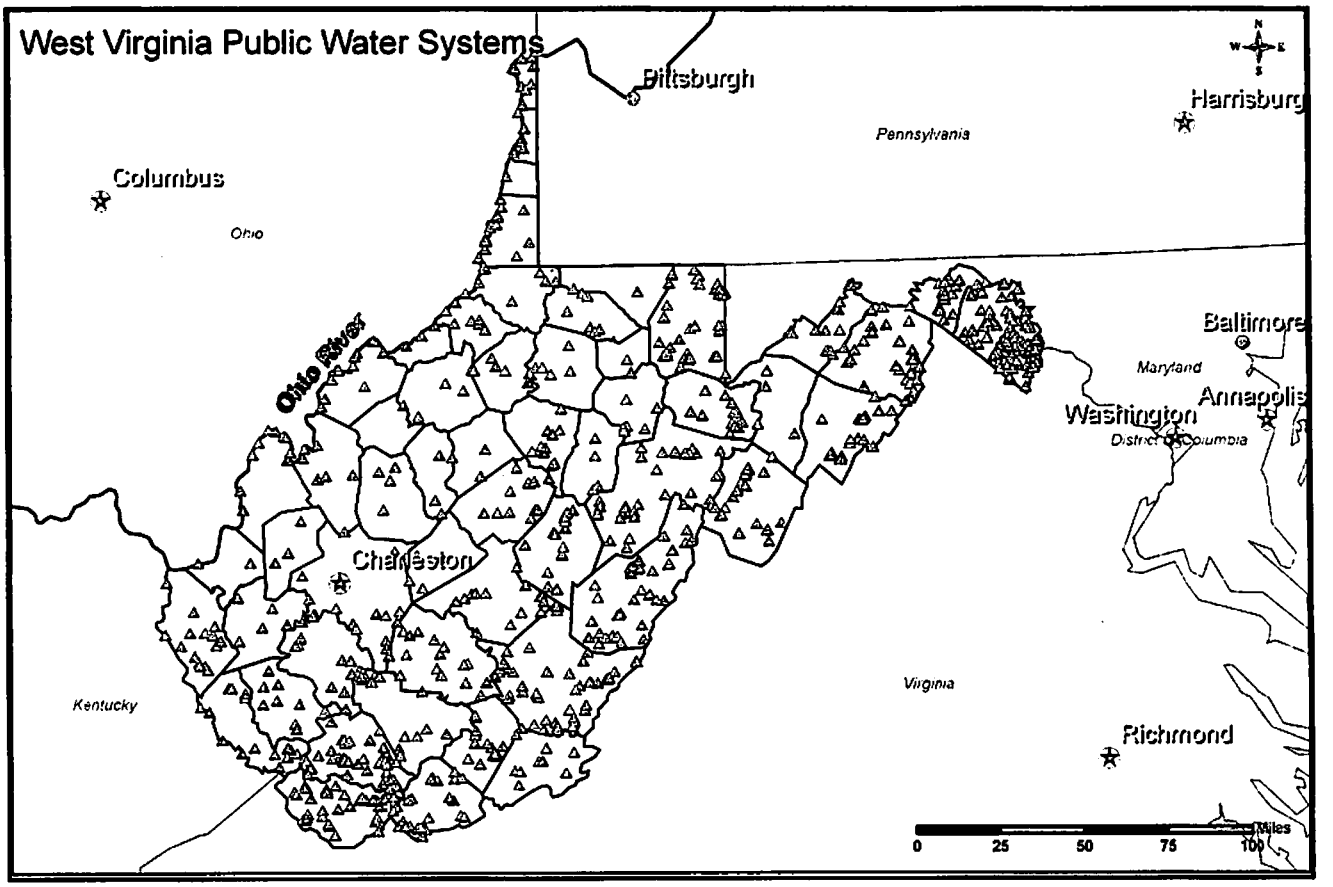
Groundwater Data Collection and Management

The WHP/SWAP programs acquire a variety of data, including locations and characteristics of public water supply sources, point of entry, potential contaminant sources, and description of watersheds, hydrogeologic settings, and aquifer parameters. This data continues to be collected through field data collection activities, contractor services, as well as programs within federal, state and local agencies.

Future Program Needs

West Virginia BPH to date has hired additional staff and spent a significant amount of time in developing the WHP/SWAP programs, creating a GIS for collection and storage of geologic/hydrologic data, the regulatory site data, delineations, and existing significant contaminant source inventories. Potential future Source Water Protection program needs are as follows:

- Pollution prevention technical assistance to small businesses located within wellhead protection areas to balance Brownfields redevelopment with local water protection/restoration efforts.
- Public education efforts such as groundwater components for natural resource curriculum for grades K-12.
- Continued groundwater quality monitoring to support activities mandated by the SDWA and the Clean Water Act.


West Virginia Public Water Systems
Pittsburgh
Harrisburg
Pennsylvania
Columbus
Ohio
Ohio River
Baltimore
Maryland
Annapolis
Washington
District of Columbia
Charleston
Kentucky
Virginia
Richmond
0
25
50
75
100
Miles

Appendix A
Regulatory Agencies with Groundwater Responsibility and Authority

Department of Agriculture

1900 Kanawha Blvd., E.
Charleston, WV 25305
(304) 558-3708

Department of Environmental Protection

601 57th Street, SE
Charleston, WV 25304

Office of Oil and Gas
(304) 926-0450

Division of Land Restoration
(304) 926-0455

Division of Water and Waste Management
(304) 926-0495

Office of Information Technology
(304) 926- 0499, Ext. 1615

Department of Health and Human Resources

Capitol and Washington Sts.
1 Davis Square, Suite 200
Charleston, WV 25301

Office of Environmental Health Services
(304) 558-2981

Environmental Engineering Division
(304) 558-2981

Public Health Sanitation Division
(304) 558-2981

Appendix B

Division of Water and Waste Management - Groundwater Program, Department of Health and Human Resources - Office of Environmental Health Services, and the United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Data Tables From 2006

Note: Maximum contaminant levels are noted where such standards have been established for a particular parameter. Maximum contaminant levels are standards of quality and purity, established by the Environmental Quality Board in 46CSR12.

Appendix B (continued)

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia Data Tables

Key to the sampling sites- 2006

Site	County	Watersheds (Group A)	Geologic Unit	Geologic Age	Well Depth (feet)	Elevation (feet above mean sea level)
1	Kanawha	Upper Kanawha	KANAWHA FORMATION	Lower Pennsylvanian	300	420
2	Jefferson	Shenendoah	CONOCOCHEAGUE GROUP	Upper Cambrian	300	440
3	Jefferson	Shenendoah	CHILHOWEE GROUP	Lower Cambrian	655	615
4	Jefferson	Shenendoah	WAYNESBORO FORMATION	Upper Cambrian	300	940
5	Jefferson	Shenendoah	WAYNESBORO FORMATION	Middle Cambrian	70	670
6	Jefferson	Shenendoah	CONOCOCHEAGUE GROUP	Upper Cambrian	150	960
7	Hancock	Upper Ohio North	CONEMAUGH FORMATION	Upper Pennsylvanian	163	1170
8	Brooke	Upper Ohio North	HOLOCENE ALLUVIUM	Holocene	500	3000
9	Hancock	Upper Ohio North	CONEMAUGH FORMATION	Upper Pennsylvanian	160	2010
10	Hancock	Upper Ohio North	CONEMAUGH FORMATION	Upper Pennsylvanian	75	1770
11	Randolph	Cheat	GREENBRIER LIMESTONE	Mississippian	320	2270
12	Pendleton	So. Br. Potomac	TONOLOWAY LIMESTONE	Upper Silurian	324	1250
13	Pendleton	So. Br. Potomac	TONOLOWAY LIMESTONE	Upper Silurian	300	420
14	Pendleton	So. Br. Potomac	CHEMUNG FORMATION	Upper-Middle Devonian	300	440
15	Grant	So. Br. Potomac	TUSCARORA SANDSTONE	Lower Silurian	655	615

Appendix B (continued)

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia Data Tables

Key to the sampling sites- 2006

Site	County	Watersheds (Group A)	Geologic Unit	Geologic Age	Well Depth (feet)	Elevation (feet above mean sea level)
16	Tucker	Cheat	GREENBRIER LIMESTONE	Mississippian	127	3210
17	Preston	Cheat	CHEMUNG FORMATION	Upper-Middle Devonian	15	1430
18	Tucker	Cheat	CHEMUNG FORMATION	Upper-Middle Devonian	60	1700
19	Preston	Cheat	CHEMUNG FORMATION	Upper-Middle Devonian	65	2310
20	Preston	Cheat	CONEMAUGH FORMATION	Upper Pennsylvanian	57	1560
21	Preston	Cheat	CONEMAUGH FORMATION	Upper Pennsylvanian	350	2200
22	Monongalia	Cheat	POTTSVILLE FORMATION	Pennsylvanian	190	2230
23	Fayette	Upper Kanawha	NEW RIVER FORMATION	Upper Pennsylvanian	21.25	1585
24	Hampshire	So. Br. Potomac	ORISKANY GROUP	Upper-Middle Devonian	240	710
25	Hampshire	So. Br. Potomac	MARCELLUS SHALE	Upper-Middle Devonian	230	820
26	Hampshire	So. Br. Potomac	MAHANTANGO FORMATION	Devonian	90	610
27	Hampshire	So. Br. Potomac	MARCELLUS SHALE	Upper-Middle Devonian	120	760
28	Hampshire	So. Br. Potomac	HOLOCENE ALLUVIUM	Holocene	23	670
29	Hampshire	So. Br. Potomac	MARCELLUS SHALE	Upper-Middle Devonian	300	830
30	Hampshire	So. Br. Potomac	MARCELLUS SHALE	Upper-Middle Devonian	122	820

Appendix B (continued)

Field Parameters sampling sites- Group A 2006

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Water Temp. (Deg C)	Barometric Pressure (mm of Hg)	Turbidity (NTU)	Specific Conductance (Us/Cm)	Water pH (Whole Field, Standard Units)	Dissolved Oxygen, (mg/L)
1	14	748	<1.0	636	6.9	2.1
2	14	743	<1.0	648	6.9	5.2
3	13.1	743	<1.0	507	6.9	6.4
4	13	734	<1.0	611	7.1	5.4
5	15.3	743	<1.0	788	6.9	3.5
6	11.6	733	<1.0	493	8.3	<1.0
7	11.8	729	<1.0	426	7.5	6
8	12.2	684	3.7	444	8.5	2.7
9	14	711	<1.0	624	6.8	4.4
10	12.9	712	74	381	7.1	5.7
11	13.3	699	<1.0	283	9.3	<1.0
12	14	717	<1.0	538	8.5	<1.0
13	10.5	677	1.2	367	6.3	3.2
14	11.6	729	1.9	215	5.8	12.6
15	11.2	720	<1.0	199	8.1	1.2
16	10.8	705	<1.0	96	4.5	6.4
17	13.8	721	<1.0	157	9.3	<1.0
18	11	702	<1.0	106	4.2	8
19	11.1	701	12	207	6.8	5.4
20	13.6	723	2.6	62	5.4	5.8
21	19.4	740	1.3	554	9.5	<1.0
22	13	742	2.9	577	8.5	<1.0
23	14.4	742	2.6	288	7.1	<1.0
24	13.7	744	2.8	374	7.4	<1.0
25	15.7	744	8	289	6.4	<1.0
26	14.4	743	4.5	414	7.5	<1.0
27	14.2	743	<1.0	220	7	<1.0
28	14	748	<1.0	636	6.9	2.1
29	14	743	<1.0	648	6.9	5.2
30	13.1	743	<1.0	507	6.9	6.4

Appendix B (continued)

Field Parameters, Acidity and Ions sampling sites- Group A 2006

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Total Coliform, (Colonies/ 100 ml) MCL= max. 5%/ month	Fecal Coliform, (Colonies/ 100 ml) MCL= 0	E. Coli (Colonies/ 100 ml)	Hardness Non-carbonate (mg/L as $CaCO_3$)	Acidity (mg/L as H^+)	CO_2 (mg/L)	Organic Carbon (mg/L)	Calcium (mg/L as Ca)
1	4	<1	<1	--	--	18	3.2	47
2	1000	11	27	106	--	97	0.7	140
3	<1	<1	<1	--	--	13	<.4	40.4
4	37	<1	<1	25	--	77	E.3	77
5	<1	<1	<1	75	--	61	E.3	93.3
6	<1	<1	<1	24	--	60	<.4	93.1
7	12	<1	<1	52	--	36	3.5	93.2
8	12	<1	<1	157	--	28	0.9	87.7
9	<1	<1	<1	--	--		6	51.5
10	6	<1	<1	24	--	10	E.4	49.6
11	26	<1	1	--	--	1.2	11.8	15.2
12	<1	<1	<1	26	--	69	E.3	80.2
13	39	<1	<1	12	--	26	0.7	64.8
14	1	<1	<1	--	--		0.7	17.9
15	<1	<1	<1	--	--	1.3	<.4	30.3
16	<1	<1	<1	--	0.001		1	67.1
17	53	<1	2	9	0.002	77	0.5	9.61
18	<1	<1	<1	--	--	1	<.4	16
19	<1	<1	<1	--	0.032		0.9	5.24
20	<1	<1	<1	--	--		E.4	10.9
21	3	<1	<1	--	0.064		0.7	4.55
22	2	<1	<1	5		30	0.9	29
23	1600	15	15	--	0.004		0.5	4.19
24	7	<1	<1	--	--	0.2	--	29.9
25	<1	<1	<1	28	--	1.1	--	58.4
26	16	<1	<1	37	--	13	--	30.5
27	32	<1	<1	80	--	5.8	--	23.6
28	<1	<1	<1	10	--	40	--	11
29	<1	<1	<1	43	--	8.9	<.4	33.2
30	<1	<1	<1	5	--	15	E.4	7.22

MCL = Maximum Contaminant Level; E. = estimated

Appendix B (continued)

Acidity and Ions sampling sites- Group A 2006

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Magnesium, (mg/L as Mg)	Sodium (mg/L as Na)	Potassium, (mg/L as K)	Bicarbonate (mg/L as HCO_3)	Carbonate (mg/L as CO_3)	Alkalinity (mg/L as $CaCO_3$)
1	17.6	220	220	268	<1	220
2	16.9	16.9	16.9	366	<1	300
3	4	11.8	11.8	158	<1	130
4	36.5	6.3	6.3	376	<1	308
5	22.5	8.7	8.7	300	<1	246
6	8.52	3	3	280	<1	230
7	12.7	18.3	18.3	261	<1	214
8	12.8	49.2	49.2	171	<1	140
9	11.2	35.8	35.8	283	<1	232
10	16.5	17.8	17.8	211	<1	173
11	1.72	81.5	81.5	261	<1	214
12	12	26.2	26.2	262	<1	215
13	4.59	9.3	9.3	189	<1	155
14	5.19	34.6	34.6	144	<1	118
15	11.3	70.9	70.9	268	<1	220
16	5.96	4.1	4.1	260	<1	213
17	2.43	27.4	27.4	42	<1	34
18	1.94	22.4	22.4	88	<1	73
19	1.24	6.9	6.9	<1	<1	<1
20	3.73	16.7	16.7	97	<1	79
21	4.26	4.2	4.2	1	<1	1
22	7.27	3	3	121	<1	99
23	2.6	2.2	2.2	9	<1	7
24	7.38	91	91	329	<1	270
25	15.5	48.6	48.6	227	<1	186
26	10.7	12	12	102	<1	84
27	23.4	12.1	12.1	101	<1	83
28	8.52	29.8	29.8	82	<1	67
29	25.8	13	13	173	<1	142
30	15.6	8.7	8.7	102	<1	84

MCL = Maximum Contaminant Level; SWDR = Secondary Drinking Water Reg. E. = estimated

Appendix B (continued)

Acidity and Ions sampling sites- Group A 2006

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Sulfate (mg/L as SO^{-}_{4})	Chloride (mg/L as Cl) SWDR = 250 mg/L	Fluoride (mg/L as F) SWDR = 2.0 mg/L	Bromide (mg/L as Br)	Total Dissolved Solids Residue At 180 Deg. C (mg/L)	Total Solids Residue at 105 Deg. C, (mg/L)
1	132	225	0.3	0.93	818	813
2	50.7	44.7	0.4	0.03	518	533
3	7.9	2.33	0.1	0.03	163	168
4	23.5	8.84	0.3	E.01	364	375
5	38.6	30.5	0.6	0.02	388	394
6	11.9	6.78	0.2	0.02	290	306
7	36.4	29.6	0.2	0.15	371	387
8	124	98.4	0.6	0.13	473	510
9	34.1	31	0.3	0.04	282	283
10	50.6	6.19	0.3	E.02	257	251
11	0.3	28.7	0.4	0.2	346	287
12	5.5	58.2	0.1	0.02	342	372
13	9	10.9	E.1	<.02	228	274
14	13.1	7.3	0.1	0.08	169	182
15	12.7	29.9	0.5	0.33	314	319
16	11.5	14	E.1	<.02	215	235
17	17	36.2	<.1	E.01	123	116
18	10.2	15.7	0.1	0.11	126	113
19	20.2	10.7	E.1	E.02	57	54
20	0.4	4.75	E.1	0.03	99	97
21	22	7.5	E.1	0.04	60	66
22	6.6	2.7	0.1	E.02	121	149
23	12.5	1.63	<.1	E.01	47	46
24	13.9	4.88	0.4	0.06	338	344
25	93	16.6	E.1	0.18	355	376
26	42.7	9.93	0.1	0.07	176	192
27	82.9	12.7	E.1	0.18	248	247
28	57.1	11	<.1	0.16	175	180
29	75.7	1.06	0.1	0.02	263	276
30	25.4	3.84	0.2	<.02	141	151

MCL = Maximum Contaminant Level; SWDR = Secondary Drinking Water Reg. E. = estimated

Appendix B (continued)

Acidity and Ions sampling sites- Group A 2006

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Nitrogen, Nitrite (mg/L as N)	Total Nitrogen, NO_2+NO_3 (mg/L as N)	Nitrogen, Ammonia (mg/L as N)	Nitrogen, Ammonia (mg/L as Nh_4)	Nitrogen, (mg/L as N)	Ortho-Phosphate (mg/L)
	MCL = 1.0 mg/L	MCL = 10 mg/L				
1	<.008	0.16	0.07	0.09	0.26	--
2	<.008	7.27	<.04	--	7.48	--
3	<.008	0.15	<.04	--	0.18	--
4	<.008	2.26	<.04	--	2.2	--
5	<.008	3.01	<.04	--	3.06	0.346
6	<.008	3.47	<.04	--	3.36	--
7	<.008	3.37	<.04	--	3.45	--
8	<.008	1.44	0.06	0.07	1.61	--
9	<.008	<.06	0.17	0.21	0.27	--
10	<.008	1.07	<.04	--	1.1	--
11	E.004	<.06	<.04	--	1.6	2.54
12	<.008	2.02	<.04	--	2.12	0.021
13	<.008	1.81	<.04	--	1.97	--
14	<.008	<.06	0.14	0.18	0.2	0.107
15	<.008	<.06	0.18	0.23	1.55	--
16	<.008	0.58	<.04	--	0.61	--
17	<.008	0.75	<.04	--	0.8	--
18	<.008	<.06	<.04	--	<.06	0.025
19	<.008	0.51	<.04	--	0.57	
20	<.008	<.06	0.14	0.19	0.18	0.209
21	<.008	2.56	<.04	--	2.52	--
22	<.008	0.12	<.04	--	0.13	--
23	<.002	0.95	<.010	--	1.05	--
24	<.002	<.06	0.387	0.5	0.47	0.117
25	<.002	<.06	0.199	0.26	0.23	0.044
26	<.002	<.06	0.129	0.17	0.38	--
27	E.001	<.06	0.102	0.13	0.1	--
28	<.002	<.06	0.041	0.05	0.08	0.104
29	<.002	<.06	0.106	0.14	0.09	0.034
30	<.002	<.06	0.052	0.07	E.03	0.028

MCL = Maximum Contaminant Level; E. = estimated

Appendix B (continued)

Ions and Metals sampling sites- Group A 2006

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Ortho-Phosphate, (mg/L as P)	Phosphorus (mg/L as P)	Aluminum, (µg/L as Al)	Antimony, (µg/L as Sb)	Arsenic (µg/L as As)	Barium (µg/L as Ba)
			SWDR = Max. 200 µg/L	MCL = 6 µg/L	MCL = 10 µg/L	MCL = 2000 µg/L
1	<.006	E.004	E1	<.2	0.5	52
2	E.004	<.02	<2	<.2	0.14	89
3	E.003	<.02	<2	<.2	1.7	129
4	<.006	E.003	3	<.2	0.23	124
5	0.113	0.121	E1	<.2	1.1	48
6	<.006	E.003	<2	<.2	E.10	85
7	<.006	E.002	14	<.2	0.49	235
8	<.006	E.004	<2	<.2	0.25	39
9	E.004	0.021	<2	<.2	0.19	132
10	<.006	E.002	69	<.2	0.23	63
11	0.828	0.74	27	E.2	6	140
12	0.007	0.009	<2	<.2	E.08	108
13	<.006	0.047	2110	<.2	0.95	67
14	0.035	0.04	3	<.2	3.5	663
15	<.006	0.01	E1	<.2	43.2	341
16	E.005	0.009	5	<.2	0.38	183
17	E.003	0.006	16	<.2	0.13	36
18	0.008	0.011	E1	<.2	0.16	503
19	<.006	<.004	476	<.2	0.12	113
20	0.068	0.07	E2	<.2	1.3	1300
21	<.006	E.003	295	<.2	0.14	192
22	E.003	0.025	468	E.1	2.4	74
23	E.005	E.004	67	<.2	E.10	37
24	0.038	0.041	<2	<.2	0.18	7430
25	0.014	0.028	19	<.2	0.4	72
26	E.005	0.026	<2	<.2	0.85	249
27	<.006	0.115	4	<.2	E.06	32
28	0.034	0.105	12	<.2	6.2	31
29	0.011	0.029	2	<.2	E.08	41
30	0.009	0.16	<2	<.2	1.6	62

MCL = Maximum Contaminant Level; SWDR = Secondary Drinking Water Reg. E. = estimated

Appendix B (continued)

Metals sampling sites- Group A 2006

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Beryllium, (µg/L as Be)	Cadmium (µg/L as Cd)	Chromium (µg/L)	Iron, (µg/L as Fe)	Lead, (µg/L as Pb)	Manganese, (µg/L as Mn)
	MCL = 4 µg/L	MCL = 5 µg/L	MCL = 100 µg/L	SWDR = 300 µg/L	MCL = 15 µg/L	SWDR = 50 µg/L
1	<.06	<.04	0.43	673	<.06	163
2	<.06	<.04	1.1	8	0.18	E.5
3	<.06	<.04	0.33	<6	<.06	10.1
4	<.06	<.04	0.35	14	<.06	0.8
5	<.06	E.03	0.46	67	0.15	3.2
6	<.06	<.04	1.1	<6	0.09	<.6
7	<.06	0.05	0.53	858	3.91	26.6
8	<.06	<.04	0.52	21	0.07	361
9	<.06	<.04	0.33	548	E.05	93.8
10	<.06	<.04	0.17	19	0.11	1.6
11	<.06	<.04	0.27	835	1.97	1060
12	<.06	<.04	0.4	7	0.24	<.6
13	0.11	0.09	1.4	2540	1.35	508
14	<.06	<.04	0.13	221	<.06	75.3
15	0.08	<.04	0.28	1490	<.06	176
16	<.06	E.02	0.32	1440	9.98	1.1
17	<.06	E.02	0.21	38	0.28	0.9
18	<.06	<.04	0.27	21	<.06	60.5
19	0.28	0.49	0.44	38	1.98	245
20	<.06	<.04	0.17	174	17.1	57.8
21	0.3	0.49	0.53	148	0.91	381
22	0.07	0.06	1.6	884	2.62	441
23	<.06	<.04	0.24	79	E.05	1.8
24	<.06	<.04	0.11	29	<.06	147
25	<.06	<.04	0.12	674	0.14	986
26	<.06	<.04	0.37	2960	0.18	606
27	<.06	<.04	0.04	9140	0.15	433
28	<.06	E.04	0.59	10300	0.33	307
29	<.06	<.04	0.13	578	0.14	135
30	0.09	<.04	0.12	5110	E.05	1120

MCL = Maximum Contaminant Level; SWDR = Secondary Drinking Water Reg. E. = estimated

Appendix B (continued)

Metals and Radionuclides sampling sites- Group A 2006

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Mercury (µg/L Hg)	Nickel, (µg/L as Ni)	Selenium, (µg/L as Se)	Thallium (µg/L as Th)	Zinc, (µg/L as Zn)	Radon (pCi/L)
	MCL = 2 µg/L		MCL = 50 µg/L	MCL = 2 µg/L	SWDR = 5000 µg/L	MCL = 300 pCi/L
1	<.01	1.55	1.4	<.2	E1	40
2	<.01	3.19	0.19	<.2	5	430
3	<.01	0.41	0.14	<.2	3	3330
4	<.01	1.55	0.28	<.2	E2	380
5	<.01	2.32	0.36	<.2	4	1110
6	<.01	1.17	0.14	<.2	134	480
7	<.01	1.71	0.2	<.2	419	2380
8	<.01	1.3	0.74	<.2	6	510
9	<.01	0.71	E.06	<.2	4	50
10	<.01	0.53	0.57	<.2	13	540
11	<.01	1.04	0.1	<.2	7	50
12	<.01	1.79	0.1	<.2	13	400
13	<.01	4.48	0.29	<.2	47	680
14	<.01	0.39	<.08	<.2	<2	40
15	<.01	7.41	<.08	<.2	5	1390
16	<.01	0.64	0.14	<.2	347	770
17	<.01	0.33	E.07	<.2	E1	630
18	<.01	E.12	<.08	<.2	3	120
19	<.01	6.93	0.12	<.2	43	1260
20	<.01	0.34	E.04	<.2	31	170
21	<.01	29.3	0.16	<.2	82	860
22	<.01	6.8	0.14	<.2	21	1430
23	<.01	0.72	0.25	<.2	3	190
24	<.01	2.04	1.1	<.2	3	30
25	<.01	2.37	0.79	<.2	30	40
26	<.01	0.85	<.08	<.2	7	70
27	<.01	0.91	<.08	<.2	10	40
28	<.01	3.71	<.08	<.2	46	430
29	<.01	0.37	<.08	<.2	15	30
30	<.01	1.8	<.08	<.2	10	60

MCL = Maximum Contaminant Level; SWDR = Secondary Drinking Water Reg.; E. = estimated

Appendix B (continued)

Volatile Organic Compounds sampling sites- Group A 2006

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	1,1,1, Trichloro-ethane (µg/l) MCL = 200 µg/L	1,1 Dichloro-ethane µg/L)	1-1 Dichloro-ethene µg/L) MCL = 7 µg/L	1,2-Di-Chloro-propane (µg/L) MCL = 5 µg/L	1,3-Di-Chloro-benzene (µg/L)	1,4, Di-Chloro-benzene (µg/L)
1	<.1	<.1	<.1	<.1	<.1	<.1
2	<.1	<.1	<.1	<.1	<.1	<.1
3	<.1	<.1	<.1	<.1	<.1	<.1
4	<.1	<.1	<.1	<.1	<.1	<.1
5	<.1	<.1	<.1	<.1	<.1	<.1
6	<.1	<.1	<.1	<.1	<.1	<.1
7	<.1	<.1	<.1	<.1	<.1	<.1
8	<.1	<.1	<.1	<.1	<.1	<.1
9	<.1	<.1	<.1	<.1	<.1	<.1
10	<.2	<.2	<.2	<.2	<.2	<.2
11	<.1	<.1	<.1	<.1	<.1	<.1
12	<.1	<.1	<.1	<.1	<.1	<.1
13	<.1	<.1	<.1	<.1	<.1	<.1
14	<.1	<.1	<.1	<.1	<.1	<.1
15	<.1	<.1	<.1	<.1	<.1	<.1
16	<.1	<.1	<.1	<.1	<.1	<.1
17	<.1	<.1	<.1	<.1	<.1	<.1
18	<.1	<.1	<.1	<.1	<.1	<.1
19	<.1	<.1	<.1	<.1	<.1	<.1
20	<.1	<.1	<.1	<.1	<.1	<.1
21	<.1	<.1	<.1	<.1	<.1	<.1
22	<.1	<.1	<.1	<.1	<.1	<.1
23	<.1	<.1	<.1	<.1	<.1	<.1
24	<.1	<.1	<.1	<.1	<.1	<.1
25	<.1	<.1	<.1	<.1	<.1	<.1
26	<.1	<.1	<.1	<.1	<.1	<.1
27	<.1	<.1	<.1	<.1	<.1	<.1
28	<.1	<.1	<.1	<.1	<.1	<.1
29	<.1	<.1	<.1	<.1	<.1	<.1
30	<.1	<.1	<.1	<.1	<.1	<.1

MCL = Maximum Contaminant Level

Appendix A (continued)

Volatile Organic Compounds sampling sites- Group A 2006

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	CFC-113 (µg/L)	CHBrC12 (µg/L)	Total Benzene (µg/L)	Chloro-benzene (µg/L)	Cis-1,2,Dichloro-ethylene (µg/L)	Dibromo-chloro-methane (µg/L)
			MCL = 5 µg/L		MCL = 70 µg/L	MCL = 80 µg/L
1	<.1	<.1	<.1	<.1	<.1	<.2
2	<.1	<.1	<.1	<.1	<.1	<.2
3	<.1	<.1	<.1	<.1	<.1	<.2
4	<.1	<.1	<.1	<.1	<.1	<.2
5	<.1	<.1	<.1	<.1	<.1	<.2
6	<.1	<.1	<.1	<.1	<.1	<.2
7	<.1	<.1	<.1	<.1	<.1	<.2
8	<.1	<.1	<.1	<.1	<.1	<.2
9	<.1	<.1	<.1	<.1	<.1	<.2
10	<.2	<.2	<.2	<.1	<.1	<.2
11	<.1	<.1	<.1	<.1	<.1	<.2
12	<.1	<.1	<.1	<.1	<.1	<.2
13	<.1	<.1	<.1	<.1	<.1	<.2
14	<.1	<.1	<.1	<.1	<.1	<.2
15	<.1	<.1	<.1	<.2	<.2	<.4
16	<.1	<.1	<.1	<.1	<.1	<.2
17	<.1	<.1	<.1	<.1	<.1	<.2
18	<.1	<.1	<.1	<.1	<.1	<.2
19	<.1	<.1	<.1	<.1	<.1	<.2
20	<.1	<.1	<.1	<.1	<.1	<.2
21	<.1	<.1	<.1	<.1	<.1	<.2
22	<.1	<.1	<.1	<.1	<.1	<.2
23	<.1	<.1	<.1	<.1	<.1	<.2
24	<.1	<.1	<.1	<.1	<.1	<.2
25	<.1	<.1	<.1	<.1	<.1	<.2
26	<.1	<.1	<.1	<.1	<.1	<.2
27	<.1	<.1	<.1	<.1	<.1	<.2
28	<.1	<.1	<.1	<.1	<.1	<.2
29	<.1	<.1	<.1	<.1	<.1	<.2
30	<.1	<.1	<.1	<.1	<.1	<.2

MCL = Maximum Contaminant Level

Appendix B (continued)

Volatile Organic Compounds sampling sites- Group A 2006

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	CFC-12, (µg/L)	Dichloro-methane (µg/L)	Diethyl ether (µg/L)	Di-isopropyl ether (µg/L)	Ethyl benzene (µg/L)	Methyl pentyl ether (µg/L)
		MCL = 5 µg/L			MCL = 700 µg/L	
1	<.2	<.2	<.2	<.2	<.1	<.2
2	<.2	<.2	<.2	<.2	<.1	<.2
3	<.2	<.2	<.2	<.2	<.1	<.2
4	<.2	<.2	<.2	<.2	<.1	<.2
5	<.2	<.2	<.2	<.2	<.1	<.2
6	<.2	<.2	<.2	<.2	<.1	<.2
7	<.2	<.2	<.2	<.2	<.1	<.2
8	<.2	<.2	<.2	<.2	<.1	<.2
9	<.2	<.2	<.2	<.2	<.1	<.2
10	<.2	<.2	<.2	<.2	<.1	<.2
11	<.2	<.2	<.2	<.2	<.1	<.2
12	<.2	<.2	<.2	<.2	<.1	<.2
13	<.2	<.2	<.2	<.2	<.1	<.2
14	<.2	<.2	<.2	<.2	<.1	<.2
15	<.4	<.4	<.4	<.4	<.2	<.4
16	<.2	<.2	<.2	<.2	<.1	<.2
17	<.2	<.2	<.2	<.2	<.1	<.2
18	<.2	<.2	<.2	<.2	<.1	<.2
19	<.2	<.2	<.2	<.2	<.1	<.2
20	<.2	<.2	<.2	<.2	<.1	<.2
21	<.2	<.2	<.2	<.2	<.1	<.2
22	<.2	<.2	<.2	<.2	<.1	<.2
23	<.2	<.2	<.2	<.2	<.1	<.2
24	<.2	<.2	<.2	<.2	<.1	<.2
25	<.2	<.2	<.2	<.2	<.1	<.2
26	<.2	<.2	<.2	<.2	<.1	<.2
27	<.2	<.2	<.2	<.2	<.1	<.2
28	<.2	<.2	<.2	<.2	<.1	<.2
29	<.2	<.2	<.2	<.2	<.1	<.2
30	<.2	<.2	<.2	<.2	<.1	<.2

MCL = Maximum Contaminant Level

Appendix B (continued)

Volatile Organic Compounds sampling sites- Group A 2006

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	m, + p - Xylene (µg/L)	o-Xylene (µg/L)	Styrene (µg/L)	t-Butyl ethyl ether (µg/L)	MTBE (µg/L)
	MCL total xylenes = 10,000 µg/L		MCL = 100 µg/L		MCL = 20 µg/L
1	<.2	<.1	<.1	<.1	<.2
2	<.2	<.1	<.1	<.1	<.2
3	<.2	<.1	<.1	<.1	<.2
4	<.2	<.1	<.1	<.1	<.2
5	<.2	<.1	<.1	<.1	<.2
6	<.2	<.1	<.1	<.1	<.2
7	<.2	<.1	<.1	<.1	<.2
8	<.2	<.1	<.1	<.1	<.2
9	<.2	<.1	<.1	<.1	<.2
10	<.2	<.1	<.1	<.1	<.2
11	<.2	<.1	<.1	<.1	<.2
12	<.2	<.1	<.1	<.1	<.2
13	<.2	<.1	<.1	<.1	<.2
14	<.2	<.1	<.1	<.1	<.2
15	<.4	<.2	<.2	<.2	<.4
16	<.2	<.1	<.1	<.1	<.2
17	<.2	<.1	<.1	<.1	<.2
18	<.2	<.1	<.1	<.1	<.2
19	<.2	<.1	<.1	<.1	<.2
20	<.2	<.1	<.1	<.1	<.2
21	<.2	<.1	<.1	<.1	<.2
22	<.2	<.1	<.1	<.1	<.2
23	<.2	<.1	<.1	<.1	<.2
24	<.2	<.1	<.1	<.1	<.2
25	<.2	<.1	<.1	<.1	<.2
26	<.2	<.1	<.1	<.1	<.2
27	<.2	<.1	<.1	<.1	<.2
28	<.2	<.1	<.1	<.1	<.2
29	<.2	<.1	<.1	<.1	<.2
30	<.2	<.1	<.1	<.1	<.2

MCL = Maximum Contaminant Level

Appendix B (continued)

Volatile Organic Compounds sampling sites- Group A 2006

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Tetrachloro-ethene (µg/L)	Tetrachloro methane (µg/L)	Toluene (µg/L)	trans-1,2-Dichloro-ethene (µg/L)	Tribromo-methane (µg/L)
	MCL = 5 µg/L		MCL = 1000 µg/L	MCL = 100 µg/L	
1	<.1	<.2	<.1	<.1	<.2
2	<.1	<.2	<.1	<.1	<.2
3	<.1	<.2	<.1	<.1	<.2
4	<.1	<.2	<.1	<.1	<.2
5	<.1	<.2	<.1	<.1	<.2
6	<.1	<.2	<.1	<.1	<.2
7	<.1	<.2	<.1	<.1	<.2
8	3	<.2	<.1	<.1	<.2
9	<.1	<.2	<.1	<.1	<.2
10	<.1	<.2	<.1	<.1	<.2
11	<.1	<.2	<.1	<.1	<.2
12	<.1	<.2	<.1	<.1	<.2
13	<.1	<.2	<.1	<.1	<.2
14	<.1	<.2	<.1	<.1	<.2
15	<.2	<.4	<.2	<.2	<.4
16	<.1	<.2	<.1	<.1	<.2
17	<.1	<.2	<.1	<.1	<.2
18	<.1	<.2	<.1	<.1	<.2
19	<.1	<.2	<.1	<.1	<.2
20	<.1	<.2	<.1	<.1	<.2
21	<.1	<.2	<.1	<.1	<.2
22	<.1	<.2	<.1	<.1	<.2
23	<.1	<.2	<.1	<.1	<.2
24	<.1	<.2	<.1	<.1	<.2
25	<.1	<.2	<.1	<.1	<.2
26	<.1	<.2	<.1	<.1	<.2
27	<.1	<.2	<.1	<.1	<.2
28	<.1	<.2	<.1	<.1	<.2
29	<.1	<.2	<.1	<.1	<.2
30	<.1	<.2	<.1	<.1	<.2

MCL = Maximum Contaminant Level

Appendix B (continued)

Volatile Organic Compounds sampling sites- Group A 2006

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Trichloroethene (µg/L)	CFC-11 (µg/L)	Trichloromethane (µg/L)	Vinyl chloride (µg/L)
				MCL = 2 µg/L
1	<.1	<.2	<.1	<.2
2	<.1	<.2	<.1	<.2
3	<.1	<.2	<.1	<.2
4	<.1	<.2	<.1	<.2
5	<.1	<.2	<.1	<.2
6	<.1	<.2	<.1	<.2
7	<.1	<.2	<.1	<.2
8	0.5	<.2	0.6	<.2
9	<.1	<.2	<.1	<.2
10	<.1	<.2	<.1	<.2
11	<.1	<.2	<.1	<.2
12	<.1	<.2	<.1	<.2
13	<.1	<.2	<.1	<.2
14	<.1	<.2	<.1	<.2
15	<.2	<.4	<.2	<.4
16	<.1	<.2	0.2	<.2
17	<.1	<.2	<.1	<.2
18	<.1	<.2	<.1	<.2
19	<.1	<.2	<.1	<.2
20	<.1	<.2	<.1	<.2
21	<.1	<.2	<.1	<.2
22	<.1	<.2	<.1	<.2
23	<.1	<.2	<.1	<.2
24	<.1	<.2	<.1	<.2
25	<.1	<.2	<.1	<.2
26	<.1	<.2	<.1	<.2
27	<.1	<.2	<.1	<.2
28	<.1	<.2	<.1	<.2
29	<.1	<.2	<.1	<.2
30	<.1	<.2	<.1	<.2

MCL = Maximum Contaminant Level

Appendix B (continued)

Semi- Volatile Organic Compounds sampling sites- Group A 2006

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	1,2 Diphenyl hydrate (µg/L)	2,4,6-Trichloro phenol (µg/L)	2,4-Dichloro phenol (µg/L)	2,4, Dimethyl phenol (µg/L)	2,4,Dinitro phenol (µg/L)	2,4,Dinitro-toluene (µg/L)
1	--	--	--	--	--	--
2	--	--	--	--	--	--
3	--	--	--	--	--	--
4	<.30	<.31	<.39	<.4	<.80	<.43
5	--	--	--	--	--	--
6	--	--	--	--	--	--
7	--	--	--	--	--	--
8	<.30	<.31	<.39	<.4	<.80	<.43
9	--	--	--	--	--	--
10	--	--	--	--	--	--
11	--	--	--	--	--	--
12	--	--	--	--	--	--
13	--	--	--	--	--	--
14	--	--	--	--	--	--
15	--	--	--	--	--	--
16	--	--	--	--	--	--
17	--	--	--	--	--	--
18	--	--	--	--	--	--
19	--	--	--	--	--	--
20	--	--	--	--	--	--
21	--	--	--	--	--	--
22	--	--	--	--	--	--
23	--	--	--	--	--	--
24	--	--	--	--	--	--
25	--	--	--	--	--	--
26	--	--	--	--	--	--
27	--	--	--	--	--	--
28	--	--	--	--	--	--
29	--	--	--	--	--	--
30	--	--	--	--	--	--

Appendix B (continued)

Semi- Volatile Organic Compounds sampling sites- Group A 2006

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	2,6, Dinitro-toluene (µg/L)	2-Chloro-naphthalene (µg/L)	2-Chloro-phenol (µg/L)	2-Nitro-phenol (µg/L)	3,3, Di-chloro-benzidine (µg/L)
1	--	--	--	--	--
2	--	--	--	--	--
3	--	--	--	--	--
4	<.43	<.38	<.42	<.30	<.65
5	--	--	--	--	--
6	--	--	--	--	--
7	--	--	--	--	--
8	<.43	<.38	<.42	<.30	<.65
9	--	--	--	--	--
10	--	--	--	--	--
11	--	--	--	--	--
12	--	--	--	--	--
13	--	--	--	--	--
14	--	--	--	--	--
15	--	--	--	--	--
16	--	--	--	--	--
17	--	--	--	--	--
18	--	--	--	--	--
19	--	--	--	--	--
20	--	--	--	--	--
21	--	--	--	--	--
22	--	--	--	--	--
23	--	--	--	--	--
24	--	--	--	--	--
25	--	--	--	--	--
26	--	--	--	--	--
27	--	--	--	--	--
28	--	--	--	--	--
29	--	--	--	--	--
30	--	--	--	--	--

Appendix B (continued)

Semi- Volatile Organic Compounds sampling sites- Group A 2006

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	4-Bromo-diphenyl (µg/L)	4-Chloro-methylphylene (µg/L)	4-Chloro-diphenyl (µg/L)	4-Nitrophenol (µg/L)	9 H-Fluorene, (µg/L)	Acenaphthene (µg/L)
1	--	--	--	--	--	--
2	--	--	--	--	--	--
3	--	--	--	--	--	--
4	<.36	<.55	<.34	<.51	<.33	<.28
5	--	--	--	--	--	--
6	--	--	--	--	--	--
7	--	--	--	--	--	--
8	<.36	<.55	<.34	<.51	<.33	<.28
9	--	--	--	--	--	--
10	--	--	--	--	--	--
11	--	--	--	--	--	--
12	--	--	--	--	--	--
13	--	--	--	--	--	--
14	--	--	--	--	--	--
15	--	--	--	--	--	--
16	--	--	--	--	--	--
17	--	--	--	--	--	--
18	--	--	--	--	--	--
19	--	--	--	--	--	--
20	--	--	--	--	--	--
21	--	--	--	--	--	--
22	--	--	--	--	--	--
23	--	--	--	--	--	--
24	--	--	--	--	--	--
25	--	--	--	--	--	--
26	--	--	--	--	--	--
27	--	--	--	--	--	--
28	--	--	--	--	--	--
29	--	--	--	--	--	--
30	--	--	--	--	--	--

Appendix B (continued)

Semi- Volatile Organic Compounds sampling sites- Group A 2006

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Ace-naphthylene (µg/L)	Anthracene (µg/L)	Benzo(a) - anthracene (µg/L)	Benzo(a) - pyrene (µg/L) MCL = 0.2 µg/L	Benzo(b) fluoranthene (µg/L)	Benzo(ghi) perylene (µg/L)
1	--	--	--	--	--	--
2	--	--	--	--	--	--
3	--	--	--	--	--	--
4	<.30	<.39	<.26	<.33	<.40	<.64
5	--	--	--	--	--	--
6	--	--	--	--	--	--
7	--	--	--	--	--	--
8	<.30	<.39	<.26	<.33	<.40	<.64
9	--	--	--	--	--	--
10	--	--	--	--	--	--
11	--	--	--	--	--	--
12	--	--	--	--	--	--
13	--	--	--	--	--	--
14	--	--	--	--	--	--
15	--	--	--	--	--	--
16	--	--	--	--	--	--
17	--	--	--	--	--	--
18	--	--	--	--	--	--
19	--	--	--	--	--	--
20	--	--	--	--	--	--
21	--	--	--	--	--	--
22	--	--	--	--	--	--
23	--	--	--	--	--	--
24	--	--	--	--	--	--
25	--	--	--	--	--	--
26	--	--	--	--	--	--
27	--	--	--	--	--	--
28	--	--	--	--	--	--
29	--	--	--	--	--	--
30	--	--	--	--	--	--

MCL = Maximum Contaminant Level

Appendix B (continued)

Semi- Volatile Organic Compounds sampling sites- Group A 2006

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Benzo(k)-fluoranthene (µg/L)	Butylbenzyl phthalate (µg/L)	2-Chloro-ethoxymethyl (µg/L)	2-Chloro-ethylether (µg/L)	Chloro-isopropylene (µg/L)	2-Ethylhexyl phthalate (µg/L)
1	--	--	--	--	--	--
2	--	--	--	--	--	--
3	--	--	--	--	--	--
4	<.45	<1	<.35	<.30	<.38	<1
5	--	--	--	--	--	--
6	--	--	--	--	--	--
7	--	--	--	--	--	--
8	<.45	<1	<.35	<.30	<.38	<1
9	--	--	--	--	--	--
10	--	--	--	--	--	--
11	--	--	--	--	--	--
12	--	--	--	--	--	--
13	--	--	--	--	--	--
14	--	--	--	--	--	--
15	--	--	--	--	--	--
16	--	--	--	--	--	--
17	--	--	--	--	--	--
18	--	--	--	--	--	--
19	--	--	--	--	--	--
20	--	--	--	--	--	--
21	--	--	--	--	--	--
22	--	--	--	--	--	--
23	--	--	--	--	--	--
24	--	--	--	--	--	--
25	--	--	--	--	--	--
26	--	--	--	--	--	--
27	--	--	--	--	--	--
28	--	--	--	--	--	--
29	--	--	--	--	--	--
30	--	--	--	--	--	--

Appendix B (continued)

Semi- Volatile Organic Compounds sampling sites- Group A 2006

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	2-Ethylhexyl phthalate (µg/L)	Chrysene (µg/L)	Dibenz (ah) anthrazine (µg/L)	Diethyl phthalate (µg/L)	Dimethyl phthalate (µg/L)
1	--	--	--	--	--
2	--	--	--	--	--
3	--	--	--	--	--
4	<1	<.33	<.70	<.61	<.59
5	--	--	--	--	--
6	--	--	--	--	--
7	--	--	--	--	--
8	<1	<.33	<.70	<.61	<.59
9	--	--	--	--	--
10	--	--	--	--	--
11	--	--	--	--	--
12	--	--	--	--	--
13	--	--	--	--	--
14	--	--	--	--	--
15	--	--	--	--	--
16	--	--	--	--	--
17	--	--	--	--	--
18	--	--	--	--	--
19	--	--	--	--	--
20	--	--	--	--	--
21	--	--	--	--	--
22	--	--	--	--	--
23	--	--	--	--	--
24	--	--	--	--	--
25	--	--	--	--	--
26	--	--	--	--	--
27	--	--	--	--	--
28	--	--	--	--	--
29	--	--	--	--	--
30	--	--	--	--	--

Appendix B (continued)

Semi- Volatile Organic Compounds sampling sites- Group A 2006

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Dibutyl phthalate (µg/L)	Dioctyl phthalate (µg/L)	Fluoranthene (µg/L)	Hexachloro - benzene (µg/L)	Hexachloro-cyclopentadiene (µg/L)
				MCL = 1 µg/L	MCL = 50 µg/L
1	--	--	--	--	--
2	--	--	--	--	--
3	--	--	--	--	--
4	<.87	<2	<.30	<.30	<.52
5	--	--	--	--	--
6	--	--	--	--	--
7	--	--	--	--	--
8	<.87	<2	<.30	<.30	<.52
9	--	--	--	--	--
10	--	--	--	--	--
11	--	--	--	--	--
12	--	--	--	--	--
13	--	--	--	--	--
14	--	--	--	--	--
15	--	--	--	--	--
16	--	--	--	--	--
17	--	--	--	--	--
18	--	--	--	--	--
19	--	--	--	--	--
20	--	--	--	--	--
21	--	--	--	--	--
22	--	--	--	--	--
23	--	--	--	--	--
24	--	--	--	--	--
25	--	--	--	--	--
26	--	--	--	--	--
27	--	--	--	--	--
28	--	--	--	--	--
29	--	--	--	--	--
30	--	--	--	--	--

MCL = Maximum Contaminant Level

Appendix B (continued)

Semi- Volatile Organic Compounds sampling sites- Group A 2006

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Indeno-pyrene (µg/L)	Isophorone (µg/L)	Nitro-benzene (µg/L)	Nitrosodi-methylate (µg/L)	Nitrosodi-propylate (µg/L)	Nitrosodi-phenylate (µg/L)
1	--	--	--	--	--	--
2	--	--	--	--	--	--
3	--	--	--	--	--	--
4	<.56	<.60	<.21	<.33	<.82	<.81
5	--	--	--	--	--	--
6	--	--	--	--	--	--
7	--	--	--	--	--	--
8	<.56	<.60	<.21	<.33	<.82	<.81
9	--	--	--	--	--	--
10	--	--	--	--	--	--
11	--	--	--	--	--	--
12	--	--	--	--	--	--
13	--	--	--	--	--	--
14	--	--	--	--	--	--
15	--	--	--	--	--	--
16	--	--	--	--	--	--
17	--	--	--	--	--	--
18	--	--	--	--	--	--
19	--	--	--	--	--	--
20	--	--	--	--	--	--
21	--	--	--	--	--	--
22	--	--	--	--	--	--
23	--	--	--	--	--	--
24	--	--	--	--	--	--
25	--	--	--	--	--	--
26	--	--	--	--	--	--
27	--	--	--	--	--	--
28	--	--	--	--	--	--
29	--	--	--	--	--	--
30	--	--	--	--	--	--

Appendix B (continued)

Semi- Volatile Organic Compounds sampling sites- Group A 2006

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Phenol (µg/L)	Pyrene (µg/L)	Trichloro-benzene (µg/L)	Hexachloro-butadine (µg/L)	Pentachloro phenol (µg/L) MCL = 1 µg/L	Phenanthrene (µg/L)
1	--	--	--	--	--	--
2	--	--	--	--	--	--
3	--	--	--	--	--	--
4	<.4	<.35	<.41	<.46	<.87	M
5	--	--	--	--	--	--
6	--	--	--	--	--	--
7	--	--	--	--	--	--
8	<.4	<.35	<.41	<.46	<.87	<.32
9	--	--	--	--	--	--
10	--	--	--	--	--	--
11	--	--	--	--	--	--
12	--	--	--	--	--	--
13	--	--	--	--	--	--
14	--	--	--	--	--	--
15	--	--	--	--	--	--
16	--	--	--	--	--	--
17	--	--	--	--	--	--
18	--	--	--	--	--	--
19	--	--	--	--	--	--
20	--	--	--	--	--	--
21	--	--	--	--	--	--
22	--	--	--	--	--	--
23	--	--	--	--	--	--
24	--	--	--	--	--	--
25	--	--	--	--	--	--
26	--	--	--	--	--	--
27	--	--	--	--	--	--
28	--	--	--	--	--	--
29	--	--	--	--	--	--
30	--	--	--	--	--	--

MCL = Maximum Contaminant Level

Appendix B (continued)

Semi- Volatile Organic Compounds and Pesticides sampling sites- Group A 2006

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Hexachloro-ethane (µg/L)	Naphthalene (µg/L)	2,6,Diethyl-aniline (µg/L)	CIAT (µg/L)	Acetochlor (µg/L)	Alachlor (µg/L) MCL = 2 µg/L
1	--	--	--	--	--	--
2	--	--	<.006	E.152	<.006	<.005
3	--	--	--	--	--	--
4	<.66	<.32	--	--	--	--
5	--	--	<.006	E.007	<.006	<.005
6	--	--	<.006	E.100	<.006	<.005
7	--	--	<.006	<.014	<.006	<.005
8	<.66	<.32	--	--	--	--
9	--	--	--	--	--	--
10	--	--	--	--	--	--
11	--	--	--	--	--	--
12	--	--	--	--	--	--
13	--	--	--	--	--	--
14	--	--	--	--	--	--
15	--	--	--	--	--	--
16	--	--	--	--	--	--
17	--	--	--	--	--	--
18	--	--	--	--	--	--
19	--	--	--	--	--	--
20	--	--	--	--	--	--
21	--	--	--	--	--	--
22	--	--	--	--	--	--
23	--	--	--	--	--	--
24	--	--	<.006	<.014	<.006	<.005
25	--	--	<.006	<.014	<.006	<.005
26	--	--				
27	--	--	<.006	<.014	<.006	<.005
28	--	--				
29	--	--	<.006	<.014	<.006	<.005
30	--	--				

MCL = Maximum Contaminant Level E. = estimated

Appendix B (continued)

Pesticides sampling sites-Group A 2006

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	alpha-HCH (µg/L)	Atrazine (µg/L) MCL = 3 µg/L	Azinphos-methyl (µg/L)	Benfluralin (µg/L)	Butylate (µg/L)	Carbaryl (µg/L)
1	--	--	--	--	--	--
2	<.005	0.085	<.050	<.010	<.004	<.041
3	--	--	--	--	--	--
4	--	--	--	--	--	--
5	<.005	E.004	<.050	<.010	<.004	<.041
6	<.005	0.051	<.050	<.010	<.004	<.041
7	<.005	<.007	<.050	<.010	<.004	<.041
8	--	--	--	--	--	--
9	--	--	--	--	--	--
10	--	--	--	--	--	--
11	--	--	--	--	--	--
12	--	--	--	--	--	--
13	--	--	--	--	--	--
14	--	--	--	--	--	--
15	--	--	--	--	--	--
16	--	--	--	--	--	--
17	--	--	--	--	--	--
18	--	--	--	--	--	--
19	--	--	--	--	--	--
20	--	--	--	--	--	--
21	--	--	--	--	--	--
22	--	--	--	--	--	--
23	--	--	--	--	--	--
24	<.005	<.007	<.050	<.010	<.004	<.041
25	<.005	<.007	<.050	<.010	<.004	<.041
26	--	--	--	--	--	--
27	<.005	<.007	<.050	<.010	<.004	<.041
28	--	--	--	--	--	--
29	<.005	<.007	<.050	<.010	<.004	<.041
30	--	--	--	--	--	--

MCL = Maximum Contaminant Level

Appendix B (continued)

Pesticides sampling sites-Group A 2006

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Carbofuran (µg/L) MCL = 40 µg/L	Chlorpyrifos (µg/L)	cis-Permethrin (µg/L)	Cyanazine (µg/L)	DCPA (Dactal) (µg/L)	Desulfinyl fipro (µg/L)
1	--	--	--	--	--	--
2	<.020	<.005	<.006	<.018	<.003	<.012
3	--	--	--	--	--	--
4	--	--	--	--	--	--
5	<.020	<.005	<.006	<.018	<.003	<.012
6	<.020	<.005	<.006	<.018	<.003	<.012
7	<.020	<.005	<.006	<.018	<.003	<.012
8	--	--	--	--	--	--
9	--	--	--	--	--	--
10	--	--	--	--	--	--
11	--	--	--	--	--	--
12	--	--	--	--	--	--
13	--	--	--	--	--	--
14	--	--	--	--	--	--
15	--	--	--	--	--	--
16	--	--	--	--	--	--
17	--	--	--	--	--	--
18	--	--	--	--	--	--
19	--	--	--	--	--	--
20	--	--	--	--	--	--
21	--	--	--	--	--	--
22	--	--	--	--	--	--
23	--	--	--	--	--	--
24	<.020	<.005	<.006	<.018	<.003	<.012
25	<.020	<.005	<.006	<.018	<.003	<.012
26	--	--	--	--	--	--
27	<.020	<.005	<.006	<.018	<.003	<.012
28	--	--	--	--	--	--
29	<.020	<.005	<.006	<.018	<.003	<.012
30	--	--	--	--	--	--

MCL = Maximum Contaminant Level

Appendix B (continued)

Pesticides sampling sites-Group A 2006

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Diazinon (µg/L)	Dieldrin (µg/L)	Disulfoton (µg/L)	EPTC (µg/L)	Ethalfluralin (µg/L)	Ethoprop (µg/L)
1	--	--	--	--	--	--
2	<.005	<.009	<.02	<.004	<.009	<.012
3	--	--	--	--	--	--
4	--	--	--	--	--	--
5	<.005	<.009	<.02	<.004	<.009	<.012
6	<.005	<.009	<.02	<.004	<.009	<.012
7	<.005	<.009	<.02	<.004	<.009	<.012
8	--	--	--	--	--	--
9	--	--	--	--	--	--
10	--	--	--	--	--	--
11	--	--	--	--	--	--
12	--	--	--	--	--	--
13	--	--	--	--	--	--
14	--	--	--	--	--	--
15	--	--	--	--	--	--
16	--	--	--	--	--	--
17	--	--	--	--	--	--
18	--	--	--	--	--	--
19	--	--	--	--	--	--
20	--	--	--	--	--	--
21	--	--	--	--	--	--
22	--	--	--	--	--	--
23	--	--	--	--	--	--
24	<.005	<.009	<.02	<.004	<.009	<.012
25	<.005	<.009	<.02	<.004	<.009	<.012
26	--	--	--	--	--	--
27	<.005	<.009	<.02	<.004	<.009	<.012
28	--	--	--	--	--	--
29	<.005	<.009	<.02	<.004	<.009	<.012
30	--	--	--	--	--	--

Appendix B (continued)

Pesticides sampling sites-Group A 2006

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Desulf-fipronil (µg/L)	Fipronil sulfide (µg/L)	Fipronil sulfone (µg/L)	Fipronil (µg/L)	Fonofos (µg/L)	Lindane (µg/L) MCL = 0.2 µg/L
1	--	--	--	--	--	--
2	<.029	<.013	<.024	<.016	<.005	<.004
3	--	--	--	--	--	--
4	--	--	--	--	--	--
5	<.029	<.013	<.024	<.016	<.005	<.004
6	<.029	<.013	<.024	<.016	<.005	<.004
7	<.029	<.013	<.024	<.016	<.005	<.004
8	--	--	--	--	--	--
9	--	--	--	--	--	--
10	--	--	--	--	--	--
11	--	--	--	--	--	--
12	--	--	--	--	--	--
13	--	--	--	--	--	--
14	--	--	--	--	--	--
15	--	--	--	--	--	--
16	--	--	--	--	--	--
17	--	--	--	--	--	--
18	--	--	--	--	--	--
19	--	--	--	--	--	--
20	--	--	--	--	--	--
21	--	--	--	--	--	--
22	--	--	--	--	--	--
23	--	--	--	--	--	--
24	<.029	<.013	<.024	<.016	<.005	<.004
25	<.029	<.013	<.024	<.016	<.005	<.004
26	--	--	--	--	--	--
27	<.029	<.013	<.024	<.016	<.005	<.004
28	--	--	--	--	--	--
29	<.029	<.013	<.024	<.016	<.005	<.004
30	--	--	--	--	--	--

MCL = Maximum Contaminant Level

Appendix B (continued)

Pesticides sampling sites-Group A 2006

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Linuron (µg/L)	Malathion (µg/L)	Methyl parathion (µg/L)	Metolachlor (µg/L)	Metribuzin sencor (µg/L)	Molinate (µg/L)
1	--	--	--	--	--	--
2	<.035	<.027	<.015	0.549	<.028	<.003
3	--	--	--	--	--	--
4	--	--	--	--	--	--
5	<.035	<.027	<.015	<.006	<.028	<.003
6	<.035	<.027	<.015	<.006	<.028	<.003
7	<.035	<.027	<.015	<.006	<.028	<.003
8	--	--	--	--	--	--
9	--	--	--	--	--	--
10	--	--	--	--	--	--
11	--	--	--	--	--	--
12	--	--	--	--	--	--
13	--	--	--	--	--	--
14	--	--	--	--	--	--
15	--	--	--	--	--	--
16	--	--	--	--	--	--
17	--	--	--	--	--	--
18	--	--	--	--	--	--
19	--	--	--	--	--	--
20	--	--	--	--	--	--
21	--	--	--	--	--	--
22	--	--	--	--	--	--
23	--	--	--	--	--	--
24	<.035	<.027	<.015	<.006	<.028	<.003
25	<.035	<.027	<.015	<.006	<.028	<.003
26	--	--	--	--	--	--
27	<.035	<.027	<.015	<.006	<.028	<.003
28	--	--	--	--	--	--
29	<.035	<.027	<.015	<.006	<.028	<.003
30	--	--	--	--	--	--

Appendix B (continued)

Pesticides sampling sites-Group A 2006

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Napropamide (µg/L)	p,p'-DDE (µg/L)	Parathion (µg/L)	Pebulate (µg/L)	Pendimethalin (µg/L)	Phorate (µg/L)
1	--	--	--	--	--	--
2	<.007	<.003	<.010	<.004	<.022	<.055
3	--	--	--	--	--	--
4	--	--	--	--	--	--
5	<.007	<.003	<.010	<.004	<.022	<.055
6	<.007	<.003	<.010	<.004	<.022	<.055
7	<.007	<.003	<.010	<.004	<.022	<.055
8	--	--	--	--	--	--
9	--	--	--	--	--	--
10	--	--	--	--	--	--
11	--	--	--	--	--	--
12	--	--	--	--	--	--
13	--	--	--	--	--	--
14	--	--	--	--	--	--
15	--	--	--	--	--	--
16	--	--	--	--	--	--
17	--	--	--	--	--	--
18	--	--	--	--	--	--
19	--	--	--	--	--	--
20	--	--	--	--	--	--
21	--	--	--	--	--	--
22	--	--	--	--	--	--
23	--	--	--	--	--	--
24	<.007	<.003	<.010	<.004	<.022	<.055
25	<.007	<.003	<.010	<.004	<.022	<.055
26	--	--	--	--	--	--
27	<.007	<.003	<.010	<.004	<.022	<.055
28	--	--	--	--	--	--
29	<.007	<.003	<.010	<.004	<.022	<.055
30	--	--	--	--	--	--

Appendix B (continued)

Pesticides sampling sites-Group A 2006

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Prometon (µg/L)	Propyzamide (µg/L)	Propachlor (µg/L)	Propanil (µg/L)	Propargite (µg/L)	Simazine (µg/L) MCL = 4 µg/L
1	--	--	--	--	--	--
2	<.01	<.004	<.010	<.011	<.02	0.022
3	--	--	--	--	--	--
4	--	--	--	--	--	--
5	<.01	<.004	<.010	<.011	<.02	<.005
6	<.01	<.004	<.010	<.011	<.02	0.015
7	<.01	<.004	<.010	<.011	<.02	<.005
8	--	--	--	--	--	--
9	--	--	--	--	--	--
10	--	--	--	--	--	--
11	--	--	--	--	--	--
12	--	--	--	--	--	--
13	--	--	--	--	--	--
14	--	--	--	--	--	--
15	--	--	--	--	--	--
16	--	--	--	--	--	--
17	--	--	--	--	--	--
18	--	--	--	--	--	--
19	--	--	--	--	--	--
20	--	--	--	--	--	--
21	--	--	--	--	--	--
22	--	--	--	--	--	--
23	--	--	--	--	--	--
24	<.01	<.004	<.010	<.011	<.02	<.005
25	<.01	<.004	<.010	<.011	<.02	<.005
26	--	--	--	--	--	--
27	<.01	<.004	<.010	<.011	<.02	<.005
28	--	--	--	--	--	--
29	<.01	<.004	<.010	<.011	<.02	<.005
30	--	--	--	--	--	--

MCL = Maximum Contaminant Level

Appendix B (continued)

Pesticides sampling sites-Group A 2006

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Tebuthiuron (µg/L)	Terbacil (µg/L)	Terbufos (µg/L)	Thiobencarb (µg/L)	Triallate (µg/L)	Trifluralin (µg/L)
1	--	--	--	--	--	--
2	<.02	<.034	<.02	<.010	<.006	<.009
3	--	--	--	--	--	--
4	--	--	--	--	--	--
5	<.02	<.034	<.02	<.010	<.006	<.009
6	<.02	<.034	<.02	<.010	<.006	<.009
7	<.02	<.034	<.02	<.010	<.006	<.009
8	--	--	--	--	--	--
9	--	--	--	--	--	--
10	--	--	--	--	--	--
11	--	--	--	--	--	--
12	--	--	--	--	--	--
13	--	--	--	--	--	--
14	--	--	--	--	--	--
15	--	--	--	--	--	--
16	--	--	--	--	--	--
17	--	--	--	--	--	--
18	--	--	--	--	--	--
19	--	--	--	--	--	--
20	--	--	--	--	--	--
21	--	--	--	--	--	--
22	--	--	--	--	--	--
23	--	--	--	--	--	--
24	<.02	<.034	<.02	<.010	<.006	<.009
25	<.02	<.034	<.02	<.010	<.006	<.009
26	--	--	--	--	--	--
27	<.02	<.034	<.02	<.010	<.006	<.009
28	--	--	--	--	--	--
29	<.02	<.034	<.02	<.010	<.006	<.009
30	--	--	--	--	--	--

Appendix C

Division of Water and Waste Management - Groundwater Program, Department of Health and Human Resources - Office of Environmental Health Services, and the United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Data Tables From 2007

Note: Maximum contaminant levels are noted where such standards have been established for a particular parameter. Maximum contaminant levels are standards of quality and purity, established by the Environmental Quality Board in 46CSR12.

Appendix C (continued)

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia Data Tables

Key to the sampling sites- 2007

Site	County	Watersheds (Group B)	Geologic Unit	Geologic Age	Depth of Sample (feet)	Elevation (feet above mean sea level)
1	Kanawha	Lower Kanawha	Pottsville Formation	Lower Pennsylvanian		975
2	Kanawha	Lower Kanawha	Pottsville Formation	Lower Pennsylvanian	28.25	760
3	Kanawha	Elk	Monongahela Formation	Upper Pennsylvanian	101.23	900
4	Jackson	Lower Kanawha	Monongahela Formation	Upper Pennsylvanian		690
5	Preston	Tygart Valley	Conemaugh Formation	Upper Pennsylvanian	23.25	1370
6	Randolph	Tygart Valley	Pottsville Formation	Lower Pennsylvanian	36.8	2710
7	Preston	Tygart Valley	Allegheny Formation	Middle Pennsylvanian	23.3	1240
8	Randolph	Tygart Valley	Pottsville Formation	Lower Pennsylvanian	20.82	2160
9	Boone	Coal	Kanawha Formation	Lower Pennsylvanian		950
10	Boone	Coal	Kanawha Formation	Lower Pennsylvanian		700
11	Boone	Coal	Kanawha Formation	Lower Pennsylvanian		755
12	Lincoln	Coal	Kanawha Formation	Lower Pennsylvanian		685
13	Kanawha	Coal	Kanawha Formation	Lower Pennsylvanian		665
14	Raleigh	Coal	Kanawha Formation	Lower Pennsylvanian		915
15	Boone	Coal	Kanawha Formation	Lower Pennsylvanian		1200

Appendix C (continued)

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia Data Tables

Key to the sampling sites- 2007

Site	County	Watersheds (Group B)	Geologic Unit	Geologic Age	Depth of Sample (feet)	Elevation (feet above mean sea level)
16	Mineral	North Branch Potomac	Marcellus Shale	Upper-Middle Devonian	22.96	780
17	Mineral	North Branch Potomac	Monongahela Formation	Upper Pennsylvanian		2040
18	Mineral	North Branch Potomac	Conemaugh Formation	Upper Pennsylvanian		1530
19	Mineral	North Branch Potomac	Marcellus Shale	Upper-Middle Devonian		960
20	Grant	North Branch Potomac	Conemaugh Formation	Upper Pennsylvanian	8.05	2890
21	Mineral	North Branch Potomac	Tonoloway And Wills Creek Formations	Upper Silurian		880
22	Clay	Elk	Pottsville Formation	Lower Pennsylvanian		935
23	Webster	Elk	Kanawha Formation	Lower Pennsylvanian	32.88	1500
24	Randolph	Elk	Greenbrier Limestone	Lower Mississippian	2.15	2250
25	Randolph	Tygart Valley	Kanawha Formation	Lower Pennsylvanian	12.42	2190
26	Upshur	Tygart Valley	Kanawha Formation	Lower Pennsylvanian	15.7	2250
27	Webster	Elk	Kanawha Formation	Lower Pennsylvanian		1280
28	Webster	Elk	Kanawha Formation	Lower Pennsylvanian		1270
29	Webster	Elk	Bluefield Formation	Upper Mississippian	11.2	1820
30	Webster	Elk	Kanawha Formation	Lower Pennsylvanian		2650

Appendix C (continued)

Field Parameters sampling sites-Group B 2007

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Water Temp. (Deg C)	Barometric Pressure (mm of Hg)	Turbidity (NTU)	Specific Conductance (Us/Cm)	Water pH (Whole Field, Standard Units)	Dissolved Oxygen, (mg/L)
1	13	735	<1.0	240	7.5	0.8
2	13.6	740	5.1	367	8.2	1.3
3	13.9	736	6.9	381	7.9	5.7
4	13.4	741	<1.0	1130	10	0.8
5	15.1	725	<1.0	553	8.5	0.9
6	11.3	692	<1.0	114	5.7	6.2
7	13.2	734	<1.0	445	7.9	0.6
8	11.5	710	<1.0	140	7.3	0.8
9	14.5	748	<1.0	266	9.4	0.5
10	14.8	751	<1.0	484	8.8	0.5
11	14.9	749	1.3	360	8.3	0.5
12	12.6	750	190	2340	7.7	7.8
13	14.5	749	<1.0	319	8.4	0.6
14	14.7	741	2	483	8.8	0.5
15	20.4	729	1	588	8	2.2
16	16.2	748	20	711	9.6	0.6
17	14.8	714	2.8	1520	7.2	2.3
18	8.6	722	19	312	7	6.1
19	15.5	732	<1.0	380	7.4	2
20	13.6	682	6.4	29	4.7	5.6
21	13.4	749	<1.0	806	7.4	2.3
22	13.1	740	<1.0	125	7.7	0.5
23	13.8	715	<1.0	117	6.9	0.6
24	12.3	695	7.7	143	7.7	3.8
25	11.5	704	<1.0	189	7.1	1
26	14.9	701	12	40	5.2	2.6
27	13.9	731	<1.0	192	6.7	0.6
28	13.9	732	<1.0	180	7	0.6
29	11.6	718	<1.0	209	7.4	1
30	13.8	696	28	89	6.3	2.5

Appendix C (continued)

Field Parameters, Bacteria, Acidity, and Ions sampling sites- Group B 2007

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Total Coliform, (Colonies/ 100 ml) MCL= max. 5%/ month	Fecal Coliform, (Colonies/ 100 ml) MCL= 0	E. Coli (Colonies/ 100 ml)	Hardness Noncarb. (mg/L as $CaCO_3$)	CO_2 (mg/L)	Acidity (mg/L as H^+)	Calcium (mg/L as Ca)
1	<1	<1	<1	--	6.9	0.00003	31.5
2	<1	<1	<1	--	2.3	0.00001	11.3
3	13	<1	<1	--	4.8	0.00001	20.9
4	<1	<1	<1	--	0.1	M	1.67
5	<1	<1	<1	--	1	M	45.5
6	8	<1	<1	--	--	0.00201	10.5
7	<1	<1	<1	--	--	0.00001	34.4
8	<1	<1	<1	0	5.4	0.00005	15.2
9	<1	<1	<1	--	0.1	M	13.3
10	<1	<1	<1	--	0.5	M	23.2
11	<1	<1	<1	--	1.5	0.00001	19.5
12	<1	<1	<1	174	4	0.00002	79.4
13	8	<1	<1	--	1.2	M	16
14	<1	<1	<1	--	0.5	M	31.3
15	<1	<1	<1	--	4.8	0.00001	1.09
16	<1	<1	<1	--	0.1	M	0.78
17	<1	<1	<1	824	21	0.00006	286
18	8	1	1	104	7.6	0.0001	39
19	8	<1	<1	34	13	0.00004	58.5
20	12	<1	<1	--	--	0.02011	1.78
21	2	<1	<1	218	17	0.00004	103
22	<1	<1	<1	--	2.4	0.00002	8.62
23	<1	<1	<1	--	9.1	0.00013	8.71
24	250	20	34	1	2.3	0.00002	18.8
25	<1	<1	<1	--	9.7	0.00008	10.3
26	980	2	1	8	99	0.00636	3.84
27	<1	<1	<1	3	22	0.0002	17.5
28	<1	<1	<1	--	8.6	0.0001	10.1
29	<1	<1	<1	--	7.2	0.00004	12.4
30	440	<1	<1	--	36	0.00051	9.38

MCL = Maximum Contaminant Level; M = measured, not quantified

Appendix C (continued)

Acidity and Ions - sampling sites- Group B 2007

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Magnesium (mg/L as Mg)	Sodium (mg/L as Na)	Potassium (mg/L as K)	Bicarbonate (mg/L as HCO_3)	Carbonate (mg/L as CO_3)	Alkalinity (mg/L as $CaCO_3$)
1	0.28	6.4	1.88	148	<1	121
2	9.5	68.4	1.64	226	<1	185
3	8.5	62.5	1.28	248	<1	203
4	5.4	251	0.86	542	<1	445
5	3.1	52.7	4.19	178	<1	146
6	1.6	11.1	0.7	22	<1	18
7	2.4	52.6	2.27	223	<1	183
8	2.6	3.1	2.75	68	<1	56
9	12	41.4	1.83	154	<1	126
10	39	68.9	2.58	205	<1	168
11	36	54.3	1.96	195	<1	160
12	17	475	5.09	134	<1	110
13	23	50.6	1.81	186	<1	153
14	15	55.7	3.24	199	<1	163
15	15	134	0.67	285	<1	234
16	0.25	161	0.44	408	<1	335
17	10	4.8	6.96	249	<1	204
18	3.4	5.3	1.41	52	<1	42
19	6.7	5.3	0.7	205	<1	168
20	2.4	0.6	0.53	8	<1	6
21	4.4	8.7	2.57	244	<1	200
22	11	10.9	1.63	74	<1	61
23	0.14	4.1	1.27	63	<1	52
24	10	4.5	0.53	70	<1	58
25	7.9	21	1.4	84	<1	69
26	7.5	0.5	0.69	7	<1	6
27	3.6	10.1	1.77	79	<1	65
28	3.6	7.4	1.03	99	<1	81
29	7.9	28.3	0.91	107	<1	88
30	0.32	0.8	0.78	44	<1	36

Appendix C (continued)

Acidity and Ions - sampling sites- Group B 2007

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Sulfate (mg/L as SO^{-}_{4})	Chloride (mg/L as Cl) SWDR = 250 mg/L	Fluoride (mg/L as F) SWDR = 2.0 mg/L	Bromide (mg/L as Br)	Total Dissolved Solids Residue At 180 Deg. C (mg/L)	Total Solids Residue at 105 Deg. C, (mg/L)
1	8.06	3.81	0.14	0.03	179	160
2	<.18	9.63	0.38	0.04	248	226
3	17.6	2.78	0.43	E.02	282	261
4	2.2	92.8	3.58	0.48	678	663
5	30.2	64.5	0.24	0.03	320	309
6	10.4	16.6	<.10	<.02	87	93
7	19.4	20.5	0.34	0.03	257	260
8	13	1.3	0.12	<.02	85	82
9	1.26	9.8	0.25	0.04	153	--
10	<.18	49.6	0.3	0.2	271	282
11	<.18	27.6	0.28	0.1	219	211
12	38.3	736	0.17	2.7	1390	1690
13	2.98	12.5	0.28	0.08	194	175
14	18	38.6	0.1	0.1	267	266
15	0.26	44.7	0.54	0.16	340	332
16	36.6	6.51	0.86	0.09	435	466
17	767	7.61	0.24	0.04	1350	1370
18	95.8	7.69	E.09	0.02	201	209
19	32.4	2.84	0.1	0.03	243	234
20	6.38	1.14	<.10	0.02	19	28
21	191	27.2	0.17	0.12	551	564
22	2.97	1.86	0.23	E.02	76	76
23	<.18	5.84	E.07	E.02	66	69
24	8.44	2.92	0.16	<.02	86	94
25	0.32	15.3	0.13	0.03	103	102
26	7.6	0.42	<.10	<.02	31	36
27	5.43	15.9	E.09	E.02	115	107
28	E.13	12.3	0.13	0.03	104	99
29	12.7	5.97	0.14	0.05	131	122
30	3.31	1.12	E.08	<.02	55	69

SWDR = Secondary Drinking Water Reg.; E. = estimated

Appendix C (continued)

Acidity and Ions sampling sites-Group B 2007

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Nitrogen, Nitrite (mg/L as N)	Total Nitrogen, NO_2+NO_3 (mg/L as N)	Nitrogen, Ammonia (mg/L as N)	Nitrogen, Ammonia (mg/L as Nh_4)	Nitrogen, (mg/L as N)	Ortho-Phosphate (mg/L)
	MCL = 1.0 mg/L	MCL = 10 mg/L				
1	<.002	<.06	0.723	0.93	0.78	0.418
2	<.002	<.06	0.555	0.71	0.6	0.325
3	<.002	0.22	<.020	--	0.3	0.09
4	<.002	<.06	0.1	0.13	0.14	0.186
5	<.002	<.06	0.949	1.22	1.03	0.042
6	<.002	0.35	<.020	--	0.39	--
7	<.002	<.06	0.355	--	0.36	--
8	<.002	<.06	0.276	0.36	0.29	0.053
9	<.002	<.06	0.328	0.42	0.37	0.155
10	E.001	<.06	0.633	0.81	0.65	0.15
11	E.001	<.06	0.442	0.57	0.47	0.252
12	<.002	<.06	1.03	1.33	1.7	--
13	<.002	<.06	0.37	0.48	0.4	0.313
14	<.002	<.06	0.49	0.63	0.54	0.102
15	<.002	<.06	0.093	0.12	0.15	0.483
16	<.002	<.06	0.135	0.17	0.47	0.076
17	<.002	<.06	2.76	3.56	2.84	--
18	<.002	0.89	E.010	--	0.93	--
19	<.002	0.42	<.020	--	0.43	0.065
20	<.002	0.24	<.020	--	0.28	--
21	<.002	0.68	<.020	--	0.71	--
22	<.002	<.06	0.13	0.17	0.15	0.066
23	E.001	<.06	0.154	0.2	0.17	--
24	<.002	0.37	<.020	--	0.43	--
25	<.002	<.06	0.233	0.3	0.26	0.044
26	<.002	0.83	<.020	--	0.86	--
27	<.002	<.06	0.134	0.17	0.12	0.019
28	0.004	<.06	1.17	1.5	1.2	0.697
29	<.002	0.11	E.018	--	0.15	0.055
30	<.002	<.06	E.019	--	<.06	--

MCL = Maximum Contaminant Level; E. = estimated

Appendix C (continued)

Ions and metals sampling sites-Group B 2007

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Ortho-Phosphate, (mg/L as P)	Phosphorus (mg/L as P)	Aluminum, (µg/L as Al)	Antimony, (µg/L as Sb)	Arsenic (µg/L as As)
			SWDR = Max. 200 µg/L	MCL = 6 µg/L	MCL = 10 µg/L
1	0.136	0.253	<2	<.2	0.6
2	0.106	0.131	13	<.2	E.18
3	0.029	0.042	101	E.2	11.5
4	0.061	0.065	3	<.2	3.2
5	0.014	0.016	<2	<.2	0.21
6	<.006	E.006	159	0.2	0.3
7	0.009	0.029	E2	<.2	<.20
8	0.017	0.068	9	<.2	<.20
9	0.051	0.05	E2	<.2	<.20
10	0.049	0.082	E1	<.2	E.10
11	0.082	0.116	E2	<.2	<.20
12	<.006	0.215	130	<.4	10.4
13	0.102	0.113	2	<.2	<.20
14	0.033	0.044	2	0.3	<.20
15	0.157	0.162	2	<.2	<.20
16	0.025	0.054	1720	5.6	11.2
17	E.004	<.008	E2	0.3	0.71
18	E.003	E.007	253	<.2	0.34
19	0.021	0.02	<2	<.2	0.45
20	E.004	E.006	254	<.2	0.21
21	E.005	<.008	E1	E.2	0.41
22	0.021	0.069	4	<.2	1.3
23	E.015	0.095	<2	<.2	<.20
24	E.006	0.009	132	0.2	1.1
25	0.014	0.086	<2	<.2	E.17
26	E.003	<.008	150	E.1	E.14
27	0.006	0.111	<2	<.2	<.20
28	0.227	0.38	4	<.2	4.9
29	0.018	0.018	7	<.2	1.5
30	-	0.168	18	<.2	0.72

MCL = Maximum Contaminant Level; SWDR = Secondary Drinking Water Reg.; E. = estimated

Appendix C (continued)

Metals sampling sites-Group B 2007

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Barium, (µg/L as Ba)	Beryllium, (µg/L as Be)	Cadmium (µg/L as Cd)	Chromium (µg/L)
	MCL = 2000 µg/L	MCL = 4 µg/L	MCL = 5 µg/L	MCL = 100 µg/L
1	407	E.03	<.02	<.60
2	274	E.03	E.01	<.60
3	104	<.06	0.02	<.60
4	35.4	<.06	0.02	<.60
5	1060	<.06	E.01	<.60
6	65.3	E.03	0.02	<.60
7	541	<.06	<.02	<.60
8	416	E.04	E.01	<.60
9	671	<.06	<.02	<.60
10	608	<.06	<.02	<.60
11	462	<.06	<.02	<.60
12	3080	E.10	<.04	8.2
13	320	E.03	<.02	<.60
14	1200	<.06	<.02	<.60
15	68.7	<.06	<.02	<.60
16	45.9	0.1	0.23	7.5
17	104	<.06	<.02	<.60
18	25.4	E.03	E.01	E.38
19	49.9	<.06	0.02	<.60
20	30.1	0.21	0.2	7.1
21	70.9	<.06	E.01	<.60
22	141	<.06	<.02	<.60
23	161	<.06	<.02	<.60
24	107	<.06	0.03	E.53
25	237	E.04	<.02	<.60
26	109	0.17	E.01	0.6
27	875	E.04	<.02	<.60
28	160	0.07	<.02	E.33
29	135	<.06	<.02	E.48
30	27.4	0.06	E.01	0.86

MCL = Maximum Contaminant Level; E. = estimated

Appendix C (continued)

Metals sampling sites-Group B 2007

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Iron, (µg/L as Fe)	Lead, (µg/L as Pb)	Manganese, (µg/L as Mn)	Mercury (µg/L as Hg)	Nickel, (µg/L as Ni)
	SWDR = 300 µg/L	MCL = 15 µg/L	SWDR = 50 µg/L	MCL = 2 µg/L	
1	4420	E.03	167	<.010	E.15
2	788	0.73	34.8	<.010	0.16
3	310	1.29	19.8	E.006	0.76
4	11	0.1	3.6	<.010	<.16
5	353	<.06	39.6	<.010	0.16
6	524	1.17	22.4	<.010	3.55
7	1070	E0.04	204	<.010	E0.11
8	3400	0.35	152	<.010	0.54
9	17	<.06	17.1	<.010	E.09
10	1100	0.38	151	<.010	E.09
11	1160	0.09	87.2	<.010	<.16
12	5770	1.37	303	<.010	8
13	1850	0.1	91.6	<.010	<.16
14	292	2.1	28.5	<.010	0.27
15	99	0.31	3.6	<.010	0.28
16	1250	4.24	23	<.010	5
17	478	0.51	445	<.010	3.4
18	319	0.33	16.7	<.010	1.5
19	E4	0.27	1	<.010	<.16
20	509	1.18	63.8	<.010	13.9
21	9	0.26	1.2	<.010	0.46
22	1640	<.06	65.9	<.010	0.33
23	8750	0.18	361	<.010	<.16
24	197	0.21	13.4	<.010	0.43
25	7410	<.06	320	<.010	<.16
26	338	9.29	22.3	<.010	4.6
27	6450	0.19	379	<.010	E.15
28	17100	<.06	256	<.010	0.22
29	16	0.21	9.8	<.010	E.12
30	9030	0.47	340	<.010	1.2

MCL = Maximum Contaminant Level; SWDR = Secondary Drinking Water Reg.; E. = estimated

Appendix C (continued)

Metals and Radionuclides sampling sites- Group B 2007

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Selenium, (µg/L as Se)	Thallium (µg/L as Th)	Zinc (µg/L as Zn)	Radon 222 (pCi/L)	Organic Carbon, (Mg/L as C)
	MCL = 50 µg/L	MCL = 2 µg/L	SWDR = 5000 µg/L	MCL = 300 pCi/L	
1	<.08	<.18	113	70	1.9
2	<.08	<.18	18.6	M	1.2
3	0.24	<.18	4	470	2
4	E.07	<.18	8.5	380	0.8
5	<.08	<.18	E1.2	150	1
6	0.2	<.18	9.4	300	0.6
7	0.3	<.18	4.2	170	0.47
8	<.08	<.18	2.5	60	E.3
9	0.11	<.18	E1.6	80	0.7
10	<.08	<.18	13.8	180	0.7
11	<.08	<.18	65.8	45	1
12	E.13	<.36	9810	30	4.8
13	<.08	<.18	2.1	70	1.2
14	<.08	<.18	132	20	0.9
15	<.08	<.18	50.8	100	1.1
16	0.1	<.18	4.4	20	1.1
17	0.17	<.18	4080	50	0.9
18	0.36	<.18	3.6	180	0.9
19	0.22	<.18	7.5	530	1
20	E.06	<.18	75.9	290	0.5
21	0.15	<.18	72.8	160	<.4
22	<.08	<.18	5.7	70	E.4
23	<.08	<.18	7.5	30	<.4
24	1.5	<.18	2	920	0.7
25	<.08	<.18	2.5	60	0.9
26	0.4	<.18	25.3	30	0.8
27	<.08	<.18	3.2	60	E.3
28	<.08	<.18	14.8	160	1.8
29	0.12	<.18	<2.0	1170	E.2
30	<.08	<.18	8.2	50	<.4

MCL = Maximum Contaminant Level; E. = estimated; SWDR = Secondary Drinking Water Reg.; M = measured, not quantified

Appendix C (continued)

Volatile Organic Compounds sampling sites - Group B 2007

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	1,1,1, Trichloro-ethane (µg/l)	1,1 Dichloro-ethene µg/L)	1,1 Dichloro-ethane µg/L)	1,2-Di-chloro-propane (µg/L)	Benzene (µg/L)	1,3-Di-chloro-benzene (µg/L)	1,4-Di-chloro-benzene (µg/L)
	MCL = 200 µg/L	MCL = 7 µg/L		MCL = 5 µg/L	MCL = 5 µg/L		
1	<.1	<.1	<.1	<.1	< 0.1	< 0.1	< 0.1
2	<.1	<.1	<.1	<.1	< 0.1	< 0.1	< 0.1
3	0.2	0.1	<.1	<.1	< 0.1	< 0.1	< 0.1
4	<.1	<.1	<.1	<.1	< 0.1	< 0.1	< 0.1
5	<.1	<.1	<.1	<.1	< 0.1	< 0.1	< 0.1
6	<.1	<.1	0.1	<.1	< 0.1	< 0.1	< 0.1
7	<.1	<.1	<.1	<.1	< 0.1	< 0.1	< 0.1
8	<.1	<.1	<.1	<.1	< 0.1	< 0.1	< 0.1
9	<.1	<.1	<.1	<.1	< 0.1	< 0.1	< 0.1
10	<.1	<.1	<.1	<.1	< 0.1	< 0.1	< 0.1
11	<.1	<.1	<.1	<.1	< 0.1	< 0.1	< 0.1
12	<.1	<.1	<.1	<.1	< 0.1	< 0.1	< 0.1
13	<.1	<.1	<.1	<.1	< 0.1	< 0.1	< 0.1
14	<.1	<.1	<.1	<.1	< 0.1	< 0.1	< 0.1
15	<.1	<.1	<.1	<.1	< 0.1	< 0.1	< 0.1
16	<.1	<.1	<.1	<.1	< 0.1	< 0.1	< 0.1
17	<.1	<.1	<.1	<.1	< 0.1	< 0.1	< 0.1
18	<.1	<.1	<.1	<.1	< 0.1	< 0.1	< 0.1
19	<.1	<.1	<.1	<.1	< 0.1	< 0.1	< 0.1
20	<.1	<.1	<.1	<.1	< 0.1	< 0.1	< 0.1
21	<.1	<.1	<.1	<.1	< 0.1	< 0.1	< 0.1
22	<.1	<.1	<.1	<.1	< 0.1	< 0.1	< 0.1
23	<.1	<.1	<.1	<.1	< 0.1	< 0.1	< 0.1
24	<.1	<.1	<.1	<.1	< 0.1	< 0.1	< 0.1
25	<.1	<.1	<.1	<.1	< 0.1	< 0.1	< 0.1
26	<.1	<.1	<.1	<.1	< 0.1	< 0.1	< 0.1
27	<.1	<.1	<.1	<.1	< 0.1	< 0.1	< 0.1
28	<.1	<.1	<.1	<.1	< 0.1	< 0.1	< 0.1
29	<.1	<.1	<.1	<.1	< 0.1	< 0.1	< 0.1
30	<.1	<.1	<.1	<.1	< 0.1	< 0.1	< 0.1

MCL = Maximum Contaminant Level

Appendix C (continued)

Volatile Organic Compounds sampling sites- Group B 2007

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Di-bromo-chloro-methane (µg/L)	Trichloro-ethene (µg/L)	Chloro-benzene (µg/L)	Di-Chloro-methane (µg/L)	1, 2-Dichloro-benzene (µg/L)	cis-1,2, -Di-chloroethene (µg/L) MCL = 7 µg/L
1	< 0.2	< 0.1	< 0.1	< 0.2	<.1	< 0.1
2	< 0.2	< 0.1	< 0.1	< 0.2	<.1	< 0.1
3	< 0.2	< 0.1	< 0.1	< 0.2	<.1	< 0.1
4	< 0.2	< 0.1	< 0.1	< 0.2	<.1	< 0.1
5	< 0.2	< 0.1	< 0.1	< 0.2	<.1	< 0.1
6	< 0.2	<0.1	< 0.1	< 0.2	<.1	< 0.1
7	< 0.2	< 0.1	< 0.1	< 0.2	<.1	< 0.1
8	< 0.2	< 0.1	< 0.1	< 0.2	<.1	< 0.1
9	< 0.2	< 0.1	< 0.1	< 0.2	<.1	< 0.1
10	< 0.2	< 0.1	< 0.1	< 0.2	<.1	< 0.1
11	< 0.2	< 0.1	< 0.1	< 0.2	<.1	< 0.1
12	< 0.2	< 0.1	< 0.1	< 0.2	<.1	< 0.1
13	< 0.2	< 0.1	< 0.1	< 0.2	<.1	< 0.1
14	< 0.2	< 0.1	< 0.1	< 0.2	<.1	< 0.1
15	1.5	< 0.1	< 0.1	< 0.2	<.1	< 0.1
16	< 0.2	< 0.1	< 0.1	< 0.2	<.1	< 0.1
17	< 0.2	< 0.1	< 0.1	< 0.2	<.1	< 0.1
18	< 0.2	< 0.1	< 0.1	< 0.2	<.1	< 0.1
19	< 0.2	< 0.1	< 0.1	< 0.2	<.1	< 0.1
20	< 0.2	< 0.1	< 0.1	< 0.2	<.1	< 0.1
21	< 0.2	< 0.1	< 0.1	< 0.2	<.1	< 0.1
22	< 0.2	< 0.1	< 0.1	< 0.2	<.1	< 0.1
23	< 0.2	< 0.1	< 0.1	< 0.2	<.1	< 0.1
24	< 0.2	< 0.1	< 0.1	< 0.2	<.1	< 0.1
25	< 0.2	< 0.1	< 0.1	< 0.2	<.1	< 0.1
26	< 0.2	< 0.1	< 0.1	< 0.2	<.1	< 0.1
27	< 0.2	< 0.1	< 0.1	< 0.2	<.1	< 0.1
28	< 0.2	< 0.1	< 0.1	< 0.2	<.1	< 0.1
29	< 0.2	< 0.1	< 0.1	< 0.2	<.1	< 0.1
30	< 0.2	< 0.1	< 0.1	< 0.2	<.1	< 0.1

MCL = Maximum Contaminant Level

Appendix C (continued)

Volatile Organic Compounds sampling sites- Group B 2007

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	1-2-Dichloro-ethane (µg/L) MCL = 5 µg/L	CFC-113 (µg/L)	CFC-11 (µg/L)	CFC-12 (µg/L)	Di-iso-propyl ether (µg/L)	Ethyl-benzene (µg/L) MCL = 700 µg/L	Diethyl etherl (µg/L)	Methyl pentyl ether (µg/L)
1	<.2	<.1	<.2	<.2	< 0.2	< 0.1	< 0.2	< 0.2
2	<.2	<.1	<.2	<.2	< 0.2	< 0.1	< 0.2	< 0.2
3	<.2	<.1	<.2	<.2	< 0.2	< 0.1	< 0.2	< 0.2
4	<.2	<.1	<.2	<.2	< 0.2	< 0.1	< 0.2	< 0.2
5	<.2	<.1	<.2	<.2	< 0.2	< 0.1	< 0.2	< 0.2
6	<.2	<.1	<.2	<.2	< 0.2	< 0.1	< 0.2	< 0.2
7	<.2	<.1	<.2	<.2	< 0.2	< 0.1	< 0.2	< 0.2
8	<.2	<.1	<.2	<.2	< 0.2	< 0.1	< 0.2	< 0.2
9	<.2	<.1	<.2	<.2	< 0.2	< 0.1	< 0.2	< 0.2
10	<.2	<.1	<.2	<.2	< 0.2	< 0.1	< 0.2	< 0.2
11	<.2	<.1	<.2	<.2	< 0.2	< 0.1	< 0.2	< 0.2
12	<.2	<.1	<.2	<.2	< 0.2	< 0.1	< 0.2	< 0.2
13	<.2	<.1	<.2	<.2	< 0.2	< 0.1	< 0.2	< 0.2
14	<.2	<.1	<.2	<.2	< 0.2	< 0.1	< 0.2	< 0.2
15	<.2	<.1	<.2	<.2	< 0.2	< 0.1	< 0.2	< 0.2
16	<.2	<.1	<.2	<.2	< 0.2	< 0.1	< 0.2	< 0.2
17	<.2	<.1	<.2	<.2	< 0.2	< 0.1	< 0.2	< 0.2
18	<.2	<.1	<.2	<.2	< 0.2	< 0.1	< 0.2	< 0.2
19	<.2	<.1	<.2	<.2	< 0.2	< 0.1	< 0.2	< 0.2
20	<.2	<.1	<.2	<.2	< 0.2	< 0.1	< 0.2	< 0.2
21	<.2	<.1	<.2	<.2	< 0.2	< 0.1	< 0.2	< 0.2
22	<.2	<.1	<.2	<.2	< 0.2	< 0.1	< 0.2	< 0.2
23	<.2	<.1	<.2	<.2	< 0.2	< 0.1	< 0.2	< 0.2
24	<.2	<.1	<.2	<.2	< 0.2	< 0.1	< 0.2	< 0.2
25	<.2	<.1	<.2	<.2	< 0.2	< 0.1	< 0.2	< 0.2
26	<.2	<.1	<.2	<.2	< 0.2	< 0.1	< 0.2	< 0.2
27	<.2	<.1	<.2	<.2	< 0.2	< 0.1	< 0.2	< 0.2
28	<.2	<.1	<.2	<.2	< 0.2	< 0.1	< 0.2	< 0.2
29	<.2	<.1	<.2	<.2	< 0.2	< 0.1	< 0.2	< 0.2
30	<.2	<.1	<.2	<.2	< 0.2	< 0.1	< 0.2	< 0.2

MCL = Maximum Contaminant Level

Appendix C (continued)

Volatile Organic Compounds sampling sites- Group B 2007

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	M + p-Xylene (µg/L)	o-Xylene (µg/L)	Tri-bromo-methane (µg/L)	Tetrachloro-methane (µg/L)	Methyl tertiary butyl ether (µg/L)	t-Butyl ethyl ether (µg/L)	Styrene (µg/L)
	MCL total xylenes = 10,000 µg/L				MCL = 20 µg/L		MCL = 100 µg/L
1	< 0.2	< 0.1	< 0.2	< 0.2	< 0.2	< 0.1	< 0.1
2	< 0.2	< 0.1	< 0.2	< 0.2	< 0.2	< 0.1	< 0.1
3	< 0.2	< 0.1	< 0.2	< 0.2	< 0.2	< 0.1	< 0.1
4	< 0.2	< 0.1	< 0.2	< 0.2	< 0.2	< 0.1	< 0.1
5	< 0.2	< 0.1	< 0.2	< 0.2	0.7	< 0.1	< 0.1
6	< 0.2	< 0.1	< 0.2	< 0.2	< 0.2	< 0.1	< 0.1
7	< 0.2	< 0.1	< 0.2	< 0.2	< 0.2	< 0.1	< 0.1
8	< 0.2	< 0.1	< 0.2	< 0.2	< 0.2	< 0.1	< 0.1
9	< 0.2	< 0.1	< 0.2	< 0.2	< 0.2	< 0.1	< 0.1
10	< 0.2	< 0.1	< 0.2	< 0.2	< 0.2	< 0.1	< 0.1
11	< 0.2	< 0.1	< 0.2	< 0.2	< 0.2	< 0.1	< 0.1
12	< 0.2	< 0.1	< 0.2	< 0.2	< 0.2	< 0.1	< 0.1
13	< 0.2	< 0.1	< 0.2	< 0.2	< 0.2	< 0.1	< 0.1
14	< 0.2	< 0.1	< 0.2	< 0.2	< 0.2	< 0.1	< 0.1
15	< 0.2	< 0.1	1.6	< 0.2	< 0.2	< 0.1	< 0.1
16	< 0.2	< 0.1	< 0.2	< 0.2	< 0.2	< 0.1	< 0.1
17	< 0.2	< 0.1	< 0.2	< 0.2	< 0.2	< 0.1	< 0.1
18	< 0.2	< 0.1	< 0.2	< 0.2	< 0.2	< 0.1	< 0.1
19	< 0.2	< 0.1	< 0.2	< 0.2	< 0.2	< 0.1	< 0.1
20	< 0.2	< 0.1	< 0.2	< 0.2	< 0.2	< 0.1	< 0.1
21	< 0.2	< 0.1	< 0.2	< 0.2	< 0.2	< 0.1	< 0.1
22	< 0.2	< 0.1	< 0.2	< 0.2	< 0.2	< 0.1	< 0.1
23	< 0.2	< 0.1	< 0.2	< 0.2	< 0.2	< 0.1	< 0.1
24	< 0.2	< 0.1	< 0.2	< 0.2	< 0.2	< 0.1	< 0.1
25	< 0.2	< 0.1	< 0.2	< 0.2	< 0.2	< 0.1	< 0.1
26	< 0.2	< 0.1	< 0.2	< 0.2	< 0.2	< 0.1	< 0.1
27	< 0.2	< 0.1	< 0.2	< 0.2	< 0.2	< 0.1	< 0.1
28	< 0.2	< 0.1	< 0.2	< 0.2	< 0.2	< 0.1	< 0.1
29	< 0.2	< 0.1	< 0.2	< 0.2	< 0.2	< 0.1	< 0.1
30	< 0.2	< 0.1	< 0.2	< 0.2	< 0.2	< 0.1	< 0.1

MCL = Maximum Contaminant Level

Appendix C (continued)

Volatile Organic Compounds - sampling sites- Group B 2007

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Tetrachloro-ethene (µg/L)	Toluene (µg/L)	CHBrCl2 (µg/L)	trans-1,2, Di-chloroethene (µg/L)	Trichloro-methane (µg/L)	Vinyl Chloride (µg/L)
	MCL = 5 µg/L	MCL = 1000 µg/L		MCL = 100 µg/L		MCL = 2 µg/L
1	< 0.1	< 0.1	<.1	< 0.1	<.1	< 0.2
2	< 0.1	< 0.1	0.1	< 0.1	2.8	< 0.2
3	< 0.1	< 0.1	<.1	< 0.1	<.1	< 0.2
4	< 0.1	< 0.1	<.1	< 0.1	<.1	< 0.2
5	< 0.1	< 0.1	<.1	< 0.1	0.1	< 0.2
6	< 0.1	< 0.1	<.1	< 0.1	<.1	< 0.2
7	< 0.1	< 0.1	<.1	< 0.1	<.1	< 0.2
8	< 0.1	< 0.1	<.1	< 0.1	<.1	< 0.2
9	< 0.1	< 0.1	<.1	< 0.1	<.1	< 0.2
10	< 0.1	< 0.1	<.1	< 0.1	<.1	< 0.2
11	< 0.1	< 0.1	<.1	< 0.1	<.1	< 0.2
12	< 0.1	< 0.1	<.1	< 0.1	<.1	< 0.2
13	< 0.1	< 0.1	<.1	< 0.1	<.1	< 0.2
14	< 0.1	< 0.1	<.1	< 0.1	<.1	< 0.2
15	< 0.1	< 0.1	0.8	< 0.1	0.6	< 0.2
16	< 0.1	< 0.1	<.1	< 0.1	<.1	< 0.2
17	< 0.1	0.1	<.1	< 0.1	11.8	< 0.2
18	< 0.1	< 0.1	<.1	< 0.1	<.1	< 0.2
19	< 0.1	< 0.1	<.1	< 0.1	<.1	< 0.2
20	< 0.1	< 0.1	<.1	< 0.1	<.1	< 0.2
21	< 0.1	< 0.1	<.1	< 0.1	<.1	< 0.2
22	< 0.1	< 0.1	<.1	< 0.1	<.1	< 0.2
23	< 0.1	< 0.1	<.1	< 0.1	<.1	< 0.2
24	< 0.1	< 0.1	<.1	< 0.1	<.1	< 0.2
25	< 0.1	< 0.1	<.1	< 0.1	<.1	< 0.2
26	< 0.1	< 0.1	<.1	< 0.1	<.1	< 0.2
27	< 0.1	< 0.1	<.1	< 0.1	<.1	< 0.2
28	< 0.1	< 0.1	<.1	< 0.1	<.1	< 0.2
29	1	< 0.1	<.1	< 0.1	<.1	< 0.2
30	< 0.1	< 0.1	<.1	< 0.1	<.1	< 0.2

MCL = Maximum Contaminant Level

Appendix C (continued)

Semi-Volatile Organic Compounds sampling sites- Group B 2007

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	1,2 Di-phenyl hydrate (µg/L)	2,4,6 Trichloro-phenol (µg/L)	2,4-Dichloro-phenol (µg/L)	2,4 Dinitrio-phenol (µg/L)	2,4 Dinitro-toluene (µg/L)	2-6-Dinitro-toluene (µg/L)	2-Chloro-naphthalene (µg/L)
1	--	--	--	--	--	--	--
2	--	--	--	--	--	--	--
3	--	--	--	--	--	--	--
4	--	--	--	--	--	--	--
5	--	--	--	--	--	--	--
6	--	--	--	--	--	--	--
7	--	--	--	--	--	--	--
8	--	--	--	--	--	--	--
9	--	--	--	--	--	--	--
10	--	--	--	--	--	--	--
11	--	--	--	--	--	--	--
12	--	--	--	--	--	--	--
13	--	--	--	--	--	--	--
14	--	--	--	--	--	--	--
15	--	--	--	--	--	--	--
16	--	--	--	--	--	--	--
17	--	--	--	--	--	--	--
18	--	--	--	--	--	--	--
19	--	--	--	--	--	--	--
20	--	--	--	--	--	--	--
21	--	--	--	--	--	--	--
22	<.30	<.31	<.39	<.80	<.43	<.43	<.38
23	<.30	<.31	<.39	<.80	<.43	<.43	<.38
24	--	--	--	--	--	--	--
25	<.30	<.31	<.39	<.80	<.43	<.43	<.38
26	--	--	--	--	--	--	--
27	<.30	<.31	<.39	<.80	<.43	<.43	<.38
28	--	--	--	--	--	--	--
29	<.30	<.31	<.39	<.80	<.43	<.43	<.38
30	--	--	--	--	--	--	--

Appendix C (continued)

Semi-Volatile Organic Compounds sampling sites- Group B 2007

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	2-Chloro-phenol (µg/L)	2- Nitro-phenol (µg/L)	3,3 - Dichlori-benzidene (µg/L)	4-Bromo-diphenyl-ether (µg/L)	4-Chloro-methylphenyl (µg/L)	4-Chloro-diphenylene (µg/L)	4-Nitro-phenol (µg/L)
1	--	--	--	--	--	--	--
2	--	--	--	--	--	--	--
3	--	--	--	--	--	--	--
4	--	--	--	--	--	--	--
5	--	--	--	--	--	--	--
6	--	--	--	--	--	--	--
7	--	--	--	--	--	--	--
8	--	--	--	--	--	--	--
9	--	--	--	--	--	--	--
10	--	--	--	--	--	--	--
11	--	--	--	--	--	--	--
12	--	--	--	--	--	--	--
13	--	--	--	--	--	--	--
14	--	--	--	--	--	--	--
15	--	--	--	--	--	--	--
16	--	--	--	--	--	--	--
17	--	--	--	--	--	--	--
18	--	--	--	--	--	--	--
19	--	--	--	--	--	--	--
20	--	--	--	--	--	--	--
21	--	--	--	--	--	--	--
22	<.42	<.30	<.65	<.36	<.55	<.34	<.51
23	<.42	<.30	--	<.36	<.55	<.34	<.51
24	--	--	--	--	--	--	--
25	<.42	<.30	--	<.36	<.55	<.34	<.51
26	--	--	--	--	--	--	--
27	<.42	<.30		<.36	<.55	<.34	<.51
28	--	--	--	--	--	--	--
29	<.42	<.30		<.36	<.55	<.34	<.51
30	--	--	--	--	--	--	--

Appendix C (continued)

Semi-Volatile Organic Compounds sampling sites- Group B 2007

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	9-h-Fluorene (µg/L)	Acenaph-thene (µg/L)	Acenaph-thylene (µg/L)	Anthra-cene (µg/L)	Benzo(a) anthracene (µg/L)	Benzo(a) Pyrene (µg/L) MCL = 0.2 µg/L	Benzo(b) fluoranthene (µg/L)
1	--	--	--	--	--	--	--
2	--	--	--	--	--	--	--
3	--	--	--	--	--	--	--
4	--	--	--	--	--	--	--
5	--	--	--	--	--	--	--
6	--	--	--	--	--	--	--
7	--	--	--	--	--	--	--
8	--	--	--	--	--	--	--
9	--	--	--	--	--	--	--
10	--	--	--	--	--	--	--
11	--	--	--	--	--	--	--
12	--	--	--	--	--	--	--
13	--	--	--	--	--	--	--
14	--	--	--	--	--	--	--
15	--	--	--	--	--	--	--
16	--	--	--	--	--	--	--
17	--	--	--	--	--	--	--
18	--	--	--	--	--	--	--
19	--	--	--	--	--	--	--
20	--	--	--	--	--	--	--
21	--	--	--	--	--	--	--
22	<.33	<.28	<.30	<.39	<.26	<.33	<.40
23	<.33	<.28	<.30	<.39	<.26	<.33	<.40
24	--	--	--	--	--	--	--
25	<.33	<.28	<.30	<.39	<.26	<.33	<.40
26	--	--	--	--	--	--	--
27	<.33	<.28	<.30	<.39	<.26	<.33	<.40
28	--	--	--	--	--	--	--
29	<.33	<.28	<.30	<.39	<.26	<.33	<.40
30	--	--	--	--	--	--	--

Appendix C (continued)

Semi-Volatile Organic Compounds sampling sites- Group B 2007

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Benzo(k) fluoranthene (µg/L)	Benzo (ghi) perylene (µg/L)	Butyl-benzyl phthalate (µg/L)	2-Chloro-ethoxymethyl (µg/L)	2-Chloro-ethylether (µg/L)	Chloro-iso-propylene (µg/L)
1	--	--	--	--	--	--
2	--	--	--	--	--	--
3	--	--	--	--	--	--
4	--	--	--	--	--	--
5	--	--	--	--	--	--
6	--	--	--	--	--	--
7	--	--	--	--	--	--
8	--	--	--	--	--	--
9	--	--	--	--	--	--
10	--	--	--	--	--	--
11	--	--	--	--	--	--
12	--	--	--	--	--	--
13	--	--	--	--	--	--
14	--	--	--	--	--	--
15	--	--	--	--	--	--
16	--	--	--	--	--	--
17	--	--	--	--	--	--
18	--	--	--	--	--	--
19	--	--	--	--	--	--
20	--	--	--	--	--	--
21	--	--	--	--	--	--
22	<.45	<.64	<1	<.35	<.30	<.38
23	<.45	<.64	<1	<.35	<.30	<.38
24	--	--	--	--	--	--
25	<.45	<.64	<1	<.35	<.30	<.38
26	--	--	--	--	--	--
27	<.45	<.64	<1	<.35	<.30	<.38
28	--	--	--	--	--	--
29	<.45	<.64	<1	<.35	<.30	<.38
30	--	--	--	--	--	--

Appendix C (continued)

Semi-Volatile Organic Compounds sampling sites- Group B 2007

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Chrysene (µg/L)	Dibenz (ah) anthrazine (µg/L)	Diethyl-phthalate (µg/L)	Dimethyl phthalate (µg/L)	Dibutyl phthalate (µg/L)	Dioctyl phthalate µg/L)
1	--	--	--	--	--	--
2	--	--	--	--	--	--
3	--	--	--	--	--	--
4	--	--	--	--	--	--
5	--	--	--	--	--	--
6	--	--	--	--	--	--
7	--	--	--	--	--	--
8	--	--	--	--	--	--
9	--	--	--	--	--	--
10	--	--	--	--	--	--
11	--	--	--	--	--	--
12	--	--	--	--	--	--
13	--	--	--	--	--	--
14	--	--	--	--	--	--
15	--	--	--	--	--	--
16	--	--	--	--	--	--
17	--	--	--	--	--	--
18	--	--	--	--	--	--
19	--	--	--	--	--	--
20	--	--	--	--	--	--
21	--	--	--	--	--	--
22	<.33	<.70	<.61	<.59	<.87	<2
23	<.33	<.70	<.61	<.59	<.87	<2
24	--	--	--	--	--	--
25	<.33	<.70	<.61	<.59	<.87	<2
26	--	--	--	--	--	--
27	<.33	<.70	<.61	<.59	<.87	<2
28	--	--	--	--	--	--
29	<.33	<.70	<.61	<.59	<.87	<2
30	--	--	--	--	--	--

Appendix C (continued)

Semi-Volatile Organic Compounds sampling sites- Group B 2007

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Fluoranthene (µg/L)	Hexa-chloro-benzene (µg/L)	Hexachloro-cyclo-pentadiene (µg/L)	2-Ethyl-hexyl phthalate (µg/L)	Indeno-pyrene (µg/L)
		MCL = 1 µg/L	MCL = 50 µg/L		
1	--	--	--	--	--
2	--	--	--	--	--
3	--	--	--	--	--
4	--	--	--	--	--
5	--	--	--	--	--
6	--	--	--	--	--
7	--	--	--	--	--
8	--	--	--	--	--
9	--	--	--	--	--
10	--	--	--	--	--
11	--	--	--	--	--
12	--	--	--	--	--
13	--	--	--	--	--
14	--	--	--	--	--
15	--	--	--	--	--
16	--	--	--	--	--
17	--	--	--	--	--
18	--	--	--	--	--
19	--	--	--	--	--
20	--	--	--	--	--
21	--	--	--	--	--
22	<.30	<.30	<.52	<2	<.56
23	<.30	<.30	<.52	<1	<.56
24	--	--	--	--	--
25	<.30	<.30	<.52	<1	<.56
26	--	--	--	--	--
27	<.30	<.30	<.52	<1	<.56
28	--	--	--	--	--
29	<.30	<.30	<.52	<1	<.56
30	--	--	--	--	--

MCL = Maximum Contaminant Level

Appendix C (continued)

Semi-Volatile Organic Compounds sampling sites- Group B 2007

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Isophorone (µg/L)	Nitro-benzene (µg/L)	Nitrosodimethylate (µg/L)	Nitrosodi-propylate (µg/L)	Nitrosodi-phenylate (µg/L)
1	--	--	--	--	--
2	--	--	--	--	--
3	--	--	--	--	--
4	--	--	--	--	--
5	--	--	--	--	--
6	--	--	--	--	--
7	--	--	--	--	--
8	--	--	--	--	--
9	--	--	--	--	--
10	--	--	--	--	--
11	--	--	--	--	--
12	--	--	--	--	--
13	--	--	--	--	--
14	--	--	--	--	--
15	--	--	--	--	--
16	--	--	--	--	--
17	--	--	--	--	--
18	--	--	--	--	--
19	--	--	--	--	--
20	--	--	--	--	--
21	--	--	--	--	--
22	<.60	<.21	<.33	<.82	<.81
23	<.60	<.21	<.33	<.82	<.81
24	--	--	--	--	--
25	<.60	<.21	<.33	<.82	<.81
26	--	--	--	--	--
27	<.60	<.21	<.33	<.82	<.81
28	--	--	--	--	--
29	<.60	<.21	<.33	<.82	<.81
30	--	--	--	--	--

Appendix C (continued)

Semi-Volatile Organic Compounds sampling sites- Group B 2007

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Pentachloro-phenol (µg/L)	Phenan-threne (µg/L)	Phenol (µg/L)	Pyrene (µg/L)	1,2,4 Trichloro-benzene (µg/L)
	MCL = 1 µg/L				MCL = 70 µg/L
1	--	--	--	--	--
2	--	--	--	--	--
3	--	--	--	--	--
4	--	--	--	--	--
5	--	--	--	--	--
6	--	--	--	--	--
7	--	--	--	--	--
8	--	--	--	--	--
9	--	--	--	--	--
10	--	--	--	--	--
11	--	--	--	--	--
12	--	--	--	--	--
13	--	--	--	--	--
14	--	--	--	--	--
15	--	--	--	--	--
16	--	--	--	--	--
17	--	--	--	--	--
18	--	--	--	--	--
19	--	--	--	--	--
20	--	--	--	--	--
21	<.87	<.32	<.4	<.35	<.41
22	<.87	<.32	<.4	<.35	<.41
23	--	--	--	--	--
24	<.87	<.32	<.4	<.35	<.41
25	--	--	--	--	--
26	<.87	<.32	<.4	<.35	<.41
27	--	--	--	--	--
28	<.87	<.32	<.4	<.35	<.41
29	--	--	--	--	--
30	--	--	--	--	--

MCL = Maximum Contaminant Level

Appendix C (continued)

Semi-Volatile Organic Compounds sampling sites- Group B 2007

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Hexachloro-butadine (µg/L)	2,4-Dimethyl-phenol (µg/L)	Hexachloro ethane (µg/L)	2,6, Di-ethyl aniline (µg/L)	Naphthalene (µg/L)
1	--	--	--		--
2	--	--	--	--	--
3	--	--	--	--	--
4	--	--	--	--	--
5	--	--	--	--	--
6	--	--	--	--	--
7	--	--	--	--	--
8	--	--	--	--	--
9	--	--	--	--	--
10	--	--	--	--	--
11	--	--	--	--	--
12	--	--	--	--	--
13	--	--	--	--	--
14	--	--	--	--	--
15	--	--	--	--	--
16	--	--	--	--	--
17	--	--	--	<.002	--
18	--	--	--	--	--
19	--	--	--	--	--
20	--	--	--	<.002	--
21	--	--	--	--	--
22	<.46	<.4	<.66	--	<.32
23	<.46	<.4	<.66	<.002	<.32
24	--	--	--	--	--
25	<.46	<.4	<.66	--	<.32
26	--	--	--	--	--
27	<.46	<.4	<.66	--	<.32
28	--	--	--	--	--
29	<.46	<.4	<.66	--	<.32
30	--	--	--	--	--

Appendix C (continued)

Pesticides sampling sites- Group B 2007

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Acetochlor (µg/L)	Alachlor (µg/L) MCL = 2 µg/L	Alpha HCH (µg/L)	Atrazine (µg/L) MCL = 3 µg/L	Azinphos-methyl (µg/L)
1	--	--	--	--	--
2	--	--	--	--	--
3	--	--	--	--	--
4	--	--	--	--	--
5	--	--	--	--	--
6	--	--	--	--	--
7	--	--	--	--	--
8	--	--	--	--	--
9	--	--	--	--	--
10	--	--	--	--	--
11	--	--	--	--	--
12	--	--	--	--	--
13	--	--	--	--	--
14	--	--	--	--	--
15	--	--	--	--	--
16	<.006	<.005	<.002	<.007	<.080
17	--	--	--	--	--
18	--	--	--	--	--
19	<.006	<.005	<.002	<.007	<.080
20	--	--	--	--	--
21	--	--	--	--	--
22	<.006	<.005	<.002	<.007	<.080
23	--	--	--	--	--
24	--	--	--	--	--
23	--	--	--	--	--
26	--	--	--	--	--
27	--	--	--	--	--
28	--	--	--	--	--
29	--	--	--	--	--
30	--	--	--	--	--

MCL = Maximum Contaminant Level

Appendix C (continued)

Pesticides sampling sites- Group B 2007

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Benfluralin (µg/L)	Butylate (µg/L)	CIAT (µg/L)	Carbaryl (µg/L)	Carbofuran (µg/L) MCL = 40 µg/L	Chlorpyrifos, (µg/L)
1	--	--	--	--	--	--
2	--	--	--	--	--	--
3	--	--	--	--	--	--
4	--	--	--	--	--	--
5	--	--	--	--	--	--
6	--	--	--	--	--	--
7	--	--	--	--	--	--
8	--	--	--	--	--	--
9	--	--	--	--	--	--
10	--	--	--	--	--	--
11	--	--	--	--	--	--
12	--	--	--	--	--	--
13	--	--	--	--	--	--
14	--	--	--	--	--	--
15	--	--	--	--	--	--
16	<.006	<.002	<.014	<.060	<.020	<.005
17	--	--	--	--	--	--
18	--	--	--	--	--	--
19	<.006	<.002	<.014	<.060	<.020	<.005
20	--	--	--	--	--	--
21	--	--	--	--	--	--
22	<.006	<.002	<.014	<.060	<.020	<.005
23	<.006	<.002	<.014	<.060	<.020	<.005
24	--	--	--	--	--	--
23	--	--	--	--	--	--
26	--	--	--	--	--	--
27	--	--	--	--	--	--
28	--	--	--	--	--	--
29	--	--	--	--	--	--
30	--	--	--	--	--	--

MCL = Maximum Contaminant Level

Appendix C (continued)

Pesticides sampling sites- Group B 2007

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	cis-Permethrin (µg/L)	Cyanazine (µg/L)	DCPA (Dactal) (µg/L)	Desulfinyl fipro (µg/L)	Diazinon (µg/L)	EPTC (µg/L)
1	--	--	--	--	--	--
2	--	--	--	--	--	--
3	--	--	--	--	--	--
4	--	--	--	--	--	--
5	--	--	--	--	--	--
6	--	--	--	--	--	--
7	--	--	--	--	--	--
8	--	--	--	--	--	--
9	--	--	--	--	--	--
10	--	--	--	--	--	--
11	--	--	--	--	--	--
12	--	--	--	--	--	--
13	--	--	--	--	--	--
14	--	--	--	--	--	--
15	--	--	--	--	--	--
16	<.010	<.018	<.003	<.012	<.005	<.002
17	--	--	--	--	--	--
18	--	--	--	--	--	--
19	<.010	<.018	<.003	<.012	<.005	<.002
20	--	--	--	--	--	--
21	--	--	--	--	--	--
22	<.010	<.018	<.003	<.012	<.005	<.002
23	<.010	<.018	<.003	<.012	<.005	<.002
24	--	--	--	--	--	--
25	--	--	--	--	--	--
26	--	--	--	--	--	--
27	--	--	--	--	--	--
28	--	--	--	--	--	--
29	--	--	--	--	--	--
30	--	--	--	--	--	--

Appendix C (continued)

Pesticides sampling sites- Group B 2007

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Dieldrin (µg/L)	Disulfoton (µg/L)	Ethal-fluralin (µg/L)	Etho-prop (µg/L)	Desulf-fipronil (µg/L)	Fipronil sulfide (µg/L)
1	--	--	--	--	--	--
2	--	--	--	--	--	--
3	--	--	--	--	--	--
4	--	--	--	--	--	--
5	--	--	--	--	--	--
6	--	--	--	--	--	--
7	--	--	--	--	--	--
8	--	--	--	--	--	--
9	--	--	--	--	--	--
10	--	--	--	--	--	--
11	--	--	--	--	--	--
12	--	--	--	--	--	--
13	--	--	--	--	--	--
14	--	--	--	--	--	--
15	--	--	--	--	--	--
16	<.009	<.02	<.009	<.012	<.029	<.013
17	--	--	--	--	--	--
18	--	--	--	--	--	--
19	<.009	<.02	<.009	<.012	<.029	<.013
20	--	--	--	--	--	--
21	--	--	--	--	--	--
22	<.009	<.02	<.009	<.012	<.029	<.013
23	<.009	<.02	<.009	<.012	<.029	<.013
24	--	--	--	--	--	--
25	--	--	--	--	--	--
26	--	--	--	--	--	--
27	--	--	--	--	--	--
28	--	--	--	--	--	--
29	--	--	--	--	--	--
30	--	--	--	--	--	--

Appendix C (continued)

Pesticides sampling sites- Group B 2007

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Fipronil sulfone (µg/L)	Fipronil (µg/L)	Fonofos (µg/L)	Lindane (µg/L) MCL = 0.2 µg/L	Linuron (µg/L)	Malathion (µg/L)	Moliunate (µg/L)
1	--	--	--	--	--	--	--
2	--	--	--	--	--	--	--
3	--	--	--	--	--	--	--
4	--	--	--	--	--	--	--
5	--	--	--	--	--	--	--
6	--	--	--	--	--	--	--
7	--	--	--	--	--	--	--
8	--	--	--	--	--	--	--
9	--	--	--	--	--	--	--
10	--	--	--	--	--	--	--
11	--	--	--	--	--	--	--
12	--	--	--	--	--	--	--
13	--	--	--	--	--	--	--
14	--	--	--	--	--	--	--
15	--	--	--	--	--	--	--
16	<.024	<.016	<.006	<.004	<.060	<.016	<.002
17	--	--	--	--	--	--	--
18	--	--	--	--	--	--	--
19	<.024	<.016	<.006	<.004	<.060	<.016	<.002
20	--	--	--	--	--	--	--
21	--	--	--	--	--	--	--
22	<.024	<.016	<.006	<.004	<.060	<.016	<.002
23	<.024	<.016	<.006	<.004	<.060	<.016	<.002
24	--	--	--	--	--	--	--
25	--	--	--	--	--	--	--
26	--	--	--	--	--	--	--
27	--	--	--	--	--	--	--
28	--	--	--	--	--	--	--
29	--	--	--	--	--	--	--
30	--	--	--	--	--	--	--

MCL = Maximum Contaminant Level

Appendix C (continued)

Pesticides sampling sites- Group B 2007

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Methyl parathion (µg/L)	Metolachlor (µg/L)	Metribuzin sencor (µg/L)	Napropamide (µg/L)	p,p DDE (µg/L)
1	--	--	--	--	--
2	--	--	--	--	--
3	--	--	--	--	--
4	--	--	--	--	--
5	--	--	--	--	--
6	--	--	--	--	--
7	--	--	--	--	--
8	--	--	--	--	--
9	--	--	--	--	--
10	--	--	--	--	--
11	--	--	--	--	--
12	--	--	--	--	--
13	--	--	--	--	--
14	--	--	--	--	--
15	--	--	--	--	--
16	<.008	<.010	<.012	<.018	<.003
17	--	--	--	--	--
18	--	--	--	--	--
19	<.008	<.010	<.012	<.018	<.003
20	--	--	--	--	--
21	--	--	--	--	--
22	<.008	<.010	<.012	<.018	<.003
23	<.008	<.010	<.012	<.018	<.003
24	--	--	--	--	--
25	--	--	--	--	--
26	--	--	--	--	--
27	--	--	--	--	--
28	--	--	--	--	--
29	--	--	--	--	--
30	--	--	--	--	--

Appendix C (continued)

Pesticides sampling sites- Group B 2007

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Parathion (µg/L)	Pendimethalin (µg/L)	Phorate (µg/L)	Pebulate (µg/L)	Prometon (µg/L)
1	--	--	--	--	--
2	--	--	--	--	--
3	--	--	--	--	--
4	--	--	--	--	--
5	--	--	--	--	--
6	--	--	--	--	--
7	--	--	--	--	--
8	--	--	--	--	--
9	--	--	--	--	--
10	--	--	--	--	--
11	--	--	--	--	--
12	--	--	--	--	--
13	--	--	--	--	--
14	--	--	--	--	--
15	--	--	--	--	--
16	<.010	<.020	<.020	<.004	<.01
17	--	--	--	--	--
18	--	--	--	--	--
19	<.010	<.020	<.020	<.004	<.01
20	--	--	--	--	--
21	--	--	--	--	--
22	<.010	<.020	<.020	<.004	<.01
23	<.010	<.020	<.020	<.004	<.01
24	--	--	--	--	--
25	--	--	--	--	--
26	--	--	--	--	--
27	--	--	--	--	--
28	--	--	--	--	--
29	--	--	--	--	--
30	--	--	--	--	--

Appendix C (continued)

Pesticides sampling sites- Group B 2007

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Propyzaminide (µg/L)	Propargite (µg/L)	Propachlor (µg/L)	Propanil (µg/L)	Simazine (µg/L) MCL = 4 µg/L
1	--	--	--	--	--
2	--	--	--	--	--
3	--	--	--	--	--
4	--	--	--	--	--
5	--	--	--	--	--
6	--	--	--	--	--
7	--	--	--	--	--
8	--	--	--	--	--
9	--	--	--	--	--
10	--	--	--	--	--
11	--	--	--	--	--
12	--	--	--	--	--
13	--	--	--	--	--
14	--	--	--	--	--
15	--	--	--	--	--
16	<.004	<.02	<.010	<.011	<.006
17	--	--	--	--	--
18	--	--	--	--	--
19	<.004	<.02	<.010	<.011	<.006
20	--	--	--	--	--
21	--	--	--	--	--
22	<.004	<.02	<.010	<.011	0.008
23	<.004	<.02	<.010	<.011	<0.006
24	--	--	--	--	--
25	--	--	--	--	--
26	--	--	--	--	--
27	--	--	--	--	--
28	--	--	--	--	--
29	--	--	--	--	--
30	--	--	--	--	--

MCL = Maximum Contaminant Level

Appendix C (continued)

Pesticides sampling sites- Group B 2007

Division of Water and Waste Management - Groundwater Program - United States Geological Survey Study of Ambient Groundwater Quality in West Virginia

Site	Tebuthiuron (µg/L)	Terbacil (µg/L)	Terbufos (µg/L)	Thiobencarb (µg/L)	Triallate (µg/L)	Trifluralin (µg/L)
1	--	--	--	--	--	--
2	--	--	--	--	--	--
3	--	--	--	--	--	--
4	--	--	--	--	--	--
5	--	--	--	--	--	--
6	--	--	--	--	--	--
7	--	--	--	--	--	--
8	--	--	--	--	--	--
9	--	--	--	--	--	--
10	--	--	--	--	--	--
11	--	--	--	--	--	--
12	--	--	--	--	--	--
13	--	--	--	--	--	--
14	--	--	--	--	--	--
15	--	--	--	--	--	--
16	<.02	<.040	<.01	<.010	<.006	<.006
17	--	--	--	--	--	--
18	--	--	--	--	--	--
19	<.02	<.040	<.01	<.010	<.006	<.006
20	--	--	--	--	--	--
21	--	--	--	--	--	--
22	<.02	<.040	<.01	<.010	<.006	<.006
23	<.02	<.040	<.01	<.010	<.006	<.006
24	--	--	--	--	--	--
25	--	--	--	--	--	--
26	--	--	--	--	--	--
27	--	--	--	--	--	--
28	--	--	--	--	--	--
29	--	--	--	--	--	--
30	--	--	--	--	--	--