WELLHEAD PROTECTION PROGRAM

Borough of Rouseville, Pennsylvania

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Submitted To:

U.S. Environmental Protection Agency
Region 3

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Introduction

The wellhead protection (WHP) program was established in 1986 after amendments to the Safe Drinking Water Act (SDWA). The WHP program was designed for, and has been extremely successful in, protecting ground water which supplies wells and wellfields that contribute drinking water to public water supply systems. Wellhead protection requires the participation of all levels of government. The foremost responsibility for ensuring that ground water is adequately protected lies at the local government level.

Purpose

Because of their interest in promoting wellhead protection in local communities, Region 3 of the Environmental Protection Agency (EPA) funded a project to provide wellhead protection in two Pennsylvania communities. The purpose of this project was to provide "hands on" training for applying EPA's Wellhead Protection Program. This report summarizes our analysis of background materials, a site visit, and a public meeting coordinated in Rouseville, Pennsylvania. It is structured according to the five steps for wellhead protection outlined in the Safe Drinking Water Act Amendments of 1986. This report was prepared by Horsley & Witten, Inc. (H&W) under contract to the EPA Region 3 office in Philadelphia, Pennsylvania. The project was also coordinated with the Pennsylvania Rural Water Association and the Pennsylvania Department of Environmental Resources.

Step #1 - Identify Duties and Responsibilities

The primary contact for coordination of the wellhead protection program has been the Rouseville Municipal Waterworks. The Rouseville Municipal Waterworks provides water supply to 734 residents of the Borough of Rouseville, 263 residents of the Village of Plumer, and 38 residents of McClintockville. Representatives of each of these communities attended a workshop in Rouseville, sponsored by EPA Region 3, on 6 May 1993. Also present were representatives of Cornplanter Township, the County Planning Department, Pennsylvania Department of Environmental Regulation, the Pennsylvania Rural Water Association, the Pennsylvania League of Women Voters and a Representative of the Pennsylvania Legislature. All of these organizations will play key roles in the development and implementation of a wellhead protection program for Rouseville.

Specific duties of these organizations need to be defined by local officials. However, some roles are evident. The Rouseville Municipal Waterworks has already taken the lead in coordinating wellhead protection efforts by organizing and hosting the initial workshop and meeting. As they are responsible for delivering potable water to consumers it may be most appropriate for them to lead and coordinate the wellhead protection efforts. If land use controls are deemed necessary, Cornplanter Township (which administers the Zoning Ordinance in the area of the wellfields) and the County Planning Office will have to play key roles. Technical assistance is available from Pennsylvania Rural Water Association, Pennsylvania Department of Environmental Regulation, and the U.S. Environmental Protection Agency.

Step #2 - Delineation of Wellhead Protection Areas

The Borough of Rouseville is dependent upon ground water as its source of drinking water. The Borough is serviced by the Rouseville Municipal Waterworks which maintains four wells and two springs.

Wells #3 and #4 and spring #2 are on the eastern side of Cherry Creek and were found to be contaminated with chloride in 1979. Wells #3 and #4 have not been used in recent years, and spring #2 is only used when mixed with the other sources to dilute the contaminants.

The principal water supply consists of wells #1 and 2 and spring #1. These ground water sources are located on the western side of Cherry Creek (see figure and cross section) and are of excellent quality.

The wells are approximately 30-35 feet in depth and tap the Pocono Group glacial drift and sandstones. The sandstone aquifer is confined by overlying shale units. Recharge to the wells is derived both from direct infiltration into the shallow sand and gravel outwash deposits and as result of leakage vertically through fractures in the shale.

The water system services 263 connections and has an average demand of 63,746 gallons/day. Wells #1 & 2 have maximum rated pumping capacities of 30,000 gallons/day each and spring #1 at 50,000 gallons/day.

The wellhead protection areas were delineated based upon information supplied by the USGS regarding surface topography and watersheds. These areas approximate those land areas where both surface water drainage and ground water may contribute to the wells and springs. Surface water drainage is likely to infiltrate into the valley-fill glacial outwash sand and gravel deposits as it flows towards Cherry Creek in the area of the water supply sources. The surface drainage area also approximates that zone in which downward leakage through the shale layers may reach the water sources. Water levels taken in wells during our 6 May 1993 site visit indicate flow toward the Creek (and discharging as springs at the surface of the land immediately upgradient and adjacent to the Creek. See Table 1).

Table 1. **Ground Water Levels (Feet)**
Rouseville, Pennsylvania
Measured 6 May 1993

Well	Surface Elevation (MSL)	Depth to Water	Water Elevation (MSL)
MW-1*	1,360	12.5	1,347
Well #4	1,355	11.0	1,344
Well #3	1,340	(-2)	1,342

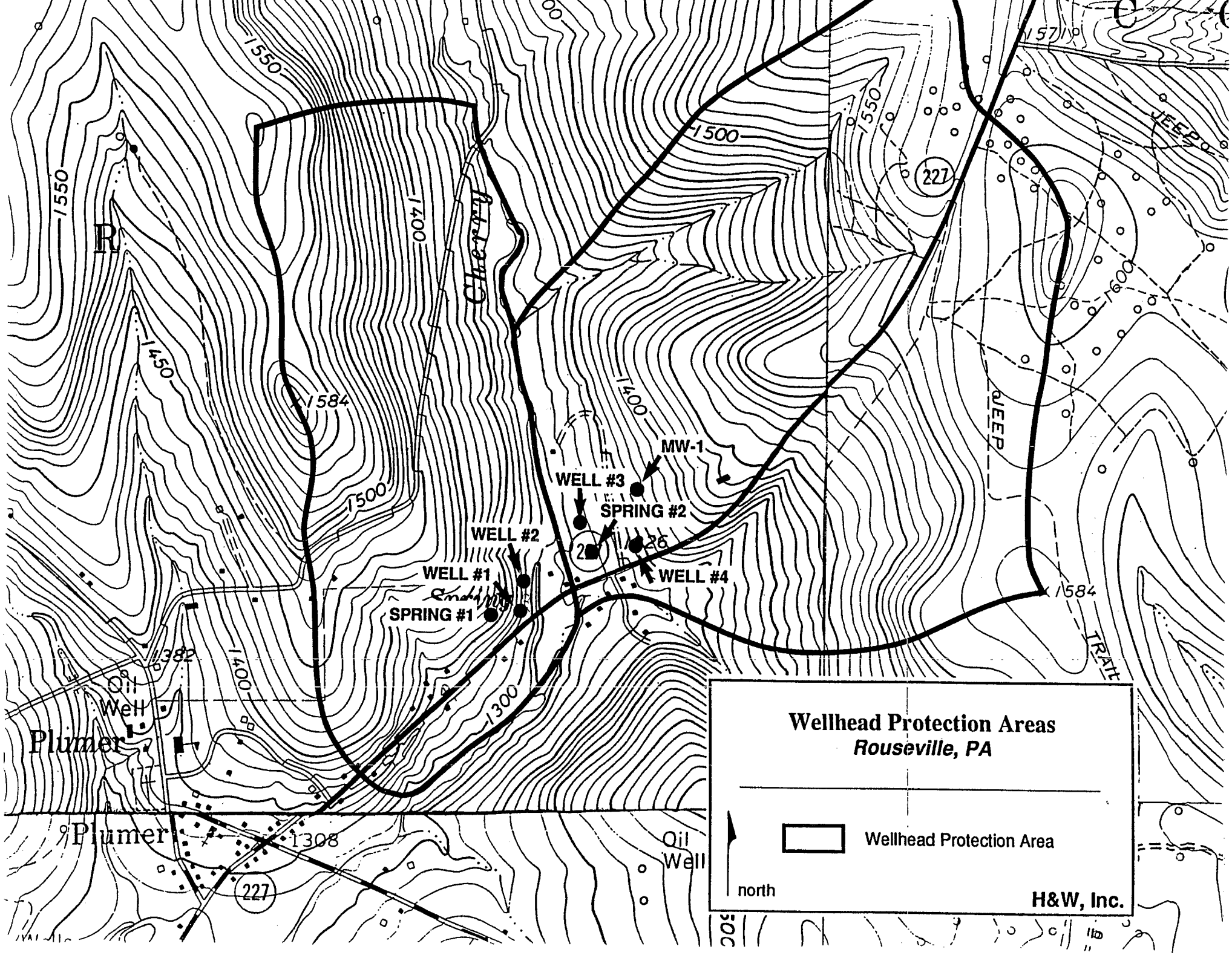
*MW-1 is a monitoring well which was found during the site visit and is located approximately 300 feet north of production well #4.

Note: The water level measured in well #3 was approximately two feet above the land level indicating a discharge area forming a free-flowing spring.

Step #3 - Identification of Potential Contamination Sources

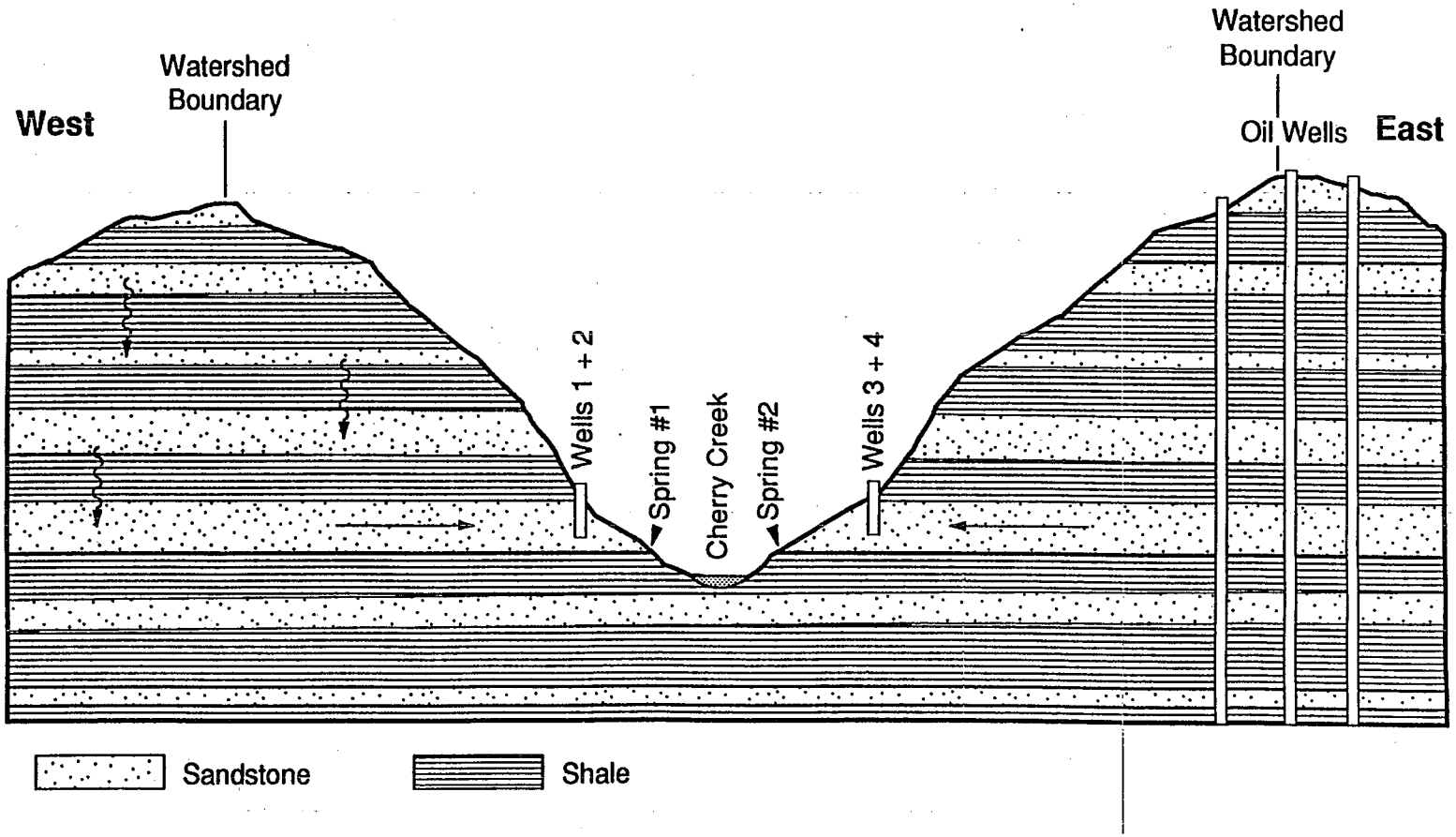
Potential sources of contamination within the delineated wellhead protection areas to the two existing wells and the proposed well were determined from USGS topographic maps and from information supplied by the Rouseville Municipal Waterworks. A field survey of potential sources was also conducted during our site visit on 6 May 1993.

Approximately 16 oil/gas wells are shown within the boundary of the eastern watershed which contributes to spring #2 and wells #3 and #4. Many other wells not shown on the USGS map are known to exist. The disposal of brines from production wells is a possible source of the chlorides found in the drinking water sources. Following the initial development of oil, water flooding is commonly used to increase the yield of oil wells. To recover the optimum amount of oil through the water-flooding method, the oil-bearing formations are first fractured by high explosives, thereby increasing their permeabilities. Then water is pumped down selected wells, and a mixture of water and oil is pumped from adjacent wells into a separator. A typical separator usually consists of a tank in which the oil, being lighter than the water, separates from the water and floats to the top where most of it can be withdrawn. If the oil-water mixture contains sufficient natural gas, this too


Wellhead Protection Areas
Rouseville, PA
Wellhead Protection Area
north
H&W, Inc.
WELL #1
WELL #2
WELL #3
WELL #4
SPRING #1
SPRING #2
MW-1
Cherrytree Run
Plumer
Plumer
Oil Well
Oil Well
1550
1500
1450
1400
1300
1584
1308
227
JEEP
JEEP
TRAIL

Hydrogeologic Cross Section

Rouseville, PA



may be withdrawn. The water is disposed of as waste, usually by discharging it into shallow settling pits where the water seeps into the subsurface.

Even though the water pumped into the wells to flood the reservoirs is fresh, the water pumped from the wells and discharged from the separators is usually very high in salt content. This is because salty water is found at depth and has been reported above and below the oil-bearing formations. The fresh water pumped into the wells mixes with the salty water at lower depths and becomes contaminated.

Thus, both oil and salt water are discharged during normal operations in an active oil field and eventually find their way into both streams and ground-water bodies, causing pollution.

Pollution in the area of the oil fields is also caused by leaking wells, pipelines, and separation tanks. Many of these installations are quite old and sometimes in a state of disrepair, which increases the leakage problem. This spilled oil and salt water can soak into the ground and reach the water table. It should be pointed out that such leakage of oil on the land surface is not intentional. Because oil is the desired product of the wells, every attempt to salvage as much as possible is usually made.

Abandoned oil wells and test holes may also present a problem if they are not properly sealed and plugged. A producing oil well is usually abandoned when it is no longer economically feasible to recover the oil, and test holes are abandoned when not enough oil is found to justify development. In either case, a considerable quantity of oil may be left in the formation. The oil and associated salt water can migrate upward through the well and eventually discharge at the land surface. The lift to the surface is provided by either the regional or local ground-water flow systems.

Approximately 20 septic systems were also found within the delineated wellhead protection areas. Septic systems can contribute nitrate-nitrogen,

bacteria, viruses and household hazardous wastes to the ground water system.

A portion of the land area along Route 227 (which runs through the delineated wellhead protection areas) is zoned for industrial uses. The Cornplanter Township Zoning Ordinance (Section 305) allows a variety of industrial uses within this zone including "electrical instrument manufacturing, jewelry, printed material, machine tools, dies and gages, plastic goods, pharmaceutical goods, oil refineries, etc" as Permitted Uses. These uses pose potential threats to ground water quality and should be prohibited or at a minimum be required to obtain a Special Exception Permit to ensure adequate review and conditions.

Transportation-related accidents and road salting along Route 227 also pose a possible contamination threat. Some of the wells are within 200 feet of the highway. Therefore, little travel time is available to respond in the event of a spill to prevent contamination from reaching the wells.

A more detailed inventory of potential contamination threats could be accomplished by a volunteer group who could inspect facilities throughout the delineated wellhead protection areas searching for underground storage tanks, storage of chemicals and hazardous wastes, and other sources. Retired senior citizens have proven to be a valuable resource in other areas of the country in this regard.

Step #4 - Management Tools

Management approaches to wellhead protection can include both regulatory and non-regulatory measures. Regulatory resources include zoning, subdivision, and health ordinances. The Pennsylvania State Enabling Legislation provides extensive authority to local governments to protect water resources. Non-regulatory measures include monitoring and public education. Table 2 provides a summary of potential wellhead protection measures.

Table 2. SUMMARY OF WELLHEAD PROTECTION TOOLS

	Applicability to Wellhead Protection	Land Use Practice	Legal Considerations	Administrative Considerations
Regulatory: Zoning				
Overlay GW Protection Districts	Used to map WHPA's. Provides for identification of sensitive areas for protection. Used in conjunction with other tools that follow.	Community identifies WHPA's on practical base/zoning map.	Well accepted method of identifying sensitive areas. May face legal challenges if WHPA boundaries are based solely on artibrary delineation.	Requires staff to develop overlay map. Inherent nature of zoning provides "grandfather" protection to pre-existing uses and structures
Prohibition of Various Land Uses	Used within mapped WHPA's to prohibit known ground-water contaminants and uses that generate contaminants.	Commuity adopts prohibited uses list within their zoning ordinance.	Well recognized function of zoning. Appropriate technique to protect natural resources from contamination.	Requires amendment to zoning ordinance. Requires enforcement by both visual inspection and on-site investigations.
Special Permitting	Used to restrict uses within WHPA's that may cause ground-water contamination if left unregulated.	Community adopts special permit "thresholds" for various uses and structures within WHPA's. Community grants special permits for "threshold" uses only if ground water quality will not be compromised.	Well recognized method of segregating land uses within critical resource areas such as WHPA's. Requires case-by-case analysis to ensure equal treatment of applicants.	Requires detailed understanding of WHPA sensitivity by local permit granting authority. Requires enforcement of special permit requirements and on-site investigations.
Large-Lot Zoning	Used to reduce impacts of residential development by limiting numbers of units within WHPA's.	Community "down zones" to increase minimum acreage needed for residential development.	Well recognized perogative of local government. Requires rational connection between minimum lot size selected and resource protection goals. Arbitrary large lot zones have been struck down without logical connection to Master Plan or WHPA program.	Requires amendment to zoning ordinance.
Transfer of Development Rights	Used to transfer development from WHPA's to locations outside WHPA's.	Community offers transfer option within zoning ordinance. Community identifies areas where development is to be transferred "from" and "to".	Accepted land use planning tool.	Cumbersome administrative requirements. Not well suited for small communities without significant administrative resources.

	Applicability to Wellhead Protection	Land Use Practice	Legal Considerations	Administrative Considerations
Cluster/PUD Design	Used to guide residential development outside of WHPA's. Allows for "point source" discharges that are more easily monitored.	Community offers cluster/PUD as development option within zoning ordinance. Community identifies areas where cluster/PUD is allowed (i.e. within WHPA's).	Well accepted option for residential land development.	Slightly more complicated to administer than traditional "grid" subdivision. Enforcement/inspection requirements are similar to "grid" subdivision.
Growth Controls/Timing	Used to time the occurence of development within WHPA's. Allows communities the opportunity to plan for wellhead delineation and protection.	Community imposes growth controls in the form of building caps, subdivision phasing or other limitation tied to planning concerns.	Well accepted option for communities facing development pressures within sensitive resource areas. Growth controls may be challenged if they are imposed without a rational connection to the resource being protected.	Generally complicated administrative process. Requires administrative staff to issue permits and enforcement growth control ordinances.
Performance Standards	Used to regulate development within WHPA's by enforcing predetermined standards for water quality. Allows for aggressive protection of WHPA's by limiting development within WHPA's to an accepted level.	Community identifies WHPA's and establishes "thresholds" for water quality.	Adoption of specific WHPA performance standards requires sound technical support. Performance standards must be enforced on a case-by-case basis.	Complex administrative requirements to evaluate impacts of land development within WHPA's.
Regulatory: Subdivision Control				
Drainage Requirements	Used to ensure that subdivision road drainage is directed outside of WHPA's. Used to employ advanced engineering designs of subdivision roads within WHPA's.	Community adopts stringent subdivision rules and regulations to regulate road drainage/runoff in subdivisions within WHPA's.	Well accepted purpose of subdivision control.	Requires moderate level of inspection and enforcement by administrative staff.

	Applicability to Wellhead Protection	Land Use Practice	Legal Considerations	Administrative Considerations
Regulatory: Health Regulations				
Underground Fuel Storage Systems	Used to prohibit underground fuel storage systems (UST) within WHPA's. Used to regulate UST's within WHPA's.	Community adopts health/zoning ordinance prohibiting UST's within WHPA's Community adopts special permit or performance standards for use of UST's within WHPA's.	Well accepted regulatory option for local government.	Prohibition of UST's require little administrative support. Regulating UST's require moderate amounts of administrative support for inspection follow-up and enforcement.
Privately-Owned Wastewater Treatment Plants (Small Sewage Treatment Plants)	Used to prohibit Small Sewage Treatment Plants (SSTP) within WHPA's.	Community adopts health/zoning ordinance prohibiting SSTP's within WHPA's. Community adopts special permit or performance standards for use of SSTP's within WHPA's.	Well accepted regulatory option for local government.	Prohibition of SSTP's require little administrative support. Regulating SSTP's require moderate amount of administrative support for inspection followup and enforcement.
Septic Cleaner Ban	Used to prohibit the application of certain solvent septic cleaners within WHPA's, a known ground water contaminant.	Community adopts health/zoning ordinance prohibiting the use of septic cleaners containing 1,1,1-Trichloroethane or other solvent compounds within WHPA's.	Well accepted method of protecting ground water quality.	Difficult regulation to enforce even with sufficient administrative support.
Septic System Upgrades	Used to require periodic inspection and upgrading of septic systems.	Community adopts health/zoning ordinance requiring inspection and, if necessary, upgrading of septic systems on a time basis (i.e. every 2 years) or upon title/property transfer.	Well accepted purview of government to ensure protection of ground water.	Significant administrative resources required for this option to be successful.
Toxic and Hazardous Materials Handling Regulations	Used to ensure proper handling and disposal of toxic materials/waste.	Community adopts health/zoning ordinance requiring registration and inspection of all businesses within WHPA using toxic/hazardous materials above certain quantities.	Well accepted purview of government to ensure protection of ground water.	Requires administrative support and on-site inspections.

	Applicability to Wellhead Protection	Land Use Practice	Legal Considerations	Administrative Considerations
Private Well Protection	Used to protect private on-site water supply wells.	Community adopts health/zoning ordinance to require permits for new private wells and to ensure appropriate well to septic system setbacks. Also requires pump and water quality testing.	Well accepted purview of government to ensure protection of ground water.	Requires administrative support and review of applications.
Non-Regulatory: Land Transfer and Voluntary Restrictions				
Sale/Donation	Land acquired by a community within WHPA's, either by purchase or donation. Provides broad protection to the ground water supply.	As non-regulatory technique, communities generally work in partnership with non-profit land conservation organizations.	There are many legal consequences of accepting land for donation or sale from the private sector, mostly involving liability.	There are few administrative requirements involved in accepting donations or sales of land from the private sector. Administrative requirements for maintenance of land accepted or purchased may be substantial, particularly if the community does not have a program for open space maintenance.
Conservation Easements	Can be used to limit development within WHPA's.	Similar to sales/donations, conservation easements are generally obtained with the assistance of non-profit land conservation organization.	Same as above.	Same as above.
Limited Development	As the title implies, this technique limits development to portions of a land parcel outside of WHPA's.	Land developers work with community as part of a cluster/PUD to develop limited portions of a site and restrict other portions, particularly those within WHPA's.	Similar to those noted in cluster/PUD under zoning.	Similar to those noted in cluster/PUD under zoning.
Non-Regulatory: Monitoring	Used to monitor ground water quality within WHPA's.	Communities establish ground water monitoring program within WHPA. Communities require developers within WHPA's to monitor ground water quality downgradient from their development.	Accepted method of ensuring ground water quality.	Requires moderate administrative staffing to ensure routine sampling and response if sampling indicates contamination.

	Applicability to Wellhead Protection	Land Use Practice	Legal Considerations	Administrative Considerations
Contingency Plans	Used to ensure appropriate response in cases of contaminant release or other emergencies. within WHPA.	Community prepares a contingency plan involving wide range of municipal/county officials.	None	Requires significant up-front planning to anticipate and be prepared for emergencies.
Hazardous Waste Collection	Used to reduce accumulation of hazardous materials within WHPA's and the community at large.	Communities, in cooperation with the state, regional planning commission, or other entity, sponsor a "hazardous waste collection day" several times per year.	There are several legal issues raised by the collection, transport and disposal of hazardous waste.	Hazardous waste collection programs are generally sponsored by government agencies, but administered by a private contractor.
Non-Regulatory: Public Education	Used to inform community residents of the connection between land use within WHPA's and drinking water quality.	Communities can employ a variety of public education techniques ranging from brochures detailing their WHPA program to seminars to involvement in events such as hazardous waste collection days.	No outstanding legal considerations.	Requires some degree of administrative support for programs such as brochure mailing to more intensive support for seminars and hazardous waste collection days.
Legislative:				
Regional WHPA Districts	Used to protect regional aquifer systems by establishing new legislative districts that often transcend existing corporate boundaries.	Requires state legislative action to create a new legislative authority.	Well accepted method of protecting regional ground water resources.	Administrative requirements will vary depending on the goal of the regional district. Mapping of the regional WHPA's requires moderate administrative support while creating land use controls within the WHPA will require significant administrative personnel and support.
Land Banking	Used to acquire and protect land within WHPA's.	Land banks are usually accomplished with a transfer tax established by state government empowering local government to impose a tax on the transfer of land from one party to another.	Land banks can be subject to legal challenge as an unjust tax, but have been accepted as a legitimate method of raising revenue for resource protection.	Land banks require significant administrative support if they are to function effectively.

Land use decisions within the Borough of Rouseville are controlled by the Cornplanter Township Zoning Ordinance. According to Resolution 85-91, made by the Borough of Rouseville, "wellhead and groundwater protection in granting permits and in making zoning, planning, subdivision, and other related land use ordinances, regulations, or decisions for areas possibly affecting the wells of the Borough of Rouseville Water System, which wells are located in Plumer, Cornplanter Township. BE IT FURTHER RESOLVED that the Borough of Rouseville requests notification for the purpose of commenting on all such land use decision-making activities".

As noted above, however, the existing Cornplanter Township Zoning Ordinance allows a variety of industrial uses within the wellhead protection areas which pose ground water contamination risks. Participants at the 6 May public meeting indicated that zoning revisions are currently being considered and that wellhead protection provisions could be integrated into the zoning ordinance, perhaps in the form an Overlay Zoning Amendment.

The oil wells which are located within the delineated wellhead protection areas are subject to EPA's Underground Injection Control Program. Under this program they must be registered with the EPA. These wells should be evaluated as contamination sources and appropriate remediation undertaken.

Another non-regulatory tool which could be implemented is the posting of "Wellhead Protection Area" signs along Route 227. This would serve two functions: First it would educate residents by providing an obvious physical connection between land areas and drinking water supplies. It would also serve as a warning to truck drivers carrying hazardous cargoes that they are entering a sensitive environmental resource area.

Step #5 - Public Education

A public meeting was held on Tuesday, 6 May 1993, in the Borough of Rouseville. This preliminary wellhead protection plan was presented and

discussed. Approximately two dozen citizens and local officials attended. Future public meetings and workshops are recommended to ensure implementation of the wellhead protection plan.

The posting of "Wellhead Protection Area" signs, as mentioned above, would serve as an effective public education tool. Septic system maintenance and could be accomplished though mailing of educational brochures on the subject available from EPA, the Pennsylvania DER, and the Pennsylvania League of Women Voters.