United States
Environmental Protection
Agency

Office of Research and
Development
Washington, DC 20460

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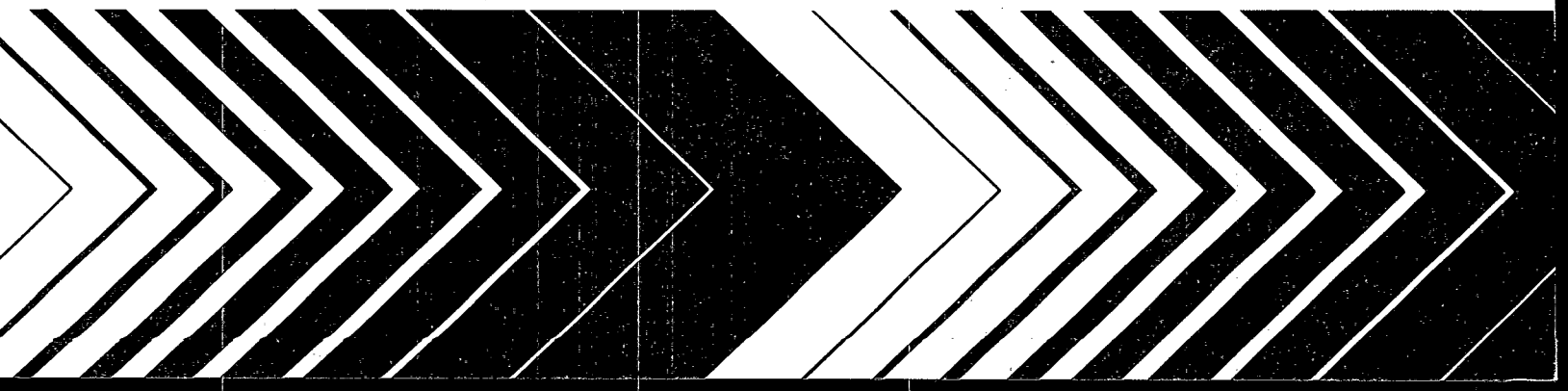
December 1992

EPA

Wellhead Protection Technology Transfer Centerpiece Workshop



WELLHEAD PROTECTION TECHNOLOGY TRANSFER
CENTERPIECE WORKSHOP

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The National Rural Water Association And Its Role In The Ground-Water/Wellhead Protection Project

The National Rural Water Association (NRWA) is a nonprofit trade association with about 10,000 members consisting of rural and small municipal water and wastewater utilities in the United States. The mission of NRWA is to enhance the quality of life in rural and small municipal areas by providing area-specific grassroots training and technical assistance programs. NRWA is organized by a federation of State associations and is governed by a Board of Directors comprised of individual members from each State.

Since its inception in 1976, the NRWA has offered services to member and nonmember small water systems in all 50 States and Puerto Rico. NRWA provides classroom training that gives water system personnel the latest information about drinking water regulations and technology. In addition, NRWA "circuit riders" travel throughout each State to assist water system personnel in providing safe water to their customers. NRWA also offers an annual technical conference for rural and small municipal facilities, seven weeks of technical and in-service training for more than 200 employees, a comprehensive resource library, a quarterly publication, technical bulletins, public educational materials, participation on National Task Groups, and many other functions.

The Ground-Water/Wellhead Protection Project involves helping small communities develop and implement local wellhead protection programs through hands-on assistance by NRWA-trained ground-water technicians. These technicians travel from system to system, meet with decisionmakers, convince them of the importance of wellhead protection, teach them a simple five-step approach to wellhead protection, help them implement each step, and provide consistent follow up. Throughout this process, the technicians encourage local communities to take charge and feel ownership of their wellhead protection plan. The project also helps small communities and State Affiliates gain access to NRWA's network of resources and expertise. As of October 1992, 553 water systems in the 14 States in the Ground-Water/Wellhead Protection Project have initiated wellhead protection efforts, and the program has been able to protect the drinking water sources for more than 1 million people.

EPA's Role In Ground-Water/Wellhead Protection

The U.S. Environmental Protection Agency (EPA) has developed a Ground-Water Protection Strategy to promote comprehensive protection at the State and local level. The overall goal of the strategy is to prevent adverse effects to human health and the environment and to protect the environmental integrity of the nation's ground-water resources.

EPA's strategy recognizes that given the uniquely local nature of ground-water pollution and use, the States and local governments must have the primary responsibility for assessing and prioritizing risks to ground-water resources and for implementing ground-water protection programs. EPA helps the States build comprehensive, integrated programs to protect ground-water resources. The Agency provides broad national guidance for designing and implementing programs and uses financial incentives to promote action.

For the National Rural Water Association (NRWA) Ground-Water/Wellhead Protection Project, EPA has provided a two-year, $2 million grant to NRWA to help small communities develop and implement wellhead protection programs. The Agency's Office of Ground Water and Drinking Water (OGWDW) has joined forces with the Office of Technology Transfer and Regulatory Support (OTTRS) and NRWA to facilitate this program. OTTRS is coordinating a major technology transfer effort, consisting of workshops, publications, and other communication mechanisms. This effort will disseminate the knowledge gained by NRWA and EPA on wellhead protection and allow many more communities to begin wellhead protection programs.

United States
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Office Of Water
(WH-550)

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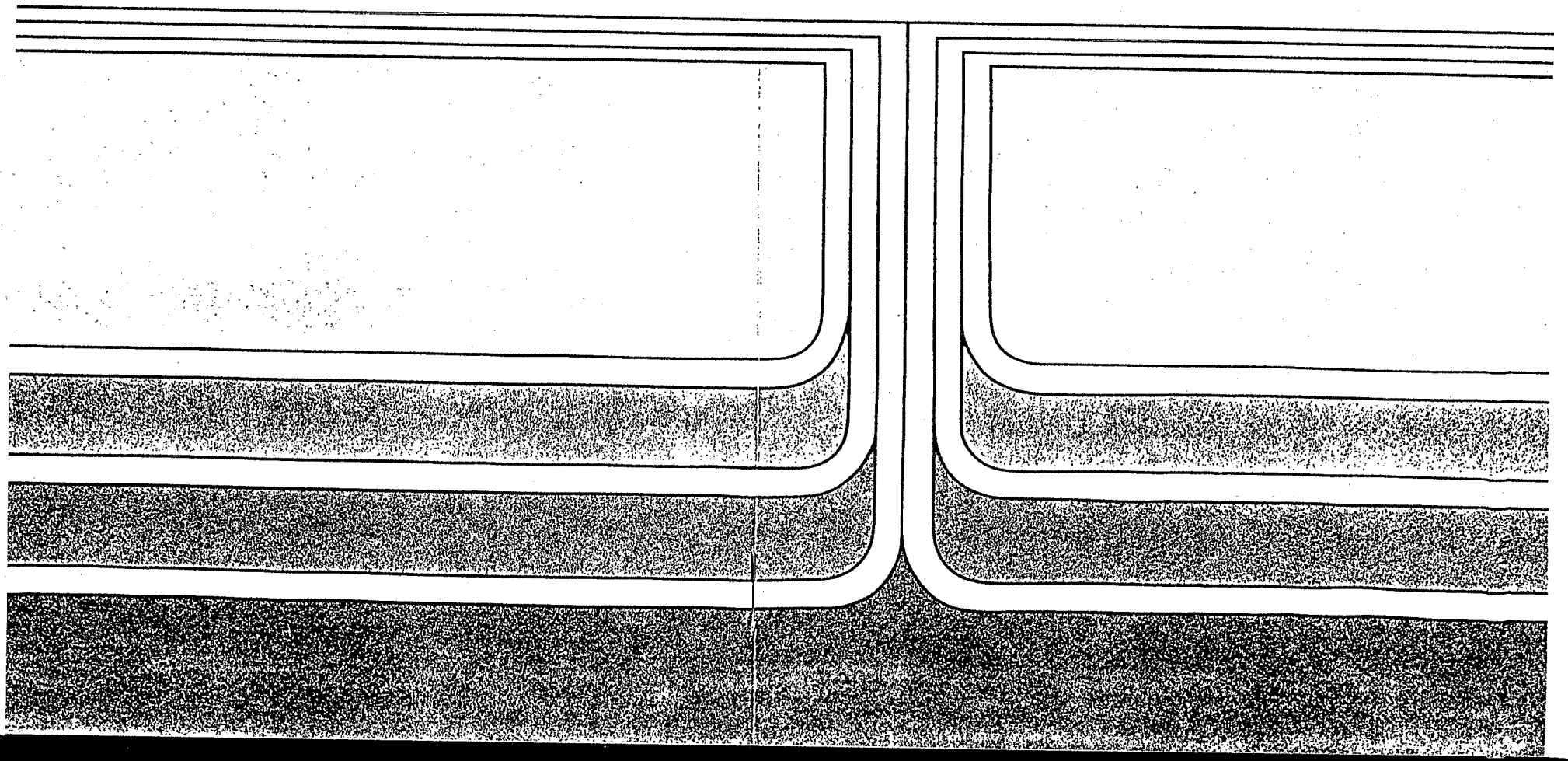
May 1991

EPA

Protecting Local Ground-Water Supplies Through Wellhead Protection



PROTECTING LOCAL GROUND-WATER SUPPLIES THROUGH WELLHEAD PROTECTION

OFFICE OF WATER
U.S. ENVIRONMENTAL PROTECTION AGENCY

May 1991

ACKNOWLEDGEMENTS

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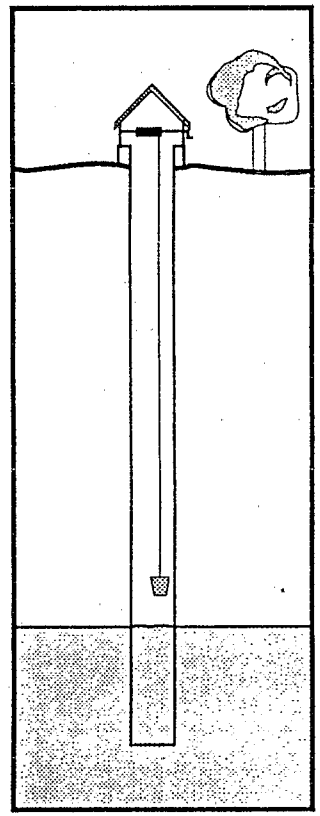
PROTECTING YOUR LOCAL GROUND-WATER SUPPLIES THROUGH WELLHEAD PROTECTION

INTRODUCTION

If you are the mayor or water supply manager or other official of a small town, county, or parish, or an interested citizen, and if your community relies on ground water for its public water supply, this booklet can help you prevent that ground-water supply from becoming contaminated.



Protecting your ground-water supply before it becomes contaminated, instead of waiting until contamination occurs, is both smart and cost effective. Communities all over the country have learned that it can be very expensive to clean up ground water once contaminated. They learned the hard way that a little bit of prevention would have been worth many pounds of cure.

This guide outlines an easy to follow, five-step process that your community can take to protect your public water supply wells.

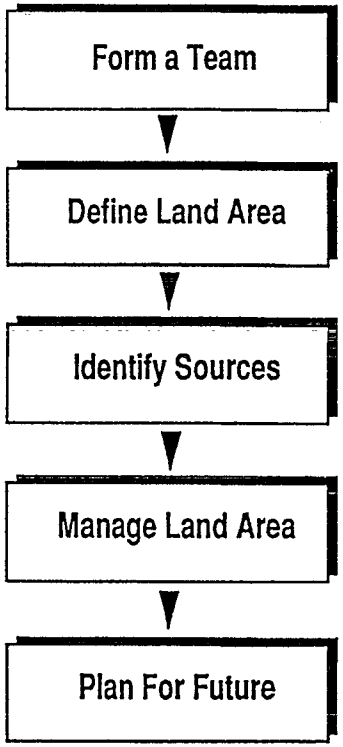
In addition, this guide presents an approach to protecting your ground-water supply that can be coordinated with existing state and federal ground-water supply protection programs such as EPA's Wellhead Protection, Underground Injection Control (UIC) and Public Water Supply System

programs. Check with your state environmental protection agency and your regional EPA office to determine what assistance and information is available to you.

FIVE STEPS TO PROTECTING YOUR PUBLIC GROUND-WATER SUPPLY

Protecting your ground-water supply wells from contamination can be accomplished by completing five basic steps:

1. *Form a community planning team;*
2. *Define the land area to be protected;*
3. *Identify and locate potential contaminants;*
4. *Manage the protection area; and*
5. *Plan for the future.*



Step 1 *Form a Community Planning Team*

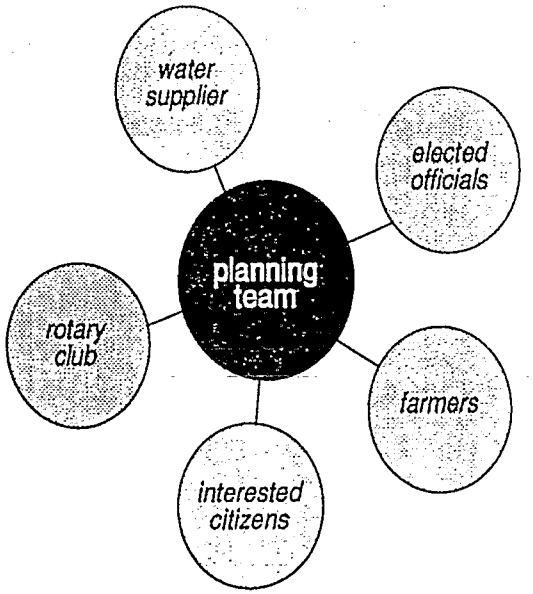
Although the size and membership of a community planning team may differ from one community to the next, it is important that the planning team represents all interests in your town. If there are existing groups in your community who have worked together successfully in the past, it may be useful to build a planning team around them.

Consider including representatives from the following groups on your planning team: water suppliers; elected officials; local government agencies such as health, planning, and natural resources; businesses; land developers; community service organizations such as the League of Women Voters, Rotary Club, Lions Club; environmental groups; public interest groups; farmers; local fire department; and interested citizens.

Perhaps most important is the selection of a leader who can keep the planning team organized and on track. A local official or community leader who has already gained community support may be helpful in pushing management options through the proper channels.

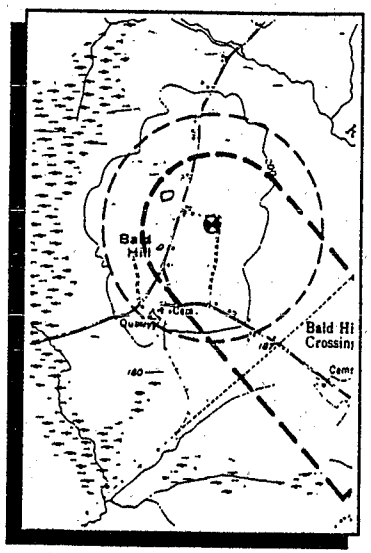
Your team will also benefit tremendously from the advice of a hydrogeologist, engineer, and land planner who may teach others in the group or act as the group's technical advisor. The local extension service, soil conservation service, or state ground-water agency may be able to lend you support in this area.

Once you have formed the planning team, the next order of business will be to define a clear goal and objectives. The goal will remind the planning team what it is trying to do, while clearly defined objectives will give the team benchmarks for measuring progress.



Step 2 *Define the Land Area to be Protected*

The first step for the planning team is to identify the land area that will need to be managed to protect your community's ground-water supply. The water pumped from a well passes through the surface and subsurface land surrounding the well and may extend up to thousands of feet from the well. This area is called a "wellhead protection area" (WHPA).



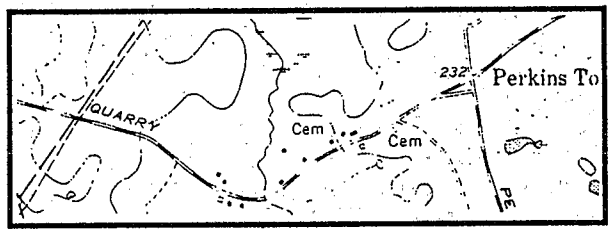
There are two good reasons for mapping wellhead protection areas. First, maps of WHPAs identify the ground-water area that is contributing directly to your well. Second, you can focus your management efforts on where they are most needed by identifying these areas of greatest concern.

EPA has published guidance documents to help define wellhead protection areas. In addition, many states have developed wellhead protection programs and are recommending methods for mapping WHPAs. Information about the guidance documents or the status of your state's wellhead protection program is available from the Regional EPA Offices (see page 18 for the location of the appropriate Regional Office for your state). If your state has a wellhead protection program, you may be able to get assistance in mapping the protection area around your town's public

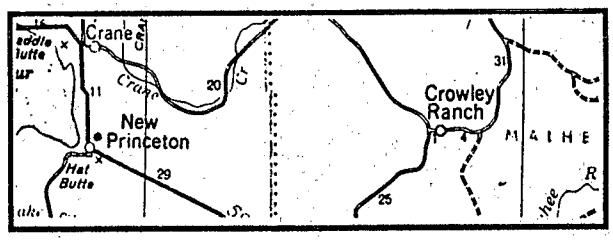
Finding a Base Map for Your Wellhead Protection Area

USGS topographic maps are easy to obtain and can be readily used as base maps for wellhead area protection programs. Other maps that can be used include county or city road maps, water resource maps produced by regional water authorities or the USGS, and USDA soil maps.

Topographic Quadrangle (USGS)

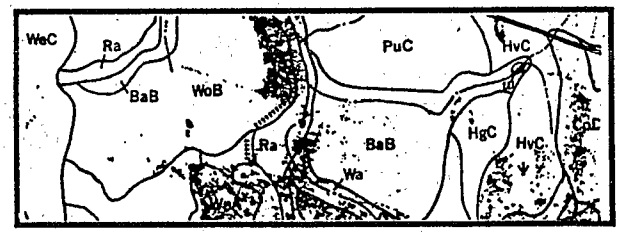


Local Road Map



Hydrologic Investigations Atlas (USGS)

Soil Survey Map (USDA)



supply well(s).

There are several different methods of mapping WHPAs. They range from drawing a circle with a specified radius around the well to more detailed calculations and the use of computer models.

If your state does not have a wellhead protection program, an initial area having a radius of one-half to one mile around the public water supply well would be considered a good starting point. This initial wellhead protection area could then be refined at a later date.

When site specific information on well construction, soils, geology, and ground-water flow is available, detailed methods can be used to calculate accurate WHPAs. Ground water computer models, for example, can predict which land areas contribute water to the well under varying conditions. EPA has developed a simplified computer model that is available to help define WHPAs.

Your community also may be able to obtain the information and expertise necessary for mapping a wellhead protection area from other sources, including:

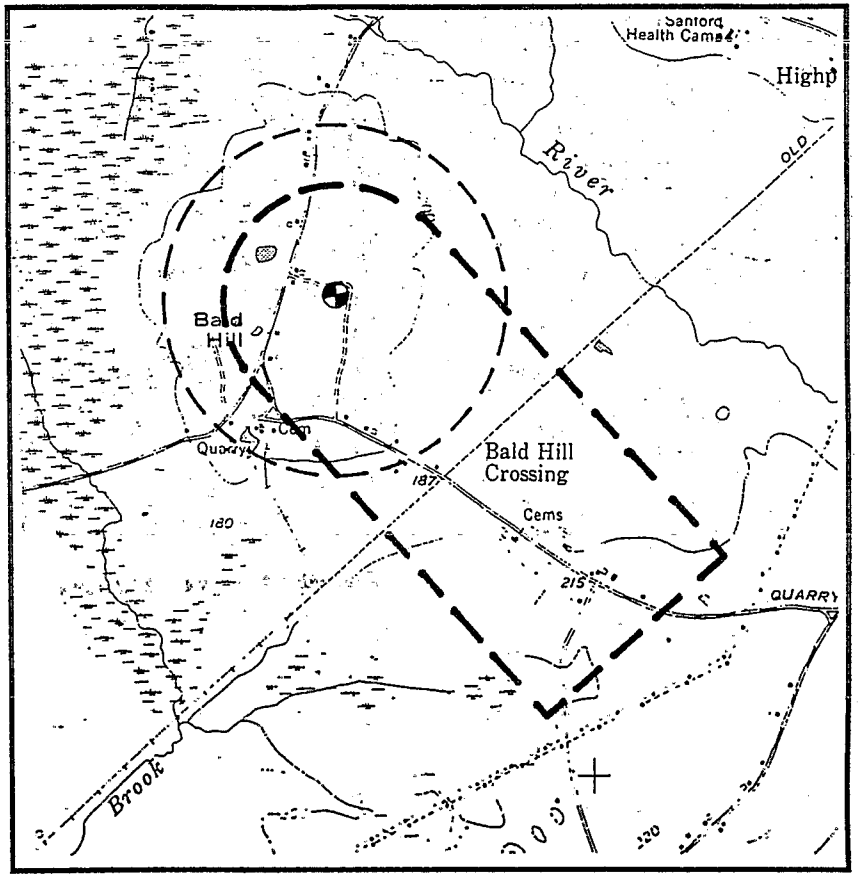
- Citizens of the community having professional expertise in these areas;
- Local universities or community colleges with

Mapping Wellhead Protection Areas

The Brookings County, South Dakota Planning Commission and Board of County Commissioners mapped wellhead protection areas identifying the ground-water area that directly contributes to the County's public supply wells. Once mapped, the County developed a protection program designed to manage land uses in the mapped WHPAs.

Mapping Your Wellhead Protection Area

Small communities can use a variety of techniques to map their wellhead protection areas, including EPA's simplified computer program, as illustrated in this example.



Legend:

- Public Water Supply Well
- Wellhead Protection Area Using Fixed Radius
- Wellhead Protection Area Using Simplified Computer Program

1000 0 2000 3000

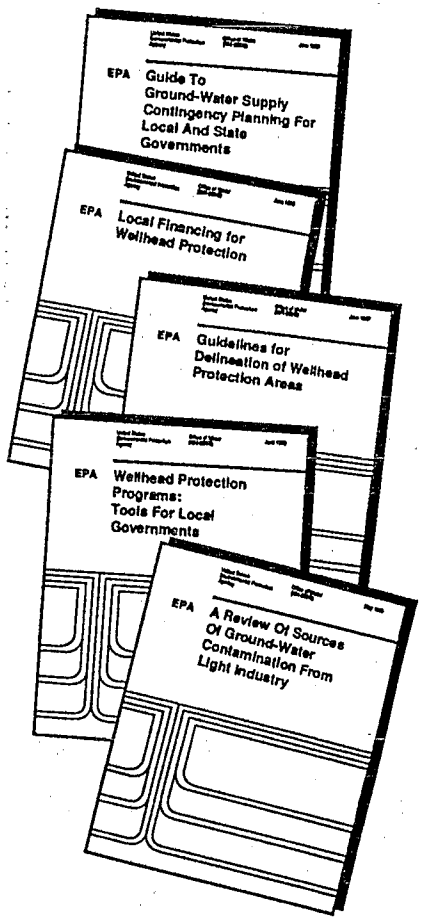
scale (feet)

departments in geology, water resources, civil or environmental engineering, environmental planning, or agriculture;

- Consulting firms specializing in hydrogeology and land-use planning; and

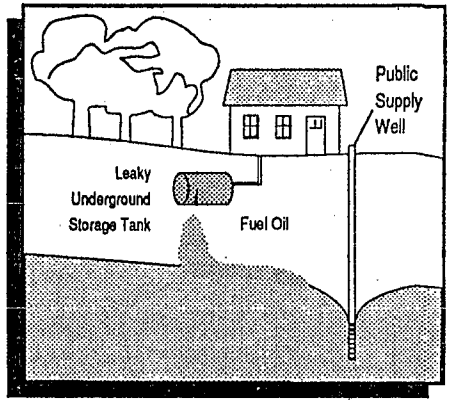
- Federal, State, or county agencies such as the United States Geological Survey, Soil Conservation Service, County Extension Service, State Health or Environmental Departments.

Once the wellhead protection area has been identified, its boundaries should be drawn on a map so everyone in the community will be able to identify the area that needs to be protected. United States Geological Survey (USGS) topographic maps provide an inexpensive yet informative base map on which you can clearly show your WHPAs. They are available from sporting goods or outdoor recreational stores, book stores, or from the USGS. You also might use or draw relevant information from town parcel (tax assessor's plat) maps; natural resources maps; soils maps (available from the U.S. Department of Agriculture and Soil Conservation Service), or water resources maps from your local library or regional planning agency.



Step 3 *Identify and Locate Potential Contaminants*

Once you know what areas in your community need to be protected, you can begin to identify and locate the potential threats to the quality of your ground-water supply. Any pollutants that are released within your WHPA have the potential to reach your well and contaminate the water. For example, less than one gallon of gasoline can contaminate one million gallons of ground water to the point that the well water is unusable for drinking purposes.



It can be helpful to divide your WHPA into smaller areas based on how the land is used (e.g. residential, commercial, agricultural, etc.) because different types of contaminants can be expected from different types of land uses. Table 1 shows some examples of potential contamination sources in different land-use categories.

Sources of information on existing land uses and potential contamination problems include the local phone book, the Chamber of Commerce's membership rosters, information maintained by your police and/or fire department and Federal, state, or county agency files. For example, the local agricultural extension agent may have records on chemical and manure storage and application areas in agricultural locations.

TABLE 1. COMMON SOURCES OF GROUND-WATER CONTAMINATION

Category	Contaminant Source	
Agricultural	Animal burial areas Animal feedlots Fertilizer storage/use	Irrigation sites Manure spreading areas/pits Pesticide storage/use
Commercial	Airports Auto repair shops Boatyards Construction areas Car washes Cemeteries Dry cleaners Gas stations Golf courses	Jewelry/metal plating Laundromats Medical institutions Paint shops Photography establishments Railroad tracks and yards Research laboratories Scrap and junkyards Storage tanks
Industrial	Asphalt plants Chemical manufacture/ storage Electronics manufacture Electroplaters Foundries/metal fabricators Machine/metalworking shops Mining and mine drainage	Petroleum production/ storage Pipelines Septage lagoons and sludge Storage tanks Toxic and hazardous spills Wells (operating/abandoned) Wood preserving facilities
Residential	Fuel oil Furniture stripping/ refinishing Household hazardous products Household lawns	Septic systems, cesspools Sewer lines Swimming pools (chemicals)
Other	Hazardous waste landfills Municipal incinerators Municipal landfills Municipal sewer lines Open burning sites	Recycling/reduction facilities Road deicing operations Road maintenance depots Storm water drains/basins Transfer stations

Conducting a Search

After your team has completed an initial review of potential contamination sources, it is important to search for specific activities that present contamination risks. This does not have to be an expensive effort involving consultants. Local volunteers, particularly senior citizens, have proven very effective in identifying potential contamination risks. Groups such as boy or girl scouts, 4-H, and volunteer fire departments also generally are willing to participate in local public service projects.

Perhaps the easiest way to conduct the field search is to make copies of your wellhead protection area map, divide the protection area into sections, and have volunteers mark on the map the contaminant sources they find within their sections.

The information collected should include a description of the activity, its location, the volume of material stored and handled, and any permit references. The final product should be a master wellhead protection area map. This map will identify all of the contaminant sources of concern within the protection area and present some indication of the nature and potential threat posed by those sources.

Once the existing sources have been identified and assessed, the next step is to determine if any threats could be sited within the wellhead protection area in the future. A close look at the current zoning map or master plan

Conducting the Search for Possible Contaminants

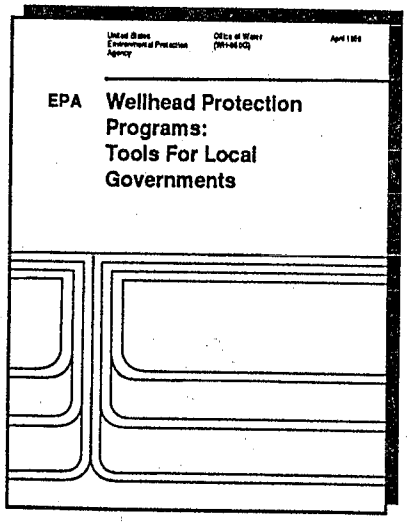
The Texas Water Commission (TWC) organized a volunteer group of senior citizens to help conduct inventories of possible contaminant sources in El Paso, Texas. Using checklists, maps, and materials supplied by the TWC, the volunteers identified and collected information on numerous potential ground-water contamination sources.

Using a similar approach, Cuba, Missouri residents successfully conducted a door-to-door survey and located 465 possible sources of ground-water contamination.

prepared by your community or your county may reveal that industrial or commercial activities could be developed within the WHPA. If your community has not adopted a zoning ordinance, this might be the time to consider doing so to protect your water supply.

Step 4 *Manage the Protection Area*

The management of activities (subdividing land, building roads, constructing and using buildings) within the WHPA usually is the responsibility of your local government. This responsibility can be an opportunity — a chance to preserve a resource critical to future growth and development. There are many ways to manage your WHPAs; some may be more appropriate for your community than others. These WHPA management methods or tools can be divided into two broad categories: regulatory and non-regulatory controls.



Regulatory Controls

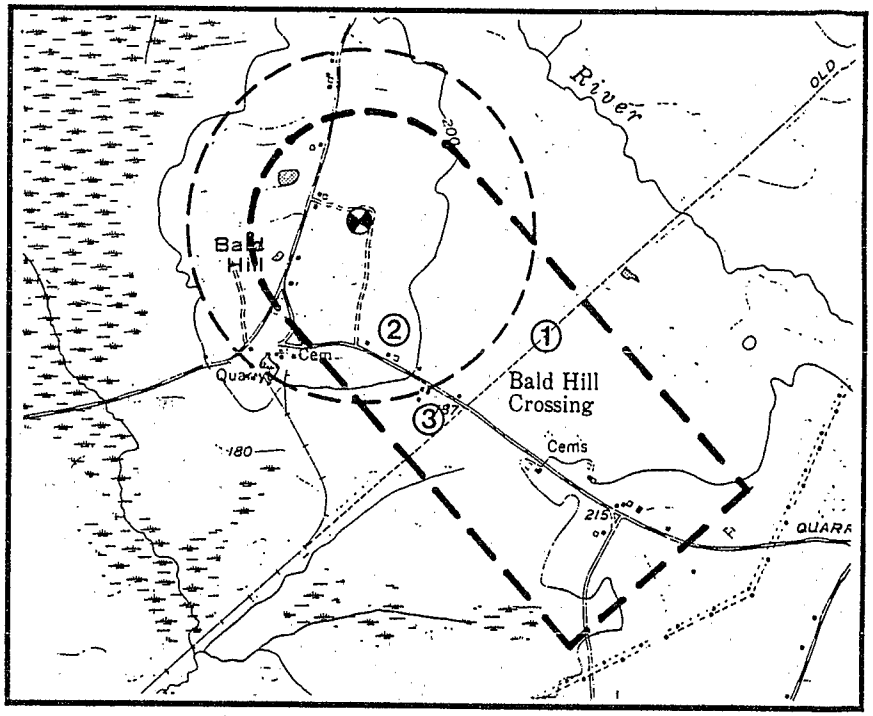
Small cities and towns have relied on **zoning** to guide their growth and protect water resources since the early 1900's. Zoning approaches can be used to separate different activities within the community and keep conflicting land uses from being sited next to each other. For example, a zoning regulation can be adopted to prevent new underground storage

Zoning

Clark County, Virginia adopted a zoning overlay district to prevent development incompatible with ground-water protection. Activities that are prohibited in the district include mining, land fills, underground storage tanks, and land application of sewage sludge. A minimum of two acres of land is required for the construction of residential dwellings.

Identifying and Managing Contaminant Sources of Concern

Once the wellhead protection areas are mapped, community planners can locate the contaminant sources of concern on the map. As a general rule, planners need to locate only sources within the WHPA. Having identified the important contaminant sources, the planning team can then use a variety of approaches to manage these sources, as illustrated in this example.



Legend:

Public Water Supply Well

Wellhead Protection Area

1000 0 2000 3000

scale (feet)

(1) RAILROAD; Possible Contaminant Sources Include:
Herbicides and accidental hazardous substance spills.
Management Options Include:
a. Railroad company agrees to reduce herbicide use.
b. Slow train speeds to prevent derailment within WHPA

(2) BALD HILL FARM; Possible Contaminant Sources Include:
Pesticide, nitrogen runoff from feedlots
Management Options Include:
a. Reduce use of pesticides within WHPA
b. Adoption of regulations governing feedlots and manure disposal

(3) BALD HILL SERVICE STATION; Possible Contaminant Sources Include:
Leaking underground fuel tanks, oil and fuel spills
Management Options Include:
a. Groundwater monitoring to detect leaks and spills
b. Removal of old underground storage tanks

tanks of petroleum from being installed within wellhead protection areas. In addition, zoning regulations could include the adoption of new districts to link the mapping of WHPAs with future management strategies.

Subdivision control rules and regulations also can be used to protect ground-water quality. When parcels of land are divided, subdivision regulations can be used to ensure that drainage from new roads is either treated or directed away from WHPAs.

Health regulations can be very effective in protecting ground-water quality. These controls are usually contaminant-source specific (e.g., for septic systems, underground storage tanks, toxic and hazardous materials control).

Regional approaches are options to consider when your local government does not have the power to regulate a certain activity or when a multi-community approach is necessary. It may be that the WHPA for your community's well extends into another town or state. Because the management techniques described above are difficult or impossible to apply outside your town, you may need to approach the neighboring community or your state legislature to create a special district for the joint management of the resource. Through a special ground-water protection district, you can establish consistent local controls across the entire WHPA and avoid piecemeal protection efforts.

Health Regulations

Provincetown, Massachusetts' 1.2 million gallon-per-day wellfield was closed due to adjacent ground-water contamination from an underground petroleum storage tank. After over $6 million in state and local funds were used to study, design, and install a treatment system, the town developed an underground storage tank health regulation to prevent similar occurrences from happening in the future.

Regional Approach

When ground-water contamination problems became evident in the Hunt River Aquifer located in eastern Rhode Island, officials from the three communities sharing the aquifer joined forces to ensure that ground water be protected from further contamination. The combined efforts ensure consistent protection of the resource, including ground-water monitoring, controls over septic systems, and proper handling, storage, and disposal of toxic hazardous waste.

Non-Regulatory Controls

Non-regulatory controls are those that do not involve the regulation of an individual's property and, when combined with an appropriate regulatory program, allow for the strongest possible management of your ground-water resource. Some non-regulatory approaches to consider include:

- Conduct eduction programs and workshops to inform your fellow city and town residents about the importance of protecting the community's ground water;
- Prepare brochures or pamphlets on the importance of disposing of pesticides, used oil, and other contaminants properly;
- Monitor your community's water quality, especially between existing water quality threats and your public wells;
- Acquire land within your WHPAs, either by purchase or by techniques such as easements, conservation restrictions, or "bargain sales".

Finally, regardless of what management steps are taken, remember to stay focused on the goal: the protection of your community's drinking water supply.

Public Education Programs

Accomack and Northampton Counties, Virginia have developed comprehensive public education programs on ground-water protection for county residents. These programs range from distribution of brochures regarding ground-water protection to establishing forums on the role of county residents in protecting WHPAs from contamination.

Ground-Water Monitoring

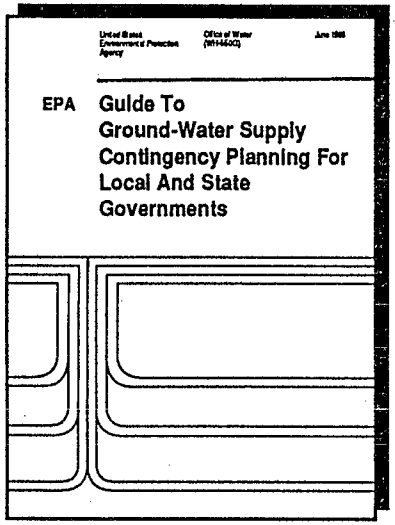
After a neighboring community lost half of its public water supply due to industrial contamination of the ground water, Littleton, Massachusetts' Water Department developed a ground-water protection strategy that included the placement of monitoring wells in strategic locations around industries and other potential pollution sources in town. The passage of a hazardous materials bylaw requires industries to install ground-water monitoring wells and pay for the inspection and sampling conducted by the town.

Step 5 *Plan for the Future*

Perhaps the most important step to take in protecting your town's ground-water supply is to sustain your protection efforts into the future. One year of intense ground-water protection measures is not likely to be adequate to establish long-term ground-water protection. Even modest ground-water protection efforts will be more effective if they are sustained.

The planning team should review the protection program each year to see where your community can improve its efforts. The planning team should think about future water supply needs and the type of program it would like to have in place five or ten years from now. It's important to try and identify potential future problems and figure out ways to head them off before they occur.

Even the most comprehensive wellhead protection program may fail to protect your community's wells. For this reason, it's important for your community to be prepared in case its water supply becomes contaminated. The planning team should begin to develop a contingency plan for response procedures and alternative water supplies in case the water supply is disrupted by contamination or other events.



Contingency Plans

Sioux Falls, South Dakota is served by a single well field that is located adjacent to industrial businesses, including the municipal airport and a petroleum storage facility. Several spills and tank leaks have occurred in the past prompting the city to develop emergency response procedures and a contingency plan to react to spills and leaks.

OVERCOMING OBSTACLES

The greatest obstacle that most small communities face in trying to implement a wellhead protection program is insufficient funds. Using a little creativity, it is possible to stretch the resources you do have and make a protection program work in your community. Using volunteers whenever possible can help control overall program costs. Local schools and universities may provide help as well. It also may be worthwhile to cosponsor a program with another organization interested in maintaining a clean water supply (e.g., local water supplier, environmental interest group, League of Women Voters, local industry, and farmers) and willing to share the cost of the program.

Financing Wellhead Protection

The Town of Bourne, Massachusetts and Collier County, Florida have generated funds through taxation for the purposes of ground-water protection. Another approach is the creation of a special "land bank" that is financed from real estate transactions. Nantucket, Massachusetts has used funds generated by a land bank to purchase lands within wellhead protection areas.

PULLING TOGETHER YOUR PROGRAM

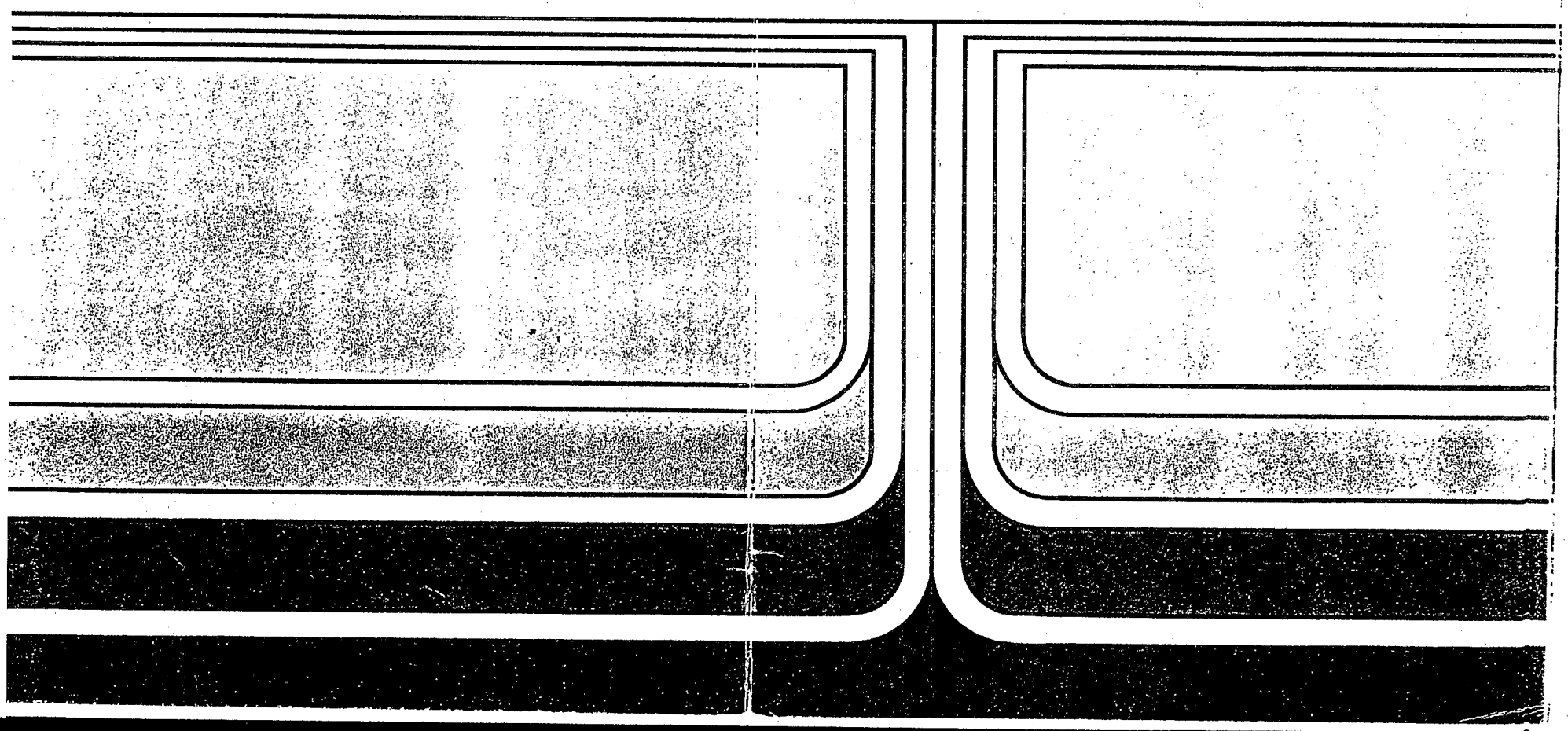
Now that you have had a chance to review the five-step approach to ground-water protection, it is time to evaluate how this process can work for you. The approach provided here, along with other information available from EPA and your county and state offices, is meant to serve as a general guide to developing a ground-water protection program that will best serve the unique needs of your community. Talk with the people in your town. Find out who is interested in wellhead protection and get them involved. Contact local, state, and EPA officials for assistance; they would rather help you protect what you have now, than try to help you clean it up or replace it later.

United States Environmental Protection Agency
Office of Ground-Water Protection Washington, D.C. 20460
May 1987 EPA 440/6-87-009
Office of Water

EPA

Wellhead Protection

A Decision-Makers' Guide



Wellhead Protection A Decision-Makers' Guide

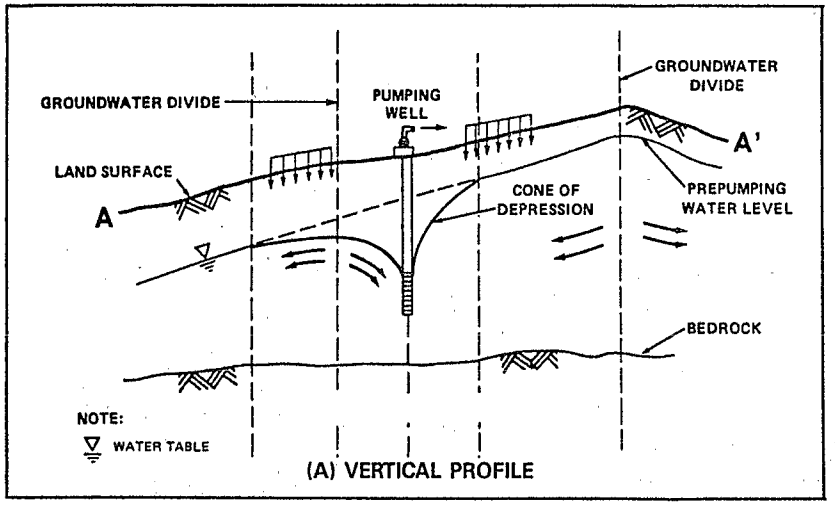
Perhaps you are a State legislator, whose constituents have been voicing their concerns to you about the contamination and closing of their local water supply wells. Or maybe you head a State public health or pollution control agency and see a need for better coordination of your State's ground-water protection activities. You could be chairman of a local zoning board making decisions on future development and worried that lack of potable water will limit the growth of your town.

These are the kinds of problems that the Federal Wellhead Protection Program is meant to help States solve, and the reason the Program became part of the Safe Drinking Water Act Amendments of 1986. EPA has produced this booklet to explain how the Program works and how your State can benefit by participating.

What is Wellhead Protection?

Wellhead protection is, by definition, protection of the area surrounding a well. So, first of all, we should explain what a "wellhead protection area" (WHPA) is. By statute, it is defined as the surface and subsurface area surrounding a well or wellfield that supplies a public water system through which contaminants are likely to pass and eventually reach the water well or wellfield.

WHPA boundaries are determined based on factors such as well pumping rates, time-of-travel of ground water flowing to the well, aquifer boundaries, and degree of confinement. All of these hydrogeologic characteristics have a direct effect on the likelihood and extent of contamination.



(A) VERTICAL PROFILE

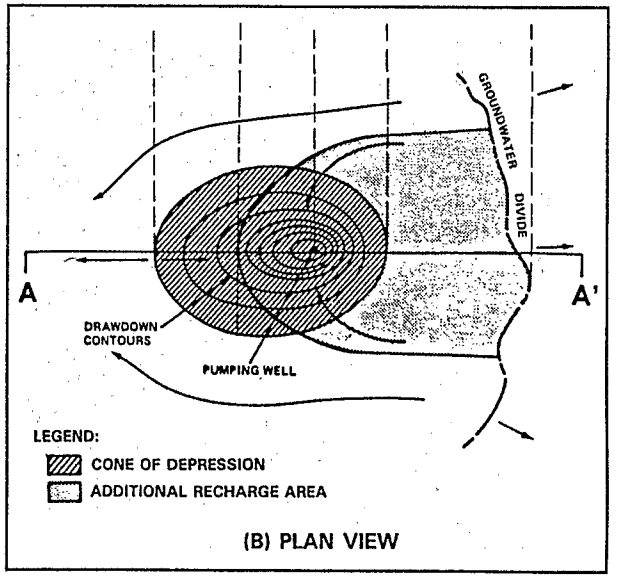
The ground-water surface around a pumping well is pulled down as water is drawn into the well, creating a cone of depression (COD) around the well. The extent of this cone can vary from only a few feet to many miles from the pumping well, depending on hydrogeological factors. Ground water drawn into the pumping well is replaced by ground water further away, usually uphill (upgradient) from the well. The recharge area, which may be limited by physical or hydrologic boundaries, may consist of all or part of the cone of depression as well as the area from which the replacing water comes.

A Well Contamination Incident

The problem of ground-water contamination is easy to define. If you pick up a newspaper in many communities, you may find an article describing a ground-water contamination incident and its effect on public water supplies. This is not surprising, since 95 percent of rural America and in total about half the U.S. population rely on ground water.

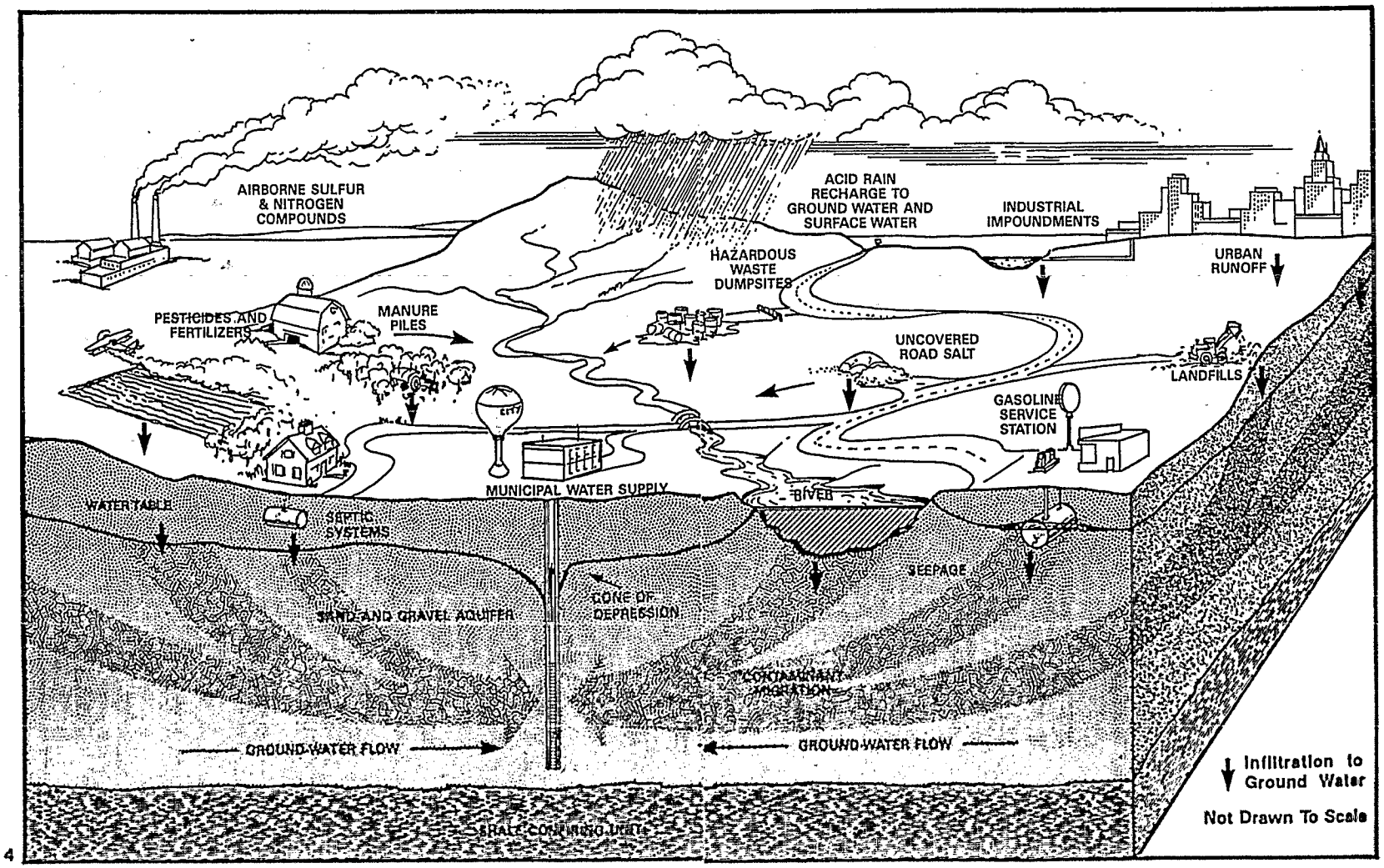
These incidents are especially sobering when you realize the amount of time and money needed for clean up. For example, a leak in a gasoline storage tank in a community in Massachusetts made headlines in 1977 when it forced the shutdown of a nearby municipal wellfield, disrupting that community's only source of drinking water. When the tank was excavated, local officials estimated that between 2,000 and 3,000 gallons of high-test unleaded gasoline had leaked into the ground less than 600 feet from the nearest well in the municipal wellfield.

A wellhead protection area (WHPA) can be established for any type of aquifer and can include all or part of the pumping well's cone of depression, the recharge area and the surrounding aquifer. The actual extent of the areas within WHPAs will vary depending upon the program goals of individual State programs and the hydrogeologic settings present in the State.



(B) PLAN VIEW

Potential Sources of Ground-Water Contamination

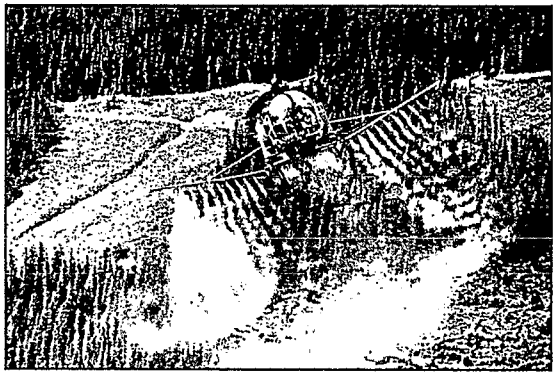


EPA has estimated that 20% of the one million underground petroleum storage tanks may be leaking and have the potential to contaminate water supplies.

To address the problem, the town temporarily provided alternative water supplies, instituted a strict water conservation program, and began a two-phase clean-up process. The second phase, which began in 1985, consists of pumping and treating the contamination and then recharging the treated water back into the aquifer. This second phase will take three to five years to complete and will cost the town $1.1 million; the Massachusetts Department of Environmental Quality Engineering, $1.2 million; the Massachusetts Executive Office of Community Development, $750,000; and the U.S. Department of Housing and Urban Development, $250,000. Many years of work and a total cost of $3.3 million is a high price to pay for a leak in a gasoline storage tank.

This type of story, though a worst case example, is repeated in many States, and the more we look, the more problems we seem to find. For example, in California, 88 large public water supply system wells were closed because of organic chemical contamination including both solvents and pesticides. In Virginia, 27 public community supplies are on indefinite "boil water" notices, and in Iowa, 57

Pesticide applications of all types are one of the many non-point sources of contamination.



percent of the wells in alluvial areas have detectable pesticide residues.

It doesn't take too many incidents like these to recognize that cleaning up and treating contamination or siting and putting in new wells is a costly process.

Threats to Water Supply Wells

Across the country, hundreds of types of potential sources of groundwater contamination have been identified. The magnitude of the potential problem begins to emerge when you consider just a few of these contaminant sources: 23 million septic tank systems; 9,000 municipal landfills; 190,000 surface impoundments; 280 million acres of cropland treated with pesticides annually; 50 million tons of fertilizer applied to crops and lawns annually; and over 10 million tons of dry salt and two million gallons of liquid salts applied to our highways every winter. These sources do not always threaten groundwater supplies, but always have the potential to do so, unless managed properly.

The areas surrounding water well supplies can be particularly vulnerable to these sources of contamination, since contaminants discharged within the recharge area to a pumping well may be drawn toward that

well. The proximity of most public water supply wells to the populations they serve, as well as to the every day activities of the community, also contribute to vulnerability. Sources as diverse as dry cleaners, septic tanks, industrial facilities, or road salting can cause well contamination. Contamination source controls and land management programs which address physical, microbial, and chemical threats to ground water are important tools that can help prevent well contamination.

Wellhead Protection Measures

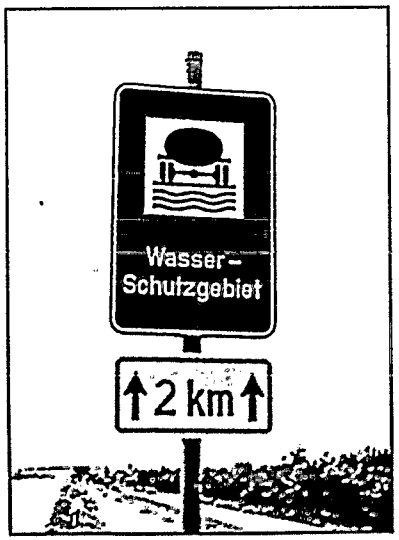
Designating protection areas around drinking water wells is one way to protect underground water supplies. Application of this concept is common in Europe. At least 11 European countries, including Germany, Switzerland, and the Netherlands have designated zones around their public water supplies. Within these zones, special controls are imposed on any number of potential hazards.

A growing number of States and municipalities in this country also are beginning to create such wellhead protection areas. To guard against the more persistent chemical threats, wellhead protection areas range anywhere from a distance of a few hundred feet to several miles from wells. The characteristics of the aquifers surrounding the wells, the extent of pumping and the vulnerability of the aquifer to surface contamination, and the degree of development and activity surrounding the well are the primary criteria by which most States, counties, or municipalities have delineated protection areas.

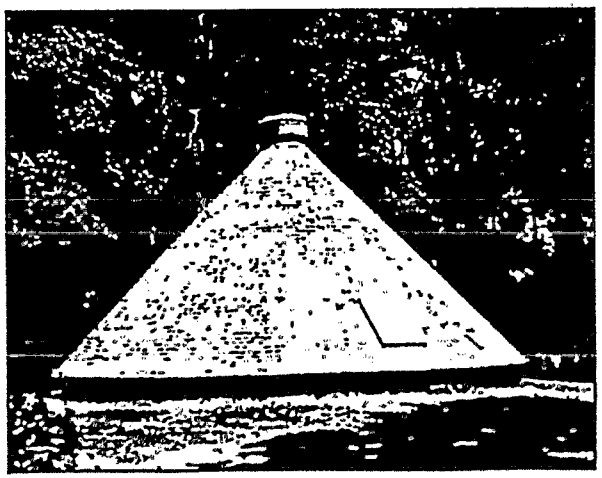
Management activities commonly employed within these protection areas include: regulation of land use through special ordinances and permits, prohibition of specified activities, and acquisition of land.

Massachusetts and Florida are among the States now using some of these management tools to protect public water supply wells. Beyond the obvious public health reasons, State-wide Wellhead Protection Programs make a lot of economic sense, as the earlier contamination examples illustrate.

Road-side signs in Europe mark the boundaries of wellhead protection areas.



The Baddacock well in Groton, MA, one of the oldest public wells in New England, is being protected through a variety of land use management techniques.



Non-community wells such as those in campgrounds, for example, are also addressed by the Wellhead Protection Program.

The Safe Drinking Water Act Amendments of 1986

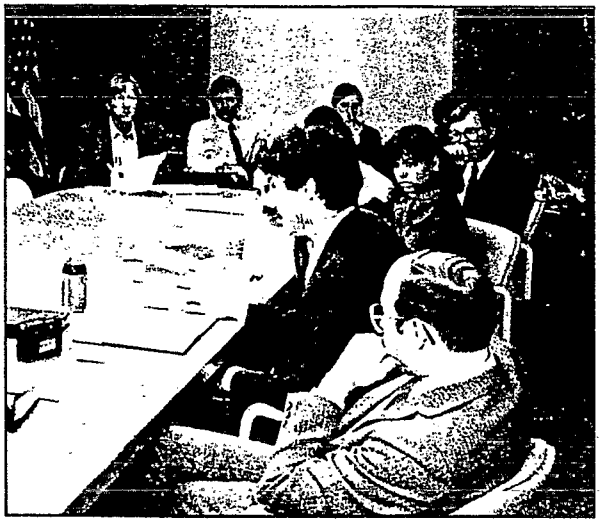
Provisions for wellhead protection were adopted as part of the reauthorization of the Safe Drinking Water Act, signed into law in June 1986. This legislation established a nationwide program to encourage States to develop systematic and comprehensive programs within their jurisdictions to protect public water supply wells and wellfields from contamination from all anthropogenic sources.

The purpose of the Wellhead Protection Program is to prevent contamination of public water supplies. The primary goal is the prevention of problems as contrasted to correction of existing situations.

EPA's role in the Program is to provide leadership to States in efforts to preserve valuable groundwater supplies that currently, or may in the future, serve as sources of drinking water. This will be accomplished through program grants and technical guidance, not by imposing another layer of Federal regulation. The Federal government is not given any authority over water allocation, which is a State responsibility. Any Federal department or agency with jurisdiction over any potential source of contamination identified by a State under this Program is subject to the State's requirements.

State Wellhead Protection Programs developed under this Program are to address public water supply wells. There are currently 187,000 public drinking water well systems, including 47,000 community and 140,000 non-community drinking water systems. These include non-residential facilities, such as campgrounds and truck stops, and public water wells, which are those serving more than 25 persons.

Siting and putting in new wells to replace contaminated wells can be a costly process.



Various levels of State and local government will be interacting in the development and implementation of Wellhead Protection Programs.

The State Role In Wellhead Protection

Historically, States have primary responsibility for ground-water management. EPA recognizes that they will fashion Wellhead Protection Programs that accommodate their own unique features and needs, since from State to State, and even within States, hydrogeology varies, sometimes dramatically, as do laws and administrative practices.

The Wellhead Protection Program was enacted to both enhance State programs already underway, and to encourage other States to begin such protection programs by providing financial and technical assistance.

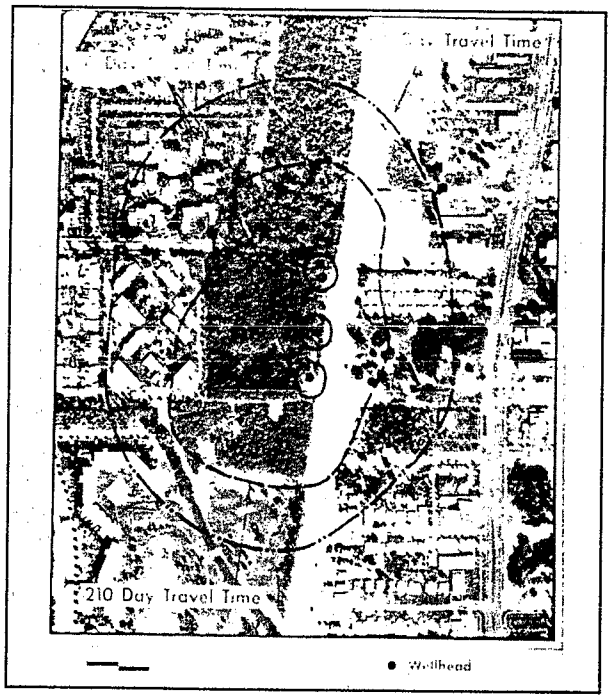
The statute specifies that all States will participate; however, the EPA has no authority to establish a Wellhead Protection Program if a State chooses to forgo action on its own. There are no EPA sanctions against States that do not participate.

Each State has the opportunity to design and implement a Wellhead Protection Program that meets broad Federal guidelines. States have a lot to gain as they go about the business of deciding how best to protect their ground water. They will benefit from the availability of a variety of technical assistance tools, and they will have additional funding to carry out the protective measures they decide are necessary.

Applying for a Wellhead Protection Program Grant

What does applying for a grant involve? Basically, a State has to supply EPA with a blueprint of its Wellhead Protection Program. The Safe Drinking Water Act Amendments of 1986 set out the kinds of information that applicants must provide by requiring that six elements be addressed:

- Specify the duties of State and local agencies and public water systems in developing and implementing the Program
- Determine the extent of the wellhead protection area to be used
- Determine all potential anthropogenic sources of contaminants which may have an adverse effect on public health in the delineated wellhead areas
- Describe procedures to protect water supplies from such contaminants that are present within wellhead protection areas
- Include contingency plans for the provision of alternative drinking water supplies for each public water system in the event of well or wellfield contamination
- Require that all potential sources of contamination within the wellhead protection area of new public water supply wells be considered prior to construction.

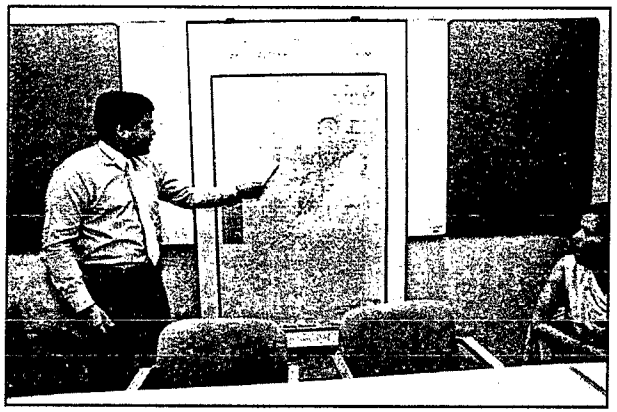


Calculation of the time it takes for contaminants to travel from the point where they enter the ground water to the wellhead is one method used to determine wellhead protection zones.

The Amendments further require an applicant State to demonstrate that public participation was solicited and carefully weighed in the process of formulating a Wellhead Protection Program.

As for choosing the way to create a Wellhead Protection Program that includes the above elements, that is left up to the individual State. However, the presumption is that, rather than starting from scratch, States will build on Ground-Water Protection Strategies and existing programs and also look to those Federal programs with ground-water protection elements.

The EPA wants to ensure that States have a clear understanding of the intent of the statutory elements and will be offering specific guidance on how to establish a Wellhead Protection Program that will be eligible for Federal funding.



Dade County is one of many communities that have established Wellhead Protection Programs.

In fact, helping States to develop eligible programs is EPA's main goal as it administers the Wellhead Protection Program. As described later in this brochure, EPA will also publish a series of informational documents that include examples of programs and provide resource information to help States in developing their own programs.

Some Program Features

Participants will need to designate a lead managing agency capable of carrying out requirements of the law and of coordinating communication and activities among the various entities that are involved in public water administration and supply.

A very important program activity will be to determine the roles that State and local agencies, as well as public water suppliers, are to play in developing and carrying out the State Wellhead Protection Program. Again, the concept of a lead managing agency is introduced to ensure implementation through a coordinated and well managed program.

Getting Started

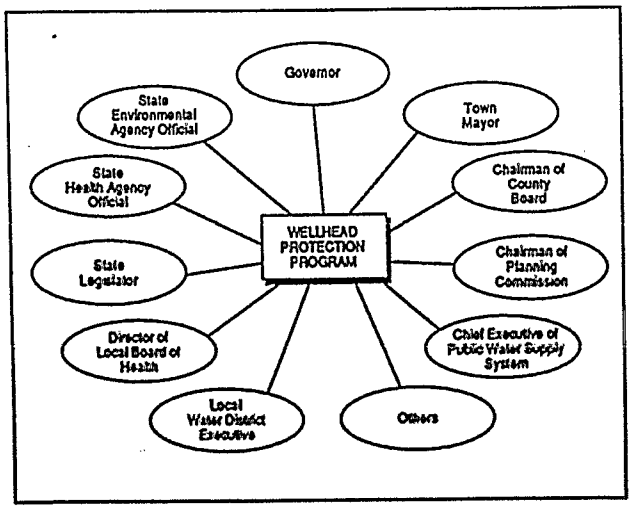
When it comes to wellhead protection, participating States obviously will vary in their

needs and goals. Some will have sophisticated systems already in place; others may have few, if any, existing protection mechanisms.

Whether the goal is to upgrade current programs, or just get started, every State has to begin by looking at the same things: the hydrogeology of the State as well as the existing legal and institutional apparatus. The latter is especially important to examine in order to get a head start in the planning process. For example, new laws may be needed to control sources of contamination not previously regulated. What are the steps necessary to get such laws enacted and implemented and how long will it take?

Here is a list of questions that you might want to consider as you begin to develop a Wellhead Protection Program in your State:

- What is the seriousness and distribution of preventable well contamination problems in the State? Does a significant need exist for a State-wide effort to control such contamination?
- What organizational and legal authorities already exist and are they sufficient to implement the type and level of wellhead protection desired on State and local levels?
- What is known about the hydrogeology of areas where public water supply wells are located?
- What jurisdictional units would be responsible for, or affected by, a WHP Program? State Departments of Environmental Quality or Public Health? What about substate units, such as special purpose districts, or public and private water companies? Are there local jurisdictional units and interested parties, such as Federal agencies with public water supply jurisdiction, to consider? How do we get these groups involved?
- What ground-water protection and resource management activities are already in place at the State and local levels? Could they be incorporated into a WHP Program? Are there Federal and State programs with ground-water protection components that could be built on and enhanced?
- What kind of administrative structure is appropriate? Is there an existing agency that can manage the overall program, ensuring communication among those involved in program development? Or is a new umbrella agency needed? What capabilities should the managing agency have?
- What technical skills are needed for defining wellhead protection areas, taking stock of sources, and analyzing source risks?
- What resources are available (technical, managerial, and financial) to carry out the program? How can any gaps be closed? Is there information on existing inventories and risk assessment to use and thus avoid duplication?



The roles of the various participants, on all levels, is a very important component of the Wellhead Protection Program

Clearly, many factors have to be considered even before the process of identifying sources and developing management strategies can begin. Recognizing the extent of the commitment in time and resources that States will need to earmark for this program, EPA sought ideas from a broad spectrum of individuals and organizations in the development of program policy and guidance.

EPA consulted Federal, State, and local agencies; environmental groups; and experts in business, industry, and academia. State and local representatives, who have sat on technical committees and attended workshops, have helped pinpoint ways that EPA can streamline the program.

To help States plan programs eligible for Federal funding, EPA is preparing a series of documents, including a program guide and application package that spells out exactly what a State needs to include in a WHP Program submission for funding. Due out in June 1987, this package also will contain deadlines and funding information.

Targeted for publication at the same time, "Guidelines for Delineation of Wellhead Protection Areas" will outline various approaches that States can use to define protection areas around wellheads. The document specifically discusses various criteria mentioned by the statute that may be used to define wellhead protection areas. These include: distance, drawdown, time-of-travel, physical boundaries, and assimilative capacity approaches. The document also discusses a variety of technical methods to delineate these areas, ranging from simple "cookie-cutter" techniques to the use of sophisticated computer models.

Beginning in the summer and in the fall, EPA will issue several other technical assistance documents. The first of these will illustrate a variety of ways to put together a State Wellhead Protection Program. Other documents in the series will be similar to the one already issued on management of septic systems and will deal with specific topics pertinent to wellhead protection.

Federal Funding

Funding for Federal support of State WHP Programs is authorized for each of the Federal fiscal years 1987-1991. Subject to Congressional appropriation, funds have been requested in the President's Budget for FY 1988.

The first two years of funding are to be directed toward program development. Once a State program is approved, the State may then apply for funds to implement its program. EPA cannot fund program development after June 1989.

Funds will be allocated on a matching basis with EPA matching State funds at 90 percent for FY 1988, the maximum allowable level, with a 10 percent Federal matching level decrease during each of the subsequent program funding years, e.g., 80 percent for FY 1989. Assistance funds are for a one-year budget period and must be applied for annually.

During the development phase, States will design a State WHP Program that specifically describes their Program and formally designates a managing agency to

Grant Process Schedule

- June 19, 1987
  - Applicants' Guidance and Application Materials can be requested from EPA
- July 1987 - August 1987
  - Training available to State staff by EPA concerning WHP Program and process for Assistance Application
- May 1987 - January 1988
  - Application Development discussion between State staff and Regional Office staff
- January 1988
  - Financial Assistance Application received from States by Regions
  - States needing more time would submit a letter of intent to the Regions by this date if they cannot provide an application
- January 1988 - May 1988
  - Funding arrangements completed

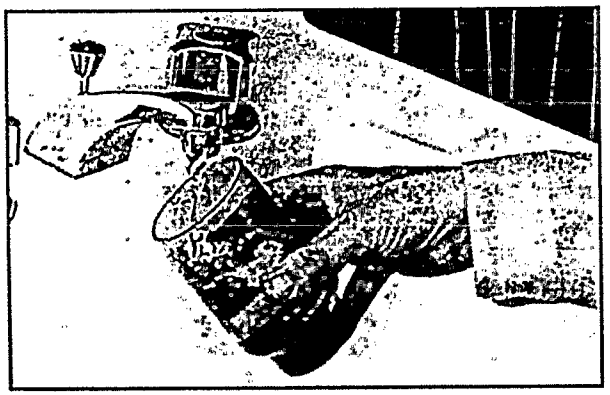
direct the Program. Many States will probably have a number of agencies, both at the State and local level, which will have responsibility for the various Wellhead Protection Program activities. The managing agency will have the responsibility of ensuring that these activities are implemented.

Summary

Wellhead protection is a management process that acknowledges the link between activities that take place in wellhead areas and the quality of the ground-water supply for those wells. It calls for cooperation among the many groups that have a say in the activities that affect wellhead protection areas.

For some States, the process already has begun. For them, Federal funding and technical assistance means a chance to create a more comprehensive ground-water protection program than they now have. For States which are just beginning, here is an opportunity to build a solid program from the start.

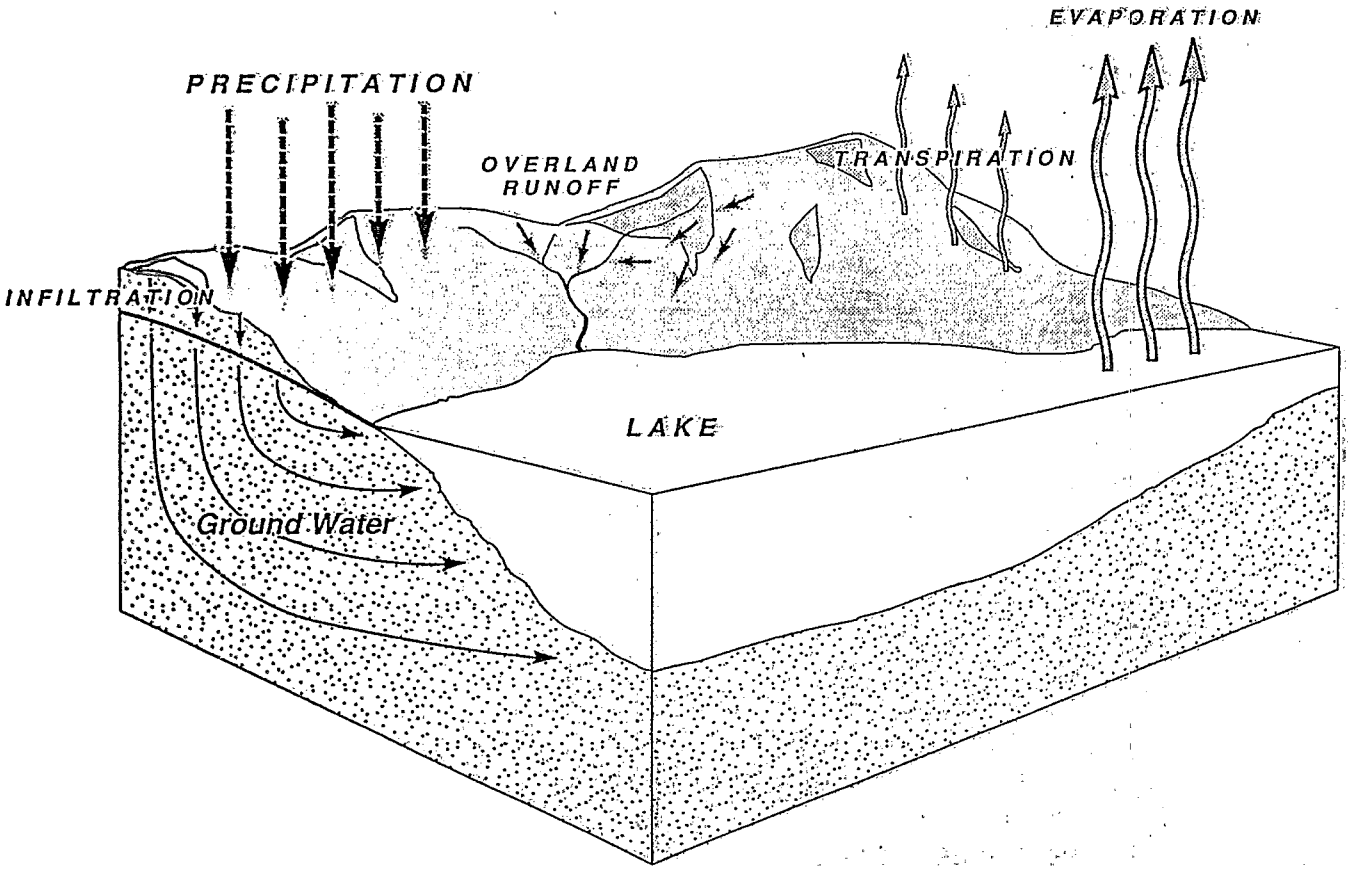
Whatever ground-water protection phase a State may be in, the Wellhead Protection Program is an opportunity to focus on the needs and goals of each individual State and help it meet its water supply protection goals. For all of those involved, there is one underlying goal, namely to help provide quality drinking water for generations to come.



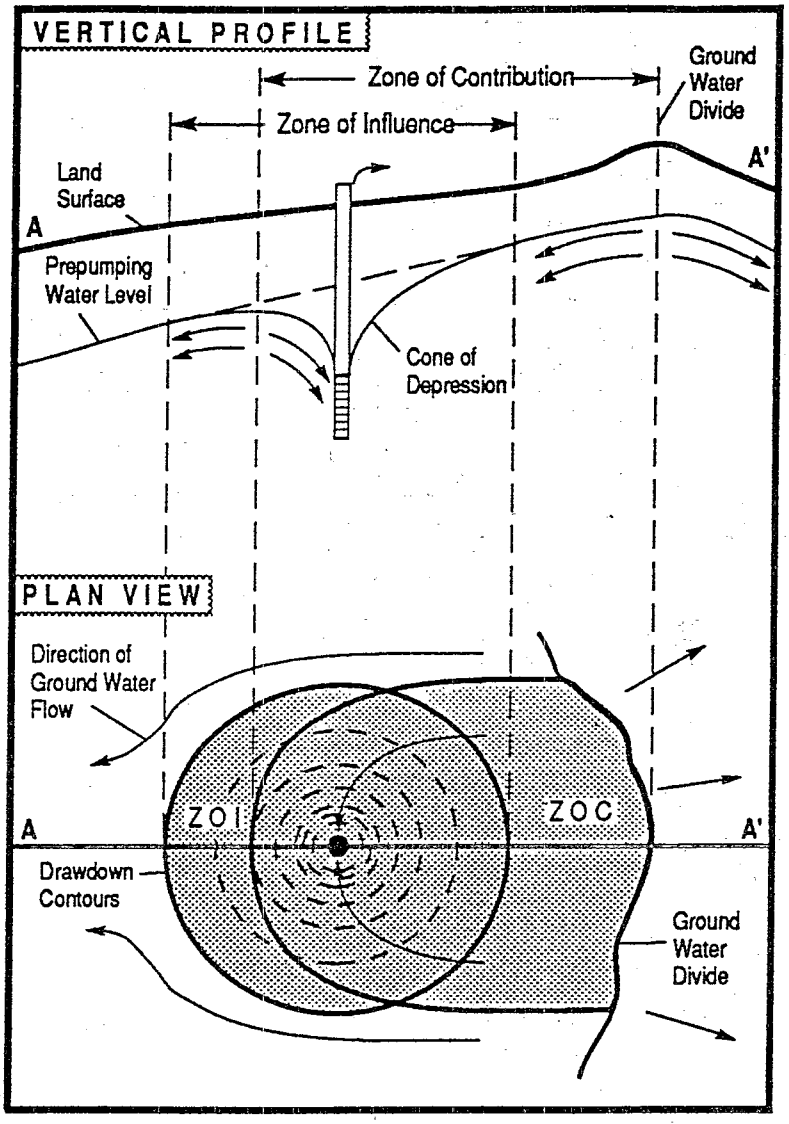
Potential Wellhead Protection Planning Team Members

Gather a broad mix of people with diverse skills in technical, managerial, administrative, and public relations areas from public, private, and regulatory organizations, such as:

- **Businesses**
- **Community service organizations**
- **Drilling contractors**
- **Elected officials**
- **Engineers**
- **Environmental groups**
- **Farmers**
- **Interested citizens**
- **Land developers**
- **Land planners**
- **Local government agencies**
  - Conservation
  - Environment
  - Extension Service
  - Health
  - Natural resources
  - Planning
  - Public works
- **Public interest groups**
- **Ranchers**
- **Volunteer organizations**
  - Fraternal organizations
  - League of Woman Voters
  - Rotary Club
  - Senior citizen groups
  - Volunteer fire departments
- **Water suppliers**



THE HYDROLOGIC CYCLE



GROUND-WATER HYDROLOGY: ZONE OF CONTRIBUTION, ZONE OF INFLUENCE, AND CONE OF DEPRESSION

Potential Sources of Ground-Water Contamination

SOURCE	HEALTH, ENVIRONMENTAL, OR AESTHETIC CONTAMINANT[1,2,3]
NATURALLY OCCURRING SOURCES	
Rocks and soils	Aesthetic Contaminants: Iron and iron bacteria; manganese; calcium and magnesium (hardness) Health and Environmental Contaminants: Arsenic; asbestos; metals; chlorides (fluorides, sulfates); sulfate-reducing bacteria; other microorganisms
Water	Excessive sodium; bacteria; viruses; low pH (acid) water
Decaying organic matter	Bacteria
Geological radioactive gas	Radionuclides (radon, etc.)
Natural hydrogeological events and formations	Salt-water/brackish water intrusion (or intrusion of other poor quality water); contamination by a variety of substances through sink-hole infiltration in limestone terrains
AGRICULTURAL SOURCES	
Animal feedlots and burial areas	Livestock sewage wastes; nitrates; phosphates; chloride; chemical sprays and dips for controlling insect, bacterial, viral, and fungal pests on livestock; coliform[4] and noncoliform bacteria; viruses
Manure spreading areas and storage pits	Livestock sewage wastes; nitrates
Livestock waste disposal areas	Livestock sewage wastes; nitrates
Crop areas and irrigation sites	Pesticides;[5] fertilizers;[6] gasoline and motor oils from chemical applicators
Chemical storage areas and containers	Pesticide[5] and fertilizer[6] residues
Farm machinery areas	Automotive wastes;[7] welding wastes
Agricultural drainage wells and canals	Pesticides;[5] fertilizers;[6] bacteria; salt water (in areas where the fresh-saltwater interface lies at shallow depths and where the water table is lowered by channelization, pumping, or other causes)
RESIDENTIAL SOURCES	
Common household maintenance and hobbies	Common Household Products:[8] Household cleaners; oven cleaners; drain cleaners; toilet cleaners; disinfectants; metal polishes; jewelry cleaners; shoe polishes; synthetic detergents; bleach; laundry soil and stain removers; spot removers and dry cleaning fluid; solvents; lye or caustic soda; household pesticides;[9] photochemicals; printing ink; other common products; Wall and Furniture Treatments: Paints; varnishes; stains,; dyes; wood preservatives (creosote); paint and lacquer thinners; paint and varnish removers and deglossers; paint brush cleaners; floor and furniture strippers; Mechanical Repair and Other Maintenance Products: Automotive wastes;[7] waste oils; diesel fuel; kerosene; #2 heating oil; grease; degreasers for driveways and garages; metal degreasers; asphalt and roofing tar; tar removers; lubricants; rustproofers; car wash detergents; car waxes and polishes; rock salt; refrigerants
Lawns and gardens	Fertilizers;[5] herbicides and other pesticides used for lawn and garden maintenance[10]
Swimming pools	Swimming pool maintenance chemicals[11]
Septic systems, cesspools, and sewer lines	Septage; coliform and noncoliform bacteria;[4] viruses; nitrates; heavy metals; synthetic detergents; cooking and motor oils; bleach; pesticides;[9,10] paints; paint thinner; photographic chemicals; swimming pool chemicals;[11] septic tank/cesspool cleaner chemicals;[12] elevated levels of chloride, sulfate, calcium, magnesium, potassium, and phosphate
Underground storage tanks	Home heating oil
Apartments and condominiums	Swimming pool maintenance chemicals;[11] pesticides for lawn and garden maintenance and cockroach, termite, ant, rodent, and other pest control;[9,10] wastes from on-site sewage treatment plants; household hazardous wastes[8]

Potential Sources of Ground-Water Contamination (Continued)

SOURCE	HEALTH, ENVIRONMENTAL, OR AESTHETIC CONTAMINANT[1,2,3]
MUNICIPAL SOURCES	
Schools and government offices and grounds	Solvents; pesticides;[9,10] acids; alkalis; waste oils; machinery/vehicle servicing wastes; gasoline and heating oil from storage tanks; general building wastes[13]
Park lands	Fertilizers;[6] herbicides;[10] insecticides[9]
Public and residential areas infested with mosquitoes, gypsy moths, ticks, ants, or other pests	Pesticides[5,9]
Highways, road maintenance depots, and deicing operations	Herbicides in highway rights-of-way;[5,10] road salt (sodium and calcium chloride); road salt anticaking additives (ferric ferrocyanide, sodium ferrocyanide); road salt anticorrosives (phosphate and chromate); automotive wastes[7]
Municipal sewage treatment plants and sewer lines	Municipal wastewater; sludge;[14] treatment chemicals[15]
Storage, treatment, and disposal ponds, lagoons, and other surface impoundments	Sewage wastewater; nitrates; other liquid wastes; microbiological contaminants
Land areas applied with wastewater or wastewater byproducts	Organic matter; nitrate; inorganic salts; heavy metals; coliform and noncoliform bacteria;[4] viruses; nitrates; sludge;[14] nonhazardous wastes[16]
Storm water drains and basins	Urban runoff; gasoline; oil; other petroleum products; road salt; microbiological contaminants
Combined sewer overflows (municipal sewers and stormwater drains)	Municipal wastewater; sludge;[14] treatment chemicals;[15] urban runoff; gasoline; oil; other petroleum products; road salt; microbial contaminants
Recycling/reduction facilities	Residential and commercial solid waste residues
Municipal waste landfills	Leachate; organic and inorganic chemical contaminants; wastes from households[8] and businesses;[13] nitrates; oils; metals
Open dumping and burning sites, closed dumps	Organic and inorganic chemicals; metals; oils; wastes from households[8] and businesses[13]
Municipal incinerators	Heavy metals; hydrocarbons; formaldehyde; methane; ethane; ethylene; acetylene; sulfur and nitrogen compounds
Water supply wells, monitoring wells, older wells, domestic and livestock wells, unsealed and abandoned wells, and test hole wells	Surface runoff; effluents from barnyards, feedlots, septic tanks, or cesspools; gasoline; used motor oil; road salt
Sumps and dry wells	Storm water runoff; spilled liquids; used oil; antifreeze; gasoline; other petroleum products; road salt; pesticides;[5] and a wide variety of other substances
Drainage wells	Pesticides;[9,10] bacteria
Well pumping that causes interaquifer leakage, induced filtration, landward migration of sea water in coastal areas; etc.	Saltwater; excessively mineralized water
Artificial ground-water recharge	Storm water runoff; excess irrigation water; stream flow; cooling water; treated sewage effluent; other substances that may contain contaminants, such as nitrates, metals, detergents, synthetic organic compounds, bacteria, and viruses
COMMERCIAL SOURCES	
Airports, abandoned airfields	Jet fuels; deicers; diesel fuel; chlorinated solvents; automotive wastes;[7] heating oil; building wastes[13]
Auto repair shops	Waste oils; solvents; acids; paints; automotive wastes;[7] miscellaneous cutting oils
Barber and beauty shops	Perm solutions; dyes; miscellaneous chemicals contained in hair rinses

Potential Sources of Ground-Water Contamination (Continued)

SOURCE	HEALTH, ENVIRONMENTAL, OR AESTHETIC CONTAMINANT[1,2,3]
COMMERCIAL SOURCES (Continued)	
Boat yards and marinas	Diesel fuels; oil; septage from boat waste disposal areas; wood preservative and treatment chemicals; paints; waxes; varnishes; automotive wastes[7]
Bowling alleys	Epoxy; urethane-based floor finish
Car dealerships (especially those with service departments)	Automotive wastes;[7] waste oils; solvents; miscellaneous wastes
Car washes	Soaps; detergents; waxes; miscellaneous chemicals
Camp grounds	Septage; gasoline; diesel fuel from boats; pesticides for controlling mosquitoes, ants, ticks, gypsy moths, and other pests;[5,9] household hazardous wastes from recreational vehicles (RVs)[8]
Carpet stores	Glues and other adhesives; fuel from storage tanks if forklifts are used
Cemeteries	Leachate; lawn and garden maintenance chemicals[10]
Construction trade areas and materials (plumbing, heating and air conditioning, painting, paper hanging, decorating, drywall and plastering, acoustical insulation, carpentry, flooring, roofing and sheet metal, wrecking and demolition, etc.)	Solvents; asbestos; paints; glues and other adhesives; waste insulation; lacquers; tars; sealants; epoxy waste; miscellaneous chemical wastes
Country clubs	Fertilizers;[6] herbicides;[5,10] pesticides for controlling mosquitoes, ticks, ants, gypsy moths, and other pests;[9] swimming pools chemicals;[11] automotive wastes
Dry cleaners	Solvents (perchloroethylene, petroleum solvents, Freon); spotting chemicals (trichloroethane, methylchloroform, ammonia, peroxides, hydrochloric acid, rust removers, amyl acetate)
Funeral services and crematories	Formaldehyde; wetting agents; fumigants; solvents
Furniture repair and finishing shops	Paints; solvents; degreasing and solvent recovery sludges
Gasoline services stations	Oils; solvents; miscellaneous wastes
Golf courses	Fertilizers;[6] herbicides;[5,10] pesticides for controlling mosquitoes, ticks, ants, gypsy moths, and other pests
Hardware/lumber/parts stores	Hazardous chemical products in inventories; heating oil and fork lift fuel from storage tanks; wood-staining and treating products such as creosote
Heating oil companies, underground storage tanks	Heating oil; wastes from truck maintenance areas[7]
Horticultural practices, garden nurseries, florists	Herbicides, insecticides, fungicides, and other pesticides[10]
Jewelry/metal plating shops	Sodium and hydrogen cyanide; metallic salts; hydrochloric acid; sulfuric acid; chromic acid
Laundromats	Detergents; bleaches; fabric dyes
Medical institutions	X-ray developers and fixers;[17] infectious wastes; radiological wastes; biological wastes; disinfectants; asbestos; beryllium; dental acids; miscellaneous chemicals
Office buildings and office complexes	Building wastes;[13] lawn and garden maintenance chemicals;[10] gasoline; motor oil
Paint stores	Paints; paint thinners; lacquers; varnishes; other wood treatments
Pharmacies	Spilled and returned products
Photography shops, photo processing laboratories	Biosludges; silver sludges; cyanides; miscellaneous sludges
Print shops	Solvents; inks; dyes; oils; photographic chemicals;

Potential Sources of Ground-Water Contamination (Continued)

SOURCE	HEALTH, ENVIRONMENTAL, OR AESTHETIC CONTAMINANT[1,2,3]
COMMERCIAL SOURCES (Continued)	
Railroad tracks and yards	Diesel fuel; herbicides for rights-of-way; creosote for preserving wood ties
Research laboratories	X-ray developers and fixers;[17] infectious wastes; radiological wastes; biological wastes; disinfectants; asbestos; beryllium; solvents; infectious materials; drugs; disinfectants (quaternary ammonia, hexachlorophene, peroxides, chlornexade, bleach); miscellaneous chemicals
Scrap and junk yards	Any wastes from businesses[13] and households;[8] oils
Sports and hobby shops	Gunpowder and ammunition; rocket engine fuel; model airplane glue
Above ground and underground storage tanks	Heating oil; diesel fuel; gasoline; other petroleum products; other commercially used chemicals
Transportation services for passenger transit (local and interurban)	Waste oil; solvents; gasoline and diesel fuel from vehicles and storage tanks; fuel oil; other automotive wastes[7]
Veterinary services	Solvents; infectious materials; vaccines; drugs; disinfectants (quaternary ammonia, hexachlorophene, peroxides, chlornexade, bleach); x-ray developers and fixers[17]
INDUSTRIAL SOURCES	
Material stockpiles (coal, metallic ores, phosphates, gypsum)	Acid drainage; other hazardous and nonhazardous wastes[16]
Waste tailing ponds (commonly for the disposal of mining wastes)	Acids; metals; dissolved solids; radioactive ores; other hazardous and nonhazardous wastes[15]
Transport and transfer stations (trucking terminals and rail yards)	Fuel tanks; repair shop wastes;[7] other hazardous and nonhazardous wastes[15]
Above-ground and underground storage tanks and containers	Heating oil; diesel and gasoline fuel; other petroleum products; hazardous and nonhazardous materials and wastes[16]
Storage, treatment, and disposal ponds, lagoons, and other surface impoundments	Hazardous and nonhazardous liquid wastes;[16] septage; sludge[14]
Chemical landfills	Leachate; hazardous and nonhazardous wastes;[16] nitrates
Radioactive waste disposal sites	Radioactive wastes from medical facilities, power plants, and defense operations; radionuclides (uranium, plutonium)
Unattended wet and dry excavation sites (unregulated dumps)	A wide range of substances; solid and liquid wastes; oil-field brines; spent acids from steel mill operations; snow removal piles containing large amounts of salt
Operating and abandoned production and exploratory wells (for gas, oil, coal, geothermal, and heat recovery); test hole wells; monitoring and excavation wells	Metals; acids; minerals; sulfides; other sulfides; other hazardous and nonhazardous chemicals[16]
Dry wells	Saline water from wells pumped to keep them dry
Injection wells	Highly toxic wastes; hazardous and nonhazardous industrial wastes;[16] oil-field brines
Well drilling operations	Brines associated with oil and gas operations
INDUSTRIAL PROCESSES (PRESENTLY OPERATED OR TORN-DOWN FACILITIES)[18]	
Asphalt plants	Petroleum derivatives
Communications equipment manufacturers	Nitric, hydrochloric, and sulfuric acid wastes; heavy metal sludges; copper-contaminated etchant (e.g., ammonium persulfate); cutting oil and degreasing solvent (trichloroethane, Freon, or trichloroethylene); waste oils; corrosive soldering flux; paint sludge; waste plating solution

Potential Sources of Ground-Water Contamination (Continued)

SOURCE	HEALTH, ENVIRONMENTAL, OR AESTHETIC CONTAMINANT[1,2,3]
INDUSTRIAL SOURCES (Continued)	
INDUSTRIAL PROCESSES (PRESENTLY OPERATED OR TORN-DOWN FACILITIES)[18] (Continued)	
Electric and electronic equipment manufacturers and storage facilities	Cyanides; metal sludges; caustics (chromic acid); solvents; oils; alkalis; acids; paints and paint sludges; calcium fluoride sludges; methylene chloride; perchloroethylene; trichloroethane; acetone; methanol; toluene; PCBs
Electroplaters	Boric, hydrochloric, hydrofluoric, and sulfuric acids; sodium and potassium hydroxide; chromic acid; sodium and hydrogen cyanide; metallic salts
Foundries and metal fabricators	Paint wastes; acids; heavy metals; metal sludges; plating wastes; oils; solvents; explosive wastes
Furniture and fixtures manufacturers	Paints; solvents; degreasing sludges; solvent recovery sludges
Machine and metalworking shops	Solvents; metals; miscellaneous organics; sludges; oily metal shavings; lubricant and cutting oils; degreasers (TCE); metal marking fluids; mold-release agents
Mining operations (surface and underground), underground storage mines	Mine spoils or tailings that often contain metals; acids; highly corrosive mineralized waters; metal sulfides
Unsealed abandoned mines used as waste pits	Metals; acids; minerals; sulfides; other hazardous and nonhazardous chemicals[16]
Paper mills	Metals; acids; minerals; sulfides; other hazardous and nonhazardous chemicals;[16] organic sludges; sodium hydroxide; chlorine; hypochlorite; chlorine dioxide; hydrogen peroxide
Petroleum production and storage companies, secondary recovery of petroleum	Hydrocarbons; oil-field brines (highly mineralized salt solutions)
Industrial pipelines	Corrosive fluids; hydrocarbons; other hazardous and nonhazardous materials and wastes[16]
Photo processing laboratories	Cyanides; biosludges; silver sludges; miscellaneous sludges
Plastics materials and synthetics producers	Solvents; oils; miscellaneous organics and inorganics (phenols, resins); paint wastes; cyanides; acids; alkalis; wastewater treatment sludges; cellulose esters; surfactant; glycols; phenols; formaldehyde; peroxides; etc.
Primary metal industries (blast furnaces, steel works, and rolling mills)	Heavy metal wastewater treatment sludge; picking liquor; waste oil; ammonia scrubber liquor; acid tar sludge; alkaline cleaners; degreasing solvents; slag; metal dust
Publishers, printers, and allied industries	Solvents; inks; dyes; oils; miscellaneous organics; photographic chemicals
Public utilities (phone, electric power, gas)	PCBs from transformers and capacitors; oils; solvents; sludges; acid solution; metal plating solutions (chromium, nickel, cadmium); herbicides from utility rights-of-way
Sawmills and planers	Treated wood residue (copper quinolate, mercury, sodium bazide); tanner gas; paint sludges; solvents; creosote; coating and gluing wastes
Stone, clay, and glass manufacturers	Solvents; oils and grease; alkalis; acetic wastes; asbestos; heavy metal sludges; phenolic solids or sludges; metal-finishing sludge
Welders	Oxygen, acetylene
Wood preserving facilities	Wood preservatives; creosote

[1]In general, ground-water contamination stems from the *misuse and improper disposal* of liquid and solid wastes; the *illegal dumping or abandonment* of household, commercial, or industrial chemicals; the *accidental spilling* of chemicals from trucks, railways, aircraft, handling facilities, and storage tanks; or the *improper siting, design, construction, operation, or maintenance* of agricultural, residential, municipal, commercial, and industrial drinking water wells and liquid and solid waste disposal facilities. Contaminants also can stem from *atmospheric pollutants*, such as airborne sulfur and nitrogen compounds, which are created by

smoke, flue dust, aerosols, and automobile emissions, fall as acid rain, and percolate through the soil. When the sources listed on this table are used and managed properly, ground-water contamination is not likely to occur.

[2]Contaminants can reach ground water from activities occurring on the land surface, such as industrial waste storage; from sources below the land surface but above the water table, such as septic systems; from structures beneath the water table, such as wells; or from contaminated recharge water.

[3]This table lists most common wastes, but not all potential wastes. For example, it is not possible to list all potential contaminants contained in storm water runoff or research laboratory wastes.

[4]Coliform bacteria can indicate the presence of pathogenic (disease-causing) microorganisms that may be transmitted in human feces. Diseases such as typhoid fever, hepatitis, diarrhea, and dysentery can result from sewage contamination of water supplies.

[5]Pesticides include herbicides, insecticides, rodenticides, fungicides, and avicides. EPA has registered approximately 50,000 different pesticide products for use in the United States (Massachusetts Audubon Society, 1985). Many are highly toxic and quite mobile in the subsurface. An EPA survey found that the most common pesticides found in drinking water wells were DCPA (dacthal) and atrazine (EPA, 1990b), which EPA classifies as *moderately toxic* (class 3) and *slightly toxic* (class 4) materials, respectively (Meister Publishing Company, 1991).

[6]The EPA National Pesticides Survey (EPA, 1991) found that the use of fertilizers correlates to nitrate contamination of ground water supplies.

[7]Automotive wastes can include gasoline; antifreeze; automatic transmission fluid; battery acid; engine and radiator flushes; engine and metal degreasers; hydraulic (brake) fluid; and motor oils.

[8]Toxic or hazardous components of common household products are noted on the attached table (EPA 1990c).

[9]Common household pesticides for controlling pests such as ants, termites, bees, wasps, flies, cockroaches, silverfish, mites, ticks, fleas, worms, rats, and mice can contain active ingredients including napthalene, phosphorus, xylene, chloroform, heavy metals, chlorinated hydrocarbons, arsenic, strychnine, kerosene, nitrosamines, and dioxin.

[10]Common pesticides used for lawn and garden maintenance (i.e., weed killers, and mite, grub, and aphid controls) include such chemicals as 2,4-D; chlorpyrifos; diazinon; benomyl; captan; dicofol; and methoxychlor.

[11]Swimming pool chemicals can contain free and combined chlorine; bromine; iodine; mercury-based, copper-based, and quaternary algicides; cyanuric acid; calcium or sodium hypochlorite; muriatic acid; sodium carbonate.

[12]Septic tank/cesspool cleaners include synthetic organic chemicals such as 1,1,1 trichloroethane, tetrachloroethylene, carbon tetrachloride, and methylene chloride.

[13]Common wastes from public and commercial buildings include automotive wastes (see above definition); rock salt; and residues from cleaning products that may contain chemicals such as xylenols, glycol esters, isopropanol, 1,1,1-trichloroethane, sulfonates, chlorinated phenolys, and cresols.

[14]Municipal wastewater treatment sludge can contain organic matter; nitrates; inorganic salts; heavy metals; coliform and noncoliform bacteria (see above definition); and viruses.

[15]Municipal wastewater treatment chemicals include calcium oxide; alum; activated alum, carbon, and silica; polymers; ion exchange resins; sodium hydroxide; chlorine; ozone; and corrosion inhibitors.

[16]The Resource Conservation and Recovery Act (RCRA) defines a hazardous waste as a solid waste that may cause an increase in mortality or serious illness or pose a substantial threat to human health and the environment when improperly treated, stored, transported, disposed of, or otherwise managed. A waste is hazardous if it exhibits characteristics of ignitability, corrosivity, reactivity, and/or toxicity. Not covered by RCRA regulations are domestic sewage; irrigation waters or industrial discharges allowed by the Clean Water Act; certain nuclear and mining wastes; household wastes; agricultural wastes (excluding some pesticides); and small quantity hazardous wastes (i.e., less than 220 pounds per month) discharged from businesses.

[17]X-ray developers and fixers may contain reclaimable silver, glutaldehyde, hydroquinone, phenedone, potassium bromide, sodium sulfite, sodium carbonate, thiosulfates, and potassium alum.

[18]This table lists potential ground-water contaminants from many common industries, but it does not address all industries.

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Potentially Harmful Components of Common Household Products

PRODUCT	TOXIC OR HAZARDOUS COMPONENTS
Antifreeze (gasoline or coolants systems)	Methanol, ethylene glycol
Automatic transmission fluid	Petroleum distillates, xylene
Battery acid (electrolyte)	Sulfuric acid
Degreasers for driveways and garages	Petroleum solvents, alcohols, glycol ether
Degreasers for engines and metal	Chlorinated hydrocarbons, toluene, phenols,dichloroperchloroethylene
Engine and radiator flushes	Petroleum solvents, ketones, butanol, glycol ether
Hydraulic fluid (brake fluid)	Hydrocarbons, fluorocarbons
Motor oils and waste oils	Hydrocarbons
Gasoline and jet fuel	Hydrocarbons
Diesel fuel, kerosene, #2 heating oil	Hydrocarbons
Grease, lubes	Hydrocarbons
Rustproofers	Phenols, heavy metals
Car wash detergents	Alkyl benzene sulfonates
Car waxes and polishes	Petroleum distillates, hydrocarbons
Asphalt and roofing tar	Hydrocarbons
Paints, varnishes, stains, dyes	Heavy metals, toluene
Paint and lacquer thinner	Acetone, benzene, toluene, butyl acetate, methyl ketones
Paint and varnish removers, deglossers	Methylene chloride, toluene, acetone, xylene, ethanol, benzene, methanol
Paint brush cleaners	Hydrocarbons, toluene, acetone, methanol, glycol ethers, methyl ethyl ketones
Floor and furniture strippers	Xylene
Metal polishes	Petroleum distillates, isopropanol, petroleum naphtha
Laundry soil and stain removers	Hydrocarbons, benzene, trichloroethylene, 1,1,1-trichloroethane
Other solvents	Acetone, benzene
Rock salt	Sodium concentration
Refrigerants	1,1,2-trichloro- 1,2,2-trifluoroethane
Bug and tar removers	Xylene, petroleum distillates
Household cleansers, oven cleaners	Xylenols, glycol ethers, isopropanol
Drain cleaners	1,1,1-trichloroethane
Toilet cleaners	Xylene, sulfonates, chlorinated phenols
Cesspool cleaners	Tetrachloroethylene, dichlorobenzene, methylene chloride
Disinfectants	Cresol, xylenols
Pesticides (all types)	Naphthalene, phosphorus, xylene, chloroform, heavy metals, chlorinated hydrocarbons
Photochemicals	Phenols, sodium sulfite, cyanide, silver halide, potassium bromide
Printing ink	Heavy metals, phenol-formaldehyde
Wood preservatives (creosote)	Pentachlorophenols
Swimming pool chlorine	Sodium hypochlorite
Lye or caustic soda	Sodium hydroxide
Jewelry cleaners	Sodium cyanide

Reprinted from "Natural Resources Facts: Household Hazardous Wastes," Fact Sheet No. 88-3, Department of Natural Science, University of Rhode Island, August 1988.

WELLHEAD PROTECTION AREA
INVENTORY OF POTENTIAL CONTAMINANT SOURCES

DIRECTIONS:

Place a number next to each category that you identify in your wellhead protection area. Place a corresponding number on a map at the location of the source. Maps that may be used for the inventory include: topography, zoning, village, city, and utility maps. Please consider ease of photocopying in your selection of a map. If there is more than one source for a category, label each site with a letter (i.e., 1A, 1B, 1C, 2A, 2B). Record the owner's name and address of each site on a separate sheet of paper. Please consider all sources within a 1/2-mile radius of each public water supply well and an assessment within the recharge area(s).

__Abandoned Wells
__Aboveground storage tank
__Airport
__Animal Feedlot/Waste Storage
__Asphalt Plant
__Auto Repair/Body Shop/Salvage Washes
__Cemetery
__Chemical Production/Mixing/Storage
__Drainage Canal
__Dumps
__Electroplaters/Metal Finishers
__Fertilizer/Pesticide Storage/
Production/Mixing
__Golf Courses/Nurseries
__Grain Storage Bin
__Holding Pond/Lagoon
__Inactive/Abandoned Hazardous Waste Site
__Injection Well
__Irrigation Practices
__Laboratories
__Laundromat/Dry Cleaner
__Machine Shops
__Major Highways and/or Railroads
__Military Base/Depot
__Mining
__Oil/Gas Pipelines
__Photo Processors
__Printers
__Production/Other Wells
__Refineries
__Refinishing
__Road Salt Storage
__Septic Systems
__Service/Gas Stations
__Sewage Plant
__Underground Storage Tank
__Waste Piles
__Wood Preserving
___Other (Specify)_____
_____
_____

Source: Wisconsin Rural Water Association.

DRAFT

WELLHEAD PROTECTION ORDINANCE

BE IT ORDAINED by the Mayor and Council of the City of _____ in Council duly assembled and it is hereby ordained by the authority of same that the following ordinance known as the Wellhead Protection Ordinance is adopted and made a part of the Code of Ordinance of the City of _____, to wit:

Section 1. Short title and purpose.

(a) This ordinance shall be known as the "Wellhead Protection Ordinance."

(b) The purpose of this ordinance is to insure the provision of a safe and sanitary drinking water supply for the City by the establishment of wellhead protection zones surrounding the wellheads for all wells which are the supply sources for the City water system and by the designation and regulation of property uses and conditions which may be maintained within such zones.

Section 2. Definitions. When used in this ordinance the following words and phrases shall have the meanings given in this Section:

(a) Hazardous waste or material - any waste or material which because of its quantity, concentration or physical, chemical or infectious characteristics may:

(1) Cause or significantly contribute to an increase in mortality or an increase in serious irreversible or incapacitating reversible illness; or

(2) Pose a substantial present or potential hazard to human health or to the environment when improperly treated, stored, transported, disposed of or otherwise managed.

(b) Sanitary landfill - A disposal site where solid wastes, including putrescible wastes, or hazardous wastes, are disposed of on land by placing earth cover thereon.

(c) Wellhead - the upper terminal of a well, including adapters, ports, seals, valves and other attachments.

(d) Regulatory agency - any governmental agency with jurisdiction over hazardous waste as defined herein.

Section 3. Establishment of wellhead protection zone. There is hereby established a use district to be known as a wellhead protection zone, identified and described as all the area within a circle the center of which is the center of any city water supply wellhead and the radius of which is 1,320 feet, or any part thereof which the city has jurisdiction.

Section 4. Permitted uses. The following uses shall be permitted within wellhead protection zones:

(a) Any use permitted within existing agricultural, single family residential, multi-family residential, and commercial districts so long as uses conform to the rules and regulations of the regulatory agencies.

(b) Any other open land use where any building located on the property is incidental and accessory to the primary open land use.

Section 5. Prohibited uses. The following uses or conditions shall be and are hereby prohibited within wellhead protection zones, whether or not such use or condition may otherwise be ordinarily included as a part of a use permitted under Section 4 of this ordinance unless such uses are approved or permitted by State and Federal Regulatory Agencies:

(a) Surface use or storage of hazardous material, including commercial use of agricultural pesticides;

(b) Septic tanks or drain fields appurtenant thereto;

(c) Impervious surfaces other than roofs of buildings, and streets, parking lots, driveways and walks serving buildings permitted under Section 4 of this ordinance;

(d) Sanitary landfills;

(e) Hazardous waste disposal sites;

(f) Stormwater infiltration basins;

(g) Underground storage tanks;

(h) Sanitary sewer lines within 100 feet of a wellhead.

Section 6. Administration. The policies and procedures for administration of any wellhead protection zone established under this ordinance, including without limitation those applicable

to nonconforming uses, exceptions, enforcement and penalties, shall be the same as provided in the existing zoning ordinance for the City of _____, as the same is presently enacted or may from time to time be amended.

This Ordinance shall be effective as of _____ (date). All ordinances and parts or ordinances in conflict herewith shall not be and the same are hereby repealed.

ENACTED AND ADOPTED this _____ day of _____, 19___.

_____

Mayor

Attest: _____

City Clerk

(CITY SEAL)

EXPLANATION/SUGGESTIONS FORM

CONTINGENCY PLAN FOR THE WATER SUPPLY OF:

----------, LOUISIANA

I. Purpose

The purpose of this Contingency Plan is to establish, provide and keep updated certain emergency response procedures which may become necessary in the event of a partial or total loss of public water supply service as a result of natural disasters, chemical contamination, or civil disorders. This Contingency Plan is the procedural guide for responding to such emergencies. This Plan is coordinated with existing plans such as Hazardous Materials Response and Civil Defense Plans.

II. Public Water Supply Characteristics

A. Current Supply Source

B. Treatment

C. Distribution

III. Priority of Water Users During Water Supply Disruption/Emergency

IV. Short Term Replacement Alternatives

A. Surface Water Sources and Necessary Treatment

B. Bottled Water and Other Alternatives
Location of Sources/Contact Persons

V. Inventory of Available Equipment and Materials for Use in Emergency

A. Location, Ownership, Telephone Numbers

VI. Notification Procedures - Personnel Contact Plan and List of Telephone Numbers

A. Lead Coordinating Agency/Office Identified?

B. Incident Assessment Team in Place?

C. Public Announcement Plan?

II. Public Water Supply System Characteristics

A. Current Supply Source

Supply Components

The supply component of the water supply system consists of the supply wells and the facilities for delivering the water to the treatment plant (if any). Each well should be analyzed for three major factors:

1) production capacity;
2) connection to supply; and
3) monitoring wells.*

For each of these factors, consider the following questions:

1) Production Capacity (supply wells)
   - What is the maximum yield?
   - What is the pump capacity?
   - What is the current flow?
   - Are there seasonal variations?
   - Is there excess capacity?

2) Connection to Supply (pumps, valves)
   - Can the well be isolated or cut-off?
   - Where is the pump cut-off?
   - If the well is cut-off, what are the impacts on supply?
   - How can supplies be obtained from another system?

3) Monitoring Wells
   - What are the potential sources of contamination in the wellhead area?
   - Are monitoring wells located to detect contamination from identified potential sources?
   - Are well samples and monitoring well samples analyzed for contaminants from potential sources?

---

* Note that while monitoring wells are a part of the supply system, they usually do not have production capacity and are not physically connected to the water-supply system. Monitoring wells should be evaluated to assess their suitability for detecting contamination.

B. Treatment

Treatment Components

The second component of the water supply system consists of the treatment facilities and processes, which should be analyzed to determine:

1) treatment process capacity;
2) types of contaminants treated; and
3) impact of contamination on treatment capability.

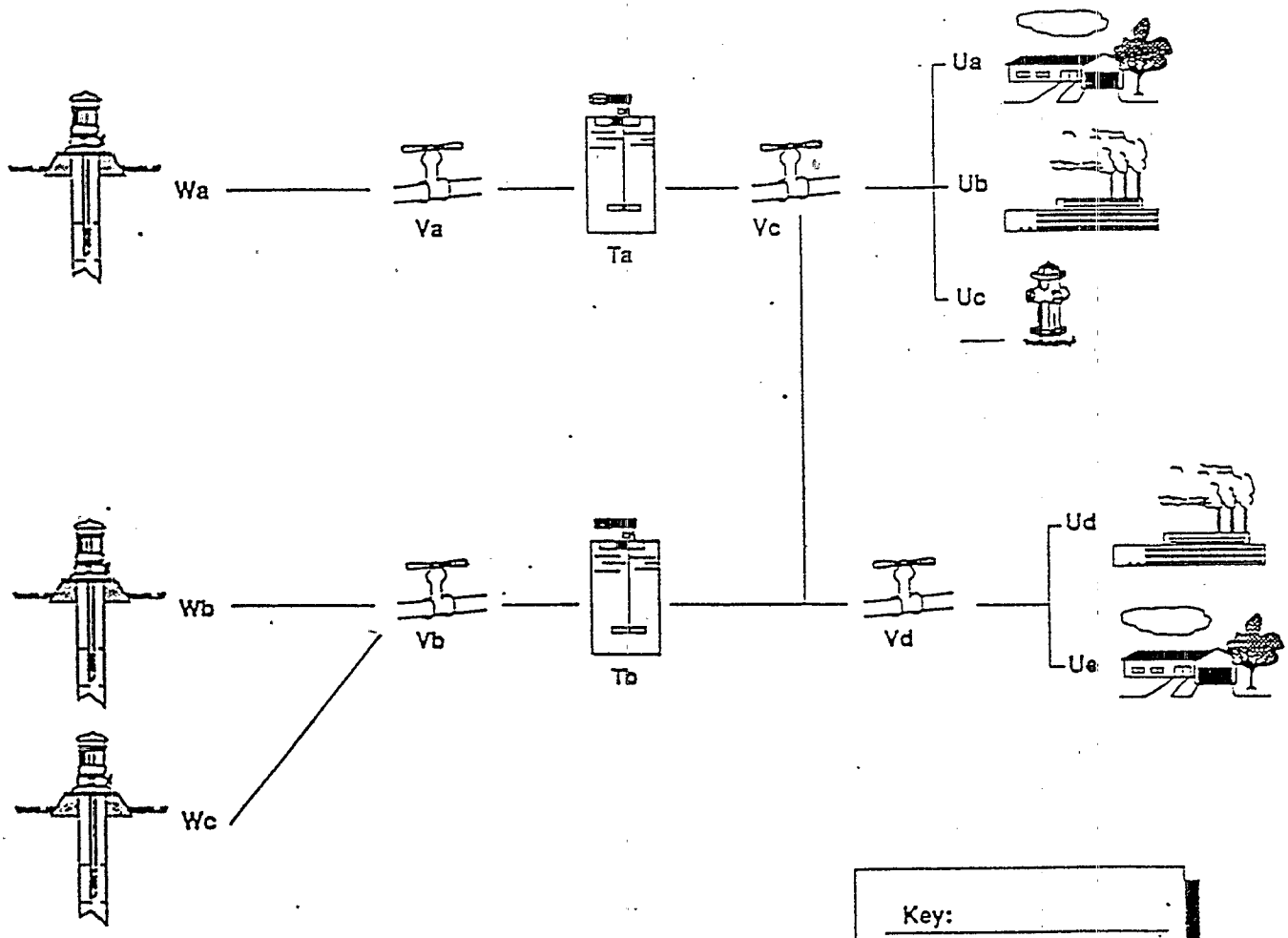
For each of these elements, consider the following questions:

1) Treatment Process Capacity
   - What is the maximum volume of water that can be treated?
   - What is the current flow?
   - Is there excess treatment capacity?
   - Can the existing treatment process be expanded or modified?

2) Types of Contaminants Treated
   - What contaminants can be treated?
   - How are they identified?
   - How does treatment capacity vary by type of contamination?

3) Impact on Treatment Capability
   - What levels of contamination will exceed the existing treatment system's capacity?
   - What type of contamination would impair the system's capability or otherwise pass through?

EXAMPLE OF A SCHEMATIC DIAGRAM



Key:

W = Well and Pump

T = Treatment Facility

V = Valve

U = User

III. Priority of Water Users During Water Supply Disruption/Emergency

Analysis of Water Use and Demand

A detailed knowledge of water use and demand is necessary in order to plan for water supply replacement. In order to choose the best alternative, planners must know the existing levels of use and the demand of different sectors of the community. The analysis of water use and demand should:

1) establish maximum daily consumption levels;
2) establish minimum daily consumption levels; and
3) identify priority uses.

The following steps might be followed to determine demands on the system for drinking water and other purposes:

1. Estimate present and projected water use (particularly for major, if not all, users):
   a. Record average daily consumption, minimum daily consumption, and maximum daily consumption levels by use category. If appropriate, major users for each category might be identified. Use categories include:
      - residential;
      - commercial;
      - industrial;
      - institutional;
      - fire safety; and
      - agricultural.
   b. Project daily use over, for example, 1, 2, and 5 years. Note seasonal fluctuations, if any. Projections allow the contingency plan to reflect future conditions, especially regarding the siting and planning for new wells.
   c. Revise projections to take into account population increases and changes in commercial and industrial development.

2. Determine priority uses:
   a. High priority uses for public health protection may include:
      - household and other public drinking water supplies;
      - hospital supplies; and
      - fire fighting systems.
   b. Lower priority uses may include:
      - landscaping;
      - certain industrial processes; and
      - non-essential household uses.

3. Determine the supply requirements for priority uses including:
   - minimum quantity;
   - minimum pressure levels;
   - time of supply; and
   - quality of the supply.

If the water supply system is large enough, this information might be more useful if organized by geographic area.

IV. Short Term Replacement Alternatives

A. Surface Water Sources and Necessary Treatment

Is there a nearby surface water source that could be a suitable alternative in either the long term or the short term in the event of a loss of your water supply?

If a surface water source is a feasible option, you should draw up a plan for putting that source to use with all the necessary elements for activating that plan and include it in this section.

Consider:

What type of treatment would be necessary in order to use a surface water source?

How long would it take to set up and where the necessary equipment located?

If this option feasible for the long term or only for the short term?

Emergency and Short-Term Options

- Bottled Water
- Tank Trucks
- Excess Capacity
- Conservation
- Treatment
  - Point of Use
  - System
- Additional Treatment

Long-Term Options

- Drill New Wells/Wellfields
- Additional Treatment In-System (without cleaning up contaminant source)
- Point-of-Use Treatment
- Clean up contamination source
- Well Field Management
  - Blending
  - Select Pumping
- Interconnection
- Bottled Water
- Surface Water Supplies
- Water Conservation
- Waste-Water Reuse Reinjection
- Desalinization
- Dual-Systems
  (Separate potable/non-potable supplies)
- Artificial Aquifer/Excess Capacity
  (Seasonal storage)

Criteria for Evaluating Options

Technical and Logistical Feasibility
- What procedures are required to implement?
- Are technologies available and well developed?
- How much water can it provide?
- Can it meet the system's priority water uses?
- Can it meet the system's total water needs?
- How quickly can it be made operational?
- What equipment and supplies are needed?

Reliability
- How reliable is it?
- Does it require operation and maintenance skills?

Political Considerations
- What administrative procedures are required?
- Is property ownership a problem?
- Will it gain public confidence?

Cost Considerations
- What is the initial investment?
- What are the operating costs?
- Who bears the costs?

EXAMPLE OF SUPPORT CALL-UP LIST

The following agencies/organizations have standing agreements and/or interconnections whereby they will provide water supplies upon request in an emergency.

ORGANIZATION	ADDRESS	NAME	TELEPHONE	QUANTITY AND METHOD TO BE PROVIDED	REQUIRED AUTHORIZATION

APPROVED _____ DATE _____

* To be completed and used by water supply system personnel.

Source: Adapted from Emergency Planning and Response - A Water Supply Guide for the Supplier of Water, NYSDOH, January 1984.

The next page illustrates an example from a typical equipment list. The capacity of the individual pieces of equipment, although not provided in the example, would be useful information to include in a plan because equipment needs then could be tied more directly to specific equipment, thus reducing response time. A complete list of equipment and services would be more exhaustive and include such items as:

- Chemical supplies;
- Treatment equipment;
- Spare parts (i.e., pipes and fittings);
- Alternative distribution equipment (tank trucks);
- Vehicles and equipment for emergency excavation and transportation;
- Water sampling and analysis equipment and services;
- Portable pumps and generators;
- Portable treatment equipment;
- Personnel protection equipment and supplies;
- Repair facilities; and
- Heavy equipment contractors.

Depending on the size of the water supply system and whether the system is a private company or a public utility, these resources may be found in-house or may be available from another branch of the municipality -- for example, the public works department. Once resource needs have been identified, water planners should consider the following types of questions:

- If the resource cannot be located within the municipality, is it available from an adjoining city or town, from the State emergency response office, or the National Guard?
- Are there local contractors who would be willing to enter into an agreement to provide emergency services?
- Where is the nearest well drilling firm and what sort of response time can they guarantee?

V. Inventory of Available Equipment and Materials for Use in Emergency

A. Location, Ownership, Telephone Numbers

EXAMPLE OF LIST OF AVAILABLE WATER TREATMENT EQUIPMENT

The following is an illustrative list of water department equipment and its location.

Quantity	Type	Age and Manufacturer	Location	Capacity	Name and Phone Number of Qualified Operator(s)
1	Fork Lift	1980 Caterpillar	WW Plant		
4	Air Compressor	Ingersoll-Rand	Equip. Yard		
1	Trencher	Davis	Equip. Yard		
1	Tapping Machine	1963 Smith	Dist. Shop		
1	Earth-boring Machine	NA	Dist. Shop		
1	(2040) Tractor	John Deere	Equip. Yard		
2	Sewer Bucket Machine	NA	Equip. Yard		
1	Concrete Mixer	Stone	Equip. Yard		
1	Welder	Hobart	Dist. Shop		
1	Jet Clean Truck	1978 Chevrolet	Dist. Shop		
1	TV Sewer Van	1980 GMC	Dist. Shop		
1	Ag-Gator	NA	Storeroom		
1	Fork Lift	1980 Clark	WW Plant		
2	580 C Backhoe	1978 Case	Equip. Yard		
2	580 SE Backhoe	1986 Case	Equip. Yard		
1	Trailer (dual)	Hy-Power	Equip. Yard		
1	Trailer (material)	NA	Equip. Yard		
1	Trailer (utility)	1972 Snoco	Equip. Yard		
1	Trailer (tandem)	Hudson	Equip. Yard		
1	Sewer Rodding Machine	NA	Equip. Yard		
1	Drill & Angur Assembly	1970 Mighty Mole	Dist. Shop		
1	Drill & Augur Assembly	1988 Mighty Mole	Dist. Shop		
1	Hydraulic Jack	1963	Dist. Shop		
1	Hot Roll Machine	1963	Dist. Shop		
1	Dump Trailer	NA	Equip. Yard		
1	Pressure Water	1983	Dist. Shop		
1	Jack Hammer	1980	Dist. Shop		
1	Power Drive	1975 Wach	Dist. Shop		
1	Power Drive	1964	Dist. Shop		
1	Hydraulic Valve Operator	1982	Dist. Shop		
1	Test Pump	1984 Hydro	Dist. Shop		
1	Gas Air Compressor	NA	Equip. Yard		
3	Trash Pump (2 ft.)	NA	Dist. Shop		
1	Multipurpose Saw	NA	Dist. Shop		
3	Sewer Wagon	NA	Equip. Yard		
1	Tapping Machine	1987	Dist. Shop		
3	Multi-Purpose Saw	NA	Dist. Shop		
1	Generator (gas)	NA	Dist. Shop		

NA - Not available

VI. Notification Procedures – Personnel Contact Plan and List of Telephone Numbers

A. Lead Coordinating Agency/Office Identified?

EXAMPLES OF EMERGENCY NOTIFICATION ROSTER

Emergency Plan for Water Supply Should Include Names and Phone Numbers for:

- Key Water Supply System Personnel (office and home, with hours) _____
- Key Community Leaders (office and home, with hours) _____
- Local Public Health Engineer (office and home, with hours) _____
- Fire Department _____
- Police, Schools _____
- Hospital and Ambulance Service _____
- Nursing Homes _____
- Dialysis Users _____
- Neighboring Water Supply System Managers _____
- Power Company Emergency _____
- Highway Department _____
- All Key Suppliers/Vendors/Technical Representatives of Water Supply Related Equipment, Chemicals, and Supplies _____
- Key Personnel of Major Industrial/Commercial Water Users _____
- State and Local Emergency Agency _____
- State and Local Civil Defense Offices _____

B. Incident Assessment Team in Place?

EXAMPLE OF EMERGENCY NOTIFICATION REPORT[1]

This notification report represents a typical form that might be adapted for use in a water supply contingency plan.

PART 1 - FACTS RELATED TO EMERGENCY

1. Person or department calling in emergency _____

   Phone No./Radio frequency _____ Date/Time call received _____

2. Location of emergency

   Street and Home/Building number _____

   Other (approximate location, distance from landmark, etc.) _____

   _____

3. Nature of the emergency (e.g., broken water main, chemical spill, lost pressure in home, etc.) ____

   _____

4. Condition at scene _____

   _____

5. Actual/Potential damage (briefly describe the situation) _____

   _____

   _____

6. Access restrictions, if any _____

   _____

7. Assistance already on the scene (who, what are they doing, etc.) _____

   _____

   _____

PART 2 - EMERGENCY INVESTIGATION

1. Personnel investigating emergency _____

   _____

2. Reported results of investigation _____

   _____

3. Time Assessed _____

---

[1] Adapted from Emergency Planning and Response - A Water Supply Guide for the Supplier of Water. New York State Department of Health, January 1984.

EXAMPLE OF EMERGENCY NOTIFICATION REPORT*

PART 3 - EMERGENCY ACTION TAKEN

1. Immediate action taken _____

_____

_____

2. Is immediate action: Permanent _____ Temporary _____

3. Was an emergency crew dispatched: Yes ___ No ___ Time arrived on scene _____

4. Note all other actions that will be necessary to bring the water supply system back into operation:

_____

_____

_____

PART 4 - PERSONS/DEPARTMENTS NOTIFIED OF EMERGENCY

Positions	Name	Work Phone	Home Phone	Time of Call
___ Chief Operator				
___ General Manager				
___ Local Health Department				
___ Engineer				
___ Operations Supervisor				
___ Plant Manager				
___ Shift Operator				
___ Fire Department				
___ Police Department				
___ Highway Department				
___ Local Elected Official (Mayor, Commissioner, etc.)				
___ Department of Health				
___ Department of Transportation				
___ Department of Environmental Conservation				
___ County Civil Defense				
___ Other (refer to system personnel and support call-up lists)				
___ Priority water users				
___ News Media				

Signature of Person Who Filled Out Form

_____

_____

* To be completed and used by water supply system personnel.

EXAMPLE OF REPORTING FORM FOR CHEMICAL INCIDENTS

- Identity of contaminant material: _____
  - Manifest/shipping invoice/billing label _____
  - Shipper/manufacturer identification _____
  - Container type _____
  - Placard/label information _____
  - Railcar/truck 4-digit identification number _____
  - Nearest railroad track intersection/line intersection _____
- Characteristics of material, if readily detectable (for example, odor, flammable, volatile, corrosive) _____
- Present physical state of material (gas, liquid, solid) _____
- Amount already released _____
- Amount that may be released _____
- Other hazardous materials in proximity _____
- Whether significant amounts of the material appear to be entering the atmosphere, nearby surface water, storm drains, or soil _____
- Direction, height, color, odor of any vapor clouds or plumes _____
- Weather conditions (including wind direction and speed) _____
- Local terrain conditions _____
- Personnel at the scene _____

C. Public Announcement Plan?

SAMPLE INITIAL NEWS RELEASE
(For distribution to previously identified television, radio, and newspaper personnel.)

The following substance has been detected in the _____ system:

It is vital that all residents in the _____ area observe the following water use restrictions until further notice:

The characteristics and potential public health hazards associated with this contaminant are as follows:

City and water system personnel are taking the following steps to address the problem:

For further information please contact _____ at this phone number: _____. A press conference is scheduled for _____ to be held at _____. News updates will be provided as additional information becomes available.

Attached please find a copy of an information sheet which provides details concerning the physical plans, organization structure, and function of the _____ water system.

Time: _____ Date: _____

Signed: _____

Title: _____

EXAMPLE OF CONSUMER CALL-IN NOTICE

The following notice may be printed on the back of water bills to advise consumers on how and where to report potential or actual water supply system emergencies.

_____ WATER SUPPLY SYSTEM

The following may constitute an emergency:

1. Vandalism of Water Supply Facilities
2. Loss of Water Pressure
3. Leaking Water
4. Sudden Changes in Water Quality
5. Spills of Chemicals or Petroleum Products

If you observe any of these conditions, please telephone the _____ water supply system immediately.

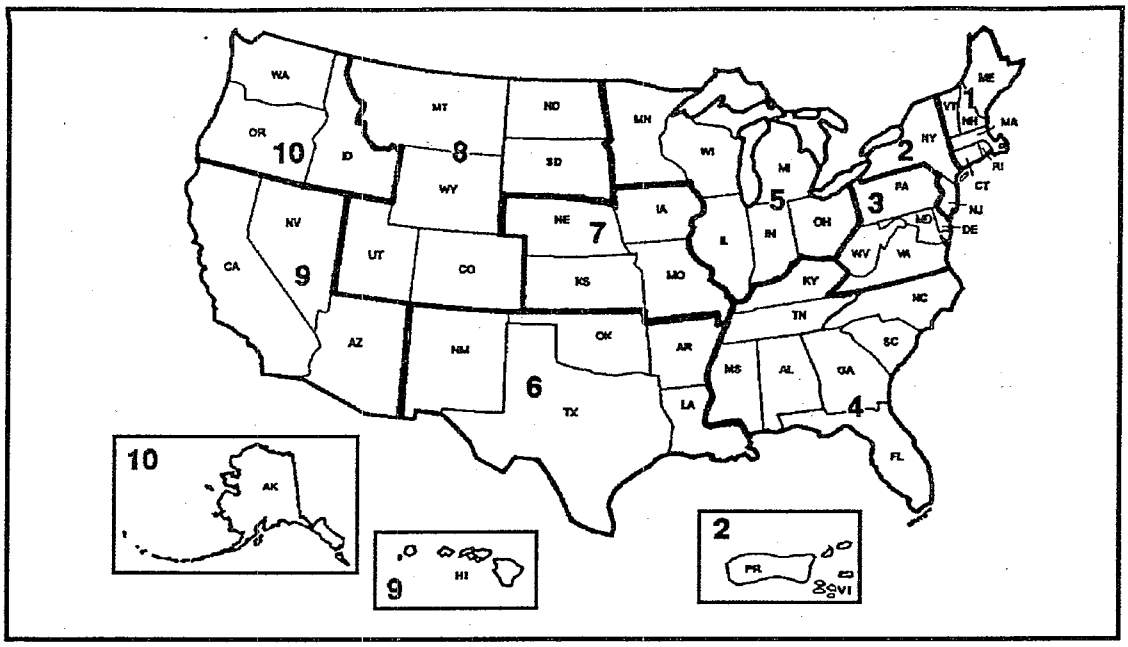
Business Office _____

Water Treatment Plant _____

After Normal Business Hours _____

If there is no answer at any of the above numbers, please contact the Police/Sheriff's Department at

_____.



EPA Ground-Water Contacts

FEDERAL CONTACT

Tom Belk
Office of Ground Water and Drinking Water
(WH 550G)
U.S. Environmental Protection Agency
401 M Street, SW
Washington, DC 20460
(202) 260-7593
FAX (202) 260-4383

REGIONAL CONTACTS

REGION 1

Rob Adler
Office of Ground Water
Water Management Division
U.S. EPA, Region 1
JFK Federal Building
Boston, MA 02203-2211
(617) 565-3601
FAX (617) 565-4940

REGION 2

Dore LaPosta
Ground Water Management Section
Water Management Division
U.S. EPA, Region 2
26 Federal Plaza
New York, NY 10278
(212) 264-5635
FAX (212) 264-2194

REGION 3

Virginia Thompson
Office of Ground Water
Water Management Division
U.S. EPA, Region 3
841 Chestnut Street
Philadelphia, PA 19106
(215) 597-2786
FAX (215) 597-8241

REGION 4

Beverly Houston
Office of Ground Water
Water Management Division
U.S. EPA, Region 4
345 Courtland Street, NE
Atlanta, GA 30365
(404) 347-3866
FAX (404) 347-3866
FAX (404) 347-1799

REGION 5

Jerri-Anne Garl
Ground Water Protection Branch
(WG-16J)
Water Management Division
U.S. EPA, Region 5
77 West Jackson Boulevard
Chicago, IL 60604
(312) 353-1441
FAX (312) 886-7804

REGION 6

Erlece Allen
Office of Ground Water
Water Management Division
U.S. EPA, Region 6
1445 Ross Avenue
Dallas, TX 75202-2733
(214) 655-6446
FAX (214) 655-6490

REGION 7

Robert Fenemore
Office of Ground Water
Water Management Division
U.S. EPA, Region 7
726 Minnesota Avenue
Kansas City, KS 66101
(913) 551-7745
FAX (913) 551-7765

REGION 8

James Dunn
Office of Ground Water
Water Management Division
U.S. EPA, Region 8
999 18th Street
Denver, CO 80202-2405
(303) 294-1135
FAX (303) 294-1424

REGION 9

Doris Betuel
Office of Ground Water (W-6-3)
Water Management Division
U.S. EPA, Region 9
75 Hawthorne Street
San Francisco, CA 94103
(415) 744-1831
FAX (415) 744-1235

REGION 10

William Mullen
Office of Ground Water
Water Management Division
U.S. EPA, Region 10
1200 6th Avenue
Seattle, WA 98101
(206) 553-1216
FAX (206) 559-0165

Evaluation

National Rural Water Association/U.S. Environmental Protection Agency

WELLHEAD PROTECTION TECHNOLOGY TRANSFER CENTERPIECE WORKSHOP

Please answer the following questions regarding your participation at this workshop.

What were your goals for attending the workshop? _____

_____

_____

_____

_____

_____

_____

Did the workshop meet your objectives? Why or why not? _____

_____

_____

_____

_____

_____

_____

For each session you attended, please check the appropriate boxes to indicate whether the information presented was useful for your work in wellhead protection and assess the workshop using the following rating system.

☐ **Excellent 5** ☐ **Very Good 4** ☐ **Good 3** ☐ **Fair 2** ☐ **Poor 1**

Overall Workshop Rating _____

Workshop Session	**Check if Useful for Your Work in Wellhead Protection**	**Rate Session Overall**	**Rate Speaker Overall**	**Rate Slides/ Overheads Handouts**
State Ground-Water Protection Plan				
Introduction to Ground Water	☐	☐	☐	☐
a. General Ground Water	☐	☐	☐	☐
b-d. State Ground Water	☐	☐	☐	☐

(over)

Evaluation

☐ Excellent 5 ☐ Very Good 4 ☐ Good 3 ☐ Fair 2 ☐ Poor 1

Workshop Session	Check if Useful for Your Work in Wellhead Protection	Rate Session Overall	Rate Speaker Overall	Rate Slides/ Overheads Handouts
Ground Water Contamination				
a. All Sources	☐	☐	☐	☐
b. State Sources	☐	☐	☐	☐
c. Local Scenarios	☐	☐	☐	☐
Resource Protection				
a. Federal Programs	☐	☐	☐	☐
b. State Programs	☐	☐	☐	☐
c. NRWA Programs	☐	☐	☐	☐
Panel Discussion	☐	☐	☐	☐
Packet Materials	☐	☐ (Rate materials overall)		

Comments/Suggestions for Improving the Workshop: _____

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