United States
Environmental Protection
Agency

Office of Water
(WH-550)

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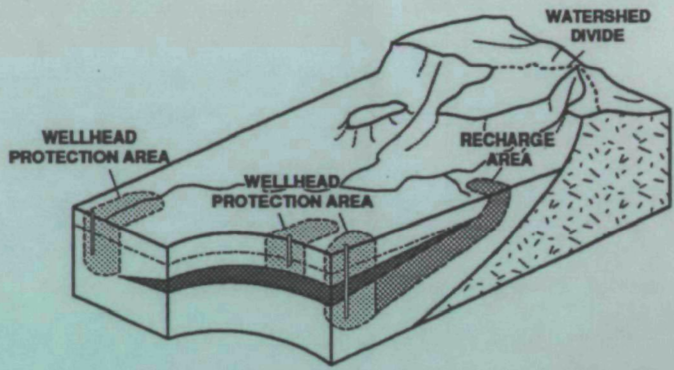
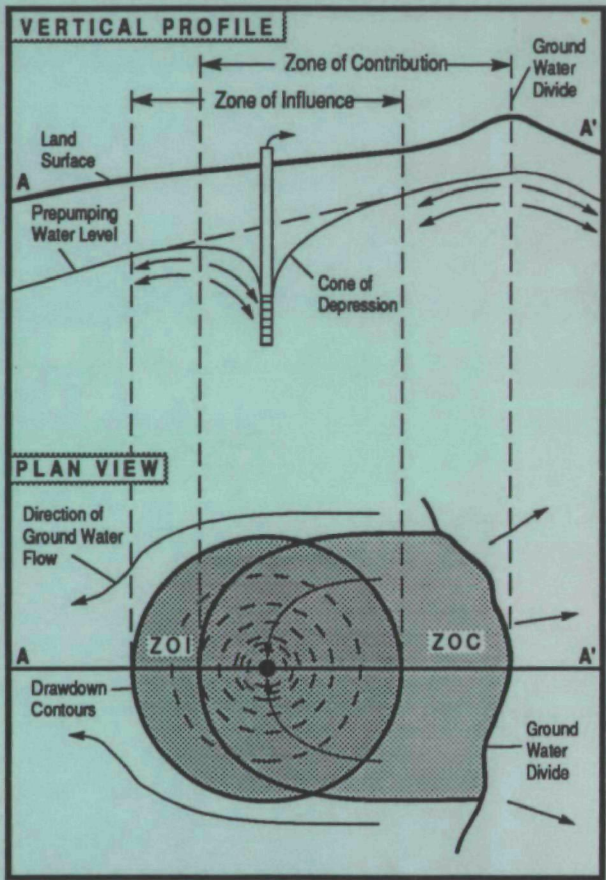
EPA

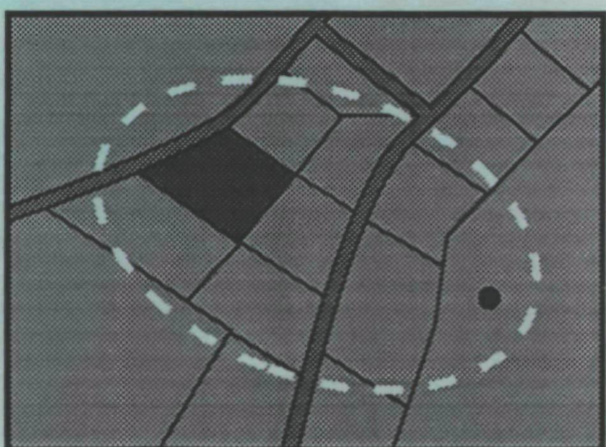


WELLHEAD PROTECTION IMPLEMENTATION TRAINING

Module 1: Overview

Briefing and Detailed Instructor's Notes





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28 September 1993

Ms. Marjorie D. Wesley
Outreach and Education
Office of Wetlands, Oceans and Watersheds
Wetlands Division (A-104F)
U.S. Environmental Protection Agency
401 M Street, SW
Washington, DC 20460

Dear Marjorie:

Please find enclosed the Train the Trainers package as promised.

Please call once you return from travel. I very much look forward to talking with you soon.

Very truly yours,

HORSLEY & WITTEN, INC.

Jon D. Witten, AICP
President

/emb

Enclosure

By Federal Express

Barnstable, Massachusetts

Washington, District of Columbia

Seattle, Washington

7 ELEMENTS • *Wellhead Protection*

1 • Specify Duties
2 • Delineate Wellhead Protection Areas
3 • Identify Potential Contaminant Sources
4 • Develop Management Approaches
5 • Develop Contingency Plan
6 • Plan for New Wells
7 • Implement Public Participation

Seven Elements of Wellhead Protection

Key Points to Cover:

- Wellhead Protection (WHP) Program has 7 distinct elements, drawn from the Safe Drinking Water Act (SDWA) 1986 Amendments
- Program is designed to be effective for a variety of hydrogeologic settings and contaminant sources
- Program is designed to protect existing and future wells
- Program focuses on protecting ground water resource through land use planning and management
- Element 7, Public Participation, should be ongoing throughout the project; other elements are sequential

Notes

Wellhead Protection Program **Slide # O-01**
Seven Elements

The 1986 Amendments to the Safe Drinking Water Act (SDWA) specify seven elements which must be included in any wellhead protection (WHP) plan. The SDWA further requires that states establish WHP programs that address and satisfy all seven elements. These need to be incorporated in WHP plans in order to obtain EPA approval.

EPA provides leadership and guidance to the states and tribes for development of WHP programs. Various reference materials are available; some of these are described in Module 9, the Annotated Bibliography of WHP Documents. Program grants and technical assistance are also components of the EPA WHP program. The primary responsibility for water protection, however, lies with the individual states or tribes.

Approved programs specify the roles and responsibilities of local governments, tribes, and water suppliers in developing local protection plans. The seven elements in these approved programs translate into five steps. It is important for the instructor to differentiate between the elements and the steps. The five steps are as follows:

1) Form a community planning team (this corresponds to Element 1, Specify duties, and Element 7, Involve the public);

2) Define the land area to be protected (this corresponds to Element 2, Delineate the wellhead protection area (WHPA));

3) Identify and locate potential contaminant sources (this corresponds to Element 3, Identify contaminant sources);

4) Manage the protection area (this corresponds to Element 4, Manage the WHPA, and Element 7, Involve the public);

5) Plan for the future (this includes Element 5, Plan for emergencies, Element 7, Involve the public, and Element 6, Plan for new wells).

Both the elements and the steps are sequential, except that public participation should occur throughout the process. The steps provide a suggested planning sequence; there may be other acceptable approaches. Considerable flexibility is allowed in programs as long as the seven elements are included.

Wellhead protection is designed to protect ground water contributing to public water supplies, through land use planning and management. This includes not only water that is currently used as a water supply, but also water that may be used in the future for that purpose. The instructor may wish to point out that some of the WHP techniques can also be applied to private water supplies, such as techniques for delineating the area contributing water to the well. Many of the management techniques are also suitable for protection of surface water resources.

The program is designed to be effective in varying hydrogeological settings. The instructor may wish to provide examples of several hydrologic regimes, such as fractured bedrock, limestone, and sand and gravel aquifers. Delineation and management techniques vary for these different ground water resources.

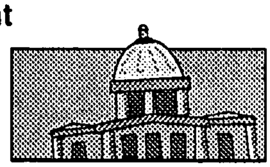
NON-TEXT PAGE

ELEMENT ONE

SPECIFY DUTIES :

- State / Local Agencies
- Tribal Government
- Public Water Supply Systems

1



Element One: Specify Duties Option A: text slide

Key Points to Cover:

- Determine roles and responsibilities so all players will be involved in wellhead protection
- Include representation from other communities if water resource is regional
- Where possible, incorporate WHP tasks with existing or planned relevant state, tribal, and local water resource protection programs
- Include determination of lead agency and communication pathways
- Project schedule and goals statement may be prepared as part of this element

Notes ____________________

Slide # O-02B

Photo of meeting with subtitle,
"Specify Duties"

Element One:
Specify Duties
Option B: picture slide

Key Points to Cover:

- Determine roles and responsibilities so all players will be involved in wellhead protection
- Include representation from other communities if water resource is regional
- Where possible, incorporate WHP tasks with existing or planned relevant state, tribal, and local water resource protection programs
- Include determination of lead agency and communication pathways
- Project schedule and goals statement may be prepared as part of this element

Notes

Element One
Specify Duties
Options A or B

Slide # O-02
(A or B)

Section 1428 of the SDWA states that all state and local entities or water suppliers that may have a role in WHP should be identified. The instructor may point out examples of WHP players, such as:

- Local/Tribal Public Officials
  - water superintendent
  - planning commission
  - wetlands or natural resources commission
  - soil and erosion control officials
  - chief elected official
  - health department
  - fire department
  - county government

- Special Interests
  - private water suppliers
  - agricultural representatives
  - chambers of commerce
  - developers
  - industry representatives
  - environmental organizations
  - watershed organizations

- Community Groups
  - League of Women Voters
  - Rotary, Lions Club, etc.
  - neighborhood associations
  - senior citizens/retired persons

Outside Groups
  - officials of neighboring towns
  - representatives of non-tribal owners of land within tribal boundaries
  - regional planning officials
  - state water resource officials
  - university/college/research institute representatives.

All interests in town should be represented, and if the water resource is regional, representation should be included from communities that share the resource. For each player, the role and responsibility should be determined. Communication pathways also should be developed to insure coordination of effort. Where possible, existing duties and authority should be utilized in the wellhead protection program, and new authority and organizational capacity created only if necessary.

A leader/lead agency for the WHP team should be selected. Technical expertise is not as important for the leader as is organizational ability and willingness to coordinate the players.

Once the team is organized, goals and priorities of WHP may be determined. Note that selection of appropriate objectives will provide benchmarks for the program, and allow progress to be evaluated. The design of the WHP and application of resources to each of objective will depend, in part, on technical and financial resources of the community. The instructor may wish to point out that there are risk assessment programs available to assist the team in determining the greatest threat to the public water supplies (see also Module 9 for information on WHP references). Using a ranking system helps the community to focus its efforts. One risk ranking system is shown below, a simple matrix which compares the likelihood of contamination against the probability of impacts:

		Probable Impact		
		Low	Medium	High
Likelihood of Contamination	High		open storage of road salt	underground storage tanks
	Medium		stormwater drains	pipeline leaks
	Low	rural density septic systems		

If the majority of threats to public water supplies in the community fall in the low-low or low-medium boxes, wellhead protection priorities will be different from protection priorities if threats fall primarily in the high-high and high-medium categories. Professionals may be employed to assist with the assessment of risk.

Lastly, a project schedule may be determined in this step of the WHP program.

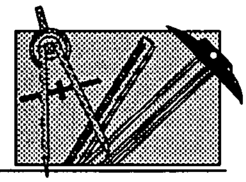
Slide # O-03A

ELEMENT TWO

FOR EACH PUBLIC SUPPLY WELL :

- Delineate the Wellhead Protection Area (WHPA)
- Various Methods Available

2



Element Two: Delineate WHPA Option A: text slide

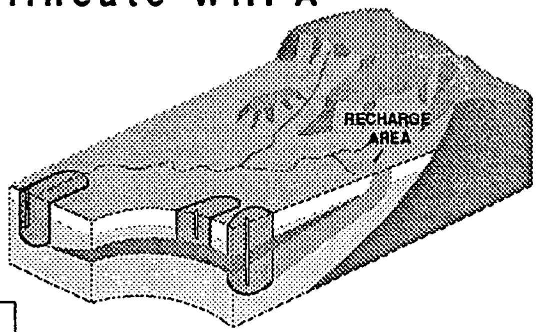
Key Points to Cover:

- The wellhead protection area (WHPA) = the surface and subsurface area through which contaminants are likely to move toward and reach a water well or wellfield
- Several methods are available to map - delineate - the area to be protected on a map; selection of a method for application depends on individual state requirements, local hydrology, technical resources, and financial wherewithal
- State and federal technical assistance is available; a professional hydrogeologist may be needed
- Some states/tribes have specified delineation methods and WHPA shapes and sizes which are directly transferable to a local region
- Delineation allows the community to focus its management efforts, avoid excessive management and regulation in areas that do not contribute to the well, and avoid spending time and funds on analysis of non-critical areas
- More detail on delineation is provided in later module

Notes ____________________

Slide # 0-03B

Delineate WHPA



2

Element Two:
Delineate WHPA
Option B: graphic slide

Key Points to Cover:

- The wellhead protection area (WHPA) = the surface and subsurface area through which contaminants are likely to move toward and reach a water well or wellfield
- Several delineation methods are available; selection depends on individual state requirements, local hydrogeology, technical resources, and financial wherewithal
- State and federal technical assistance is available; a professional hydrogeologist may be needed
- Some states/tribes have specified delineation methods and WHPA shapes and sizes which are directly transferable to a local region
- Delineation allows the community to focus its management efforts, avoid excessive management and regulation in areas that do not contribute to the well, and avoid spending time and funds on analysis of non-critical areas
- More detail on delineation is provided in later module

Notes

Element Two **Slide # O-03**
Delineate WHPA **(A or B)**
Options A or B

The wellhead protection area (WHPA) is the surface and subsurface area through which contaminants are likely to move toward and reach a water well or wellfield. This is often referred to as the primary recharge area or drainage basin to the wellhead. Delineation, or identification, of the WHPA means determining the extent of the land area that requires protection. Delineation not only focuses protection strategies on areas that contribute to drinking water, but also focuses use of technical and financial support, avoiding excessive management and regulation in areas that are not critical.

There are several delineation methods available, ranging from simply drawing a circle around the well to complex modeling and mapping. Instructors should note that four of these methods are discussed in the following slides, and more information is provided in the Delineation Module of the kit.

A good initial interim strategy, if a delineation method has not yet been specified, is to draw a circle with radius of one-half to one mile around the public supply well(s). This interim WHPA can be refined later. The radius size may be selected by reference to an existing WHPA in hydrologically similar conditions, where research has determined an appropriate size. However, this method is not appropriate for all hydrologic environments, for example, in karst terrain (limestone with solution cavities and channels).

Ideally, site-specific information such as aquifer type and well pumping rate is used to determine the WHPA, so that the area best represents actual hydrologic conditions. The instructor may wish to point out that if methods are only approximate, a larger WHPA should be delineated, to be conservative. Also, the WHPA may include sub-WHPAs, or zones. For example, a primary WHPA might be a fence around the wellhead at a 400 foot radius, to prevent physical threats to the well, with a secondary WHPA including all areas of ground water recharge, and a tertiary WHPA including land which contributes surface runoff to the secondary WHPA.

The wellhead protection area is drawn on a base map, usually a topographic map, such as the US Geological Survey quadrangles, but county and local maps, soil survey maps (US Dept. of Agriculture Soil Conservation Service) or hydrologic atlas maps (USGS) may also be used. Superimposition of the WHPA onto community zoning maps is useful in later stages of the WHP program.

EPA has published guidance documents on WHPA delineation, including the "WHPA Code", a modular, semi-analytical model for protection area delineation designed for use with personal computers. The Code is accompanied by an instructor's manual and the requisite software. EPA assistance in using the Code is available.

Many states have WHP programs that require use of specific delineation methods. Local hydrogeologists, engineers, consultants, and university researchers or professors may also be available to assist in the delineation process, as may officials of federal, state, county and tribal agencies such as EPA, US Geological Survey, Soil

Conservation Service, state health and environmental departments and county extension services.

Please note that Option A (text slide) uses slightly different language from Option B (graphic slide).

DELINEATION

METHODS OF DELINEATION

- **Arbitrary Fixed Radius**
- **Calculated Fixed Radius**
- **Simplified Variable Shapes**
- **Analytical Methods**
- **Numerical Methods**
- **Hydrogeologic Mapping**

Methods of Delineation

Key Points to Cover:

- There are several methods for delineation of wellhead protection areas, ranging from the simple to the complex, with corresponding increases in cost and effort
- Using the simple methods, the wellhead protection area is a circle
- Using the more complex methods, or a combination of methods, the WHPA is a more complicated shape
- Delineation methods may or may not include field investigations. Inclusion of such work, as well as specific site data, makes the WHPA more accurate
- Many states have already determined which wellhead delineating methods are to be used for all WHPAs in the state. Communities in such states, therefore, will not need to select a method unless there is a reason to believe that state-required method is not appropriate (e.g., very different hydrogeology from rest of state)

Notes

Methods of Delineation **Slide # O-04**

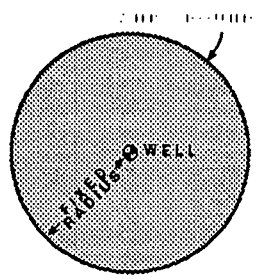
There are several methods of delineating wellhead protection areas, ranging from simple to complex, with corresponding cost and effort for their completion. The next six slides illustrate and comment on the characteristics of these methods.

Selection of a delineation method requires an understanding of the characteristics of each of the methods, including cost of delineation, degree of accuracy of delineation, and risk of contamination to the water supply. Generally, the more complex the delineation method, the more precise and the more expensive it will be to complete. Commonly, the complexity of WHPA shapes increase with the inclusion of more site-specific data and more analytical effort.

Many states, tribes, and territories have determined the delineation procedure to be used for wells under their jurisdiction. For presentations in these regions, the instructor may prefer to limit discussion to the method specified by the existing WHP program. Therefore, one or more of the following six slides may be omitted.

Slide # O-05

WHPA
Delineation Methods
Arbitrary Fixed Radius



WHPA Delineation Methods: Arbitrary (Discretionary) Fixed Radius

Key Points to Cover:

- Circle drawn around well = WHPA
- Radius may be a combination of setbacks needed for different contaminants, but should represent the minimum distance needed for attenuation of the most conservative contaminant
- The radius is arbitrary only in the sense that site-specific calculations are not performed. The radius must be justified, and the simplest approach may be to borrow a radius size from an existing, EPA-approved WHP program
- Most appropriate for bacterial threats and physical threats such as vandalism
- Quick, inexpensive and simple to apply, this method is often used for interim protection or as a first step in a protection plan

Notes

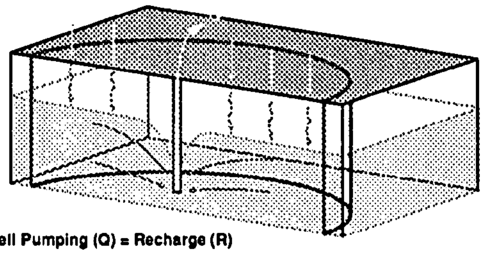
WHPA Delineation Methods: **Slide # O-05**
Arbitrary (Discretionary) Fixed Radius

(The instructor should note that the four slides on WHPA delineation methods are included in the overview to provide examples of delineation methods, not to use as teaching slides for delineation theory. The Delineation Module of this kit provides more slides and more information on WHPA delineation than that provided here.)

The simplest method to delineate a WHPA is to draw a circle around the wellhead on the base map. This method uses a fixed radius, determined somewhat arbitrarily, in that local conditions are not incorporated. However, the radius is based on minimum setback distances needed for attenuation of ground water contaminants such as bacteria derived from on-site septic systems. While setbacks for more than one contaminant may be considered, the radius selected should be the distance necessary for attenuation of the most conservative contaminant. For example, if metals can travel further in ground water than can bacteria in certain hydrogeologic environments, the metals setback should be used. The arbitrary (discretionary) radius method is most effective for bacterial threats and physical threats to the wellhead (such as vandalism).

As stated in the briefing notes, the term "arbitrary" does not mean that the radius is not scientifically justifiable. One approach a community can take to justify a radius size is to borrow a radius and the determining research and documentation from an EPA-approved wellhead protection program for a hydrologically similar region.

Because this method is simple, quick and inexpensive, it can be used as a first step in WHP, with the WHPA modified as more information becomes available. As mentioned earlier, a one-half to one mile radius may determine a reasonably effective initial WHPA.



WHPA Delineation Methods: Calculated Fixed Radius

Source: Horsley & Witten, Inc., 1991

Key Points to Cover:

- Circle drawn around well = WHPA
- Method based on setback distances for potential contaminants
- Calculated radius may be based on time-of-travel approach or hydrologic budget approach
- Local conditions including well construction, aquifer characteristics, and pumping rates are incorporated into radius calculations
- Size of the calculated WHPA is proportionate to the volume of water pumped. The accuracy of the method is limited in that it does not account for all of the factors that influence contaminant transport, including the slope of the water table and the effects of significant hydrologic boundaries

Notes

WHPA Delineation Methods: **Slide # O-06**
Calculated Fixed Radius

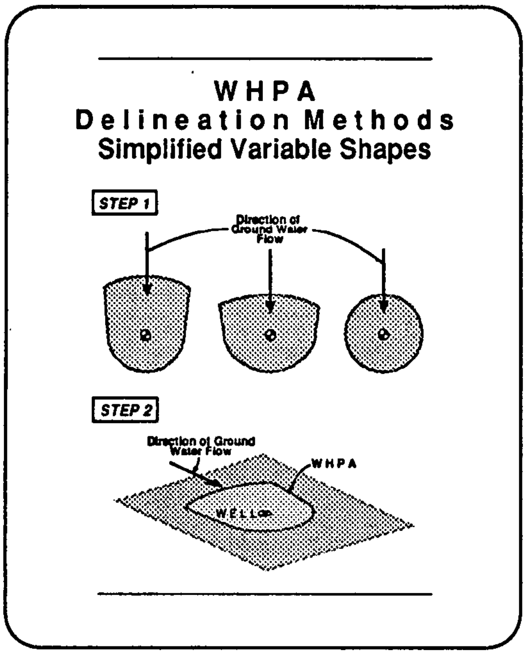
(The instructor should note that the four slides on WHPA delineation methods are included in the overview to provide examples of delineation methods, not to use as teaching slides for delineation theory. The Delineation Module of this kit provides more slides and more information on WHPA delineation than that provided here.)

As with the fixed radius method, this method also uses a circle drawn around the well as the WHPA. However, the radius is determined less arbitrarily, and incorporates local conditions. Site information which may be incorporated includes: well construction details, pumping rate, and aquifer characteristics.

The area of the calculated fixed radius WHPA is proportionate to the amount of water pumped. Calculation of the radius may follow a time of travel approach, where the volume of the aquifer (ground water) which flows to the well within a specific time period is determined. Alternatively, the calculation may be based on a hydrologic budget, where the WHPA is a function of that circular area which recharges water at an equal rate to that which is pumped.

The accuracy of this method is limited because it assumes average and uniform conditions throughout the aquifer. It does not incorporate all the factors that may influence transport of contaminants to a well, as more detailed calculations or modeling would. Nonetheless, the accuracy is often adequate for protection planning purposes.

Slide # O-07



WHPA Delineation Methods: Simplified Variable Shapes

Key Points to Cover:

- WHPA shape commonly elongated in direction of ground water flow
- Method utilizes geometric shapes designed to approximate the hydrologic characteristics associated with pumping wells in a particular area
- Shape size and initial radius may be determined via calculations described for the calculated radius method

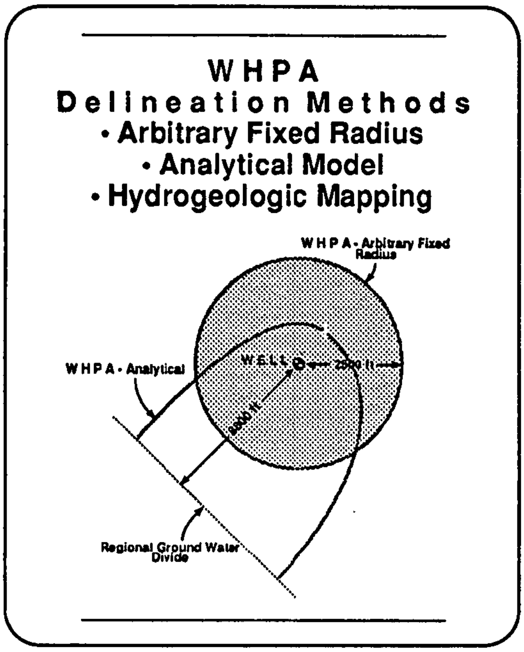
Notes

WHPA Delineation Methods: **Slide # O-07**
Simplified Variable Shapes

(The instructor should note that the four slides on WHPA delineation methods are included in the overview to provide examples of delineation methods, not to use as teaching slides for delineation theory. The Delineation Module of this kit provides more slides and more information on WHPA delineation than that provided here.)

In this method, the WHPA is a geometric shape, designed as responsive to approximate hydrologic characteristics of the aquifer under pumping well conditions. The shapes are often elongated upgradient in the direction of natural ground water flow, because areas upgradient of the well contribute water (and potentially contaminants) from beyond the well's zone of influence. The shape before elongation may be a simple circle determined with the arbitrary or fixed radius methods.

Among other factors, pumping rates affect the WHPA shape. For example, given equivalent aquifer characteristics, the shape at the top left in the slide (or icon) represents a WHPA delineated for a well pumping at a relatively high rate, while the shape at the top right represents a WHPA delineated for a well pumping at a relatively low rate.



WHPA Delineation Methods: Combination

Key Points to Cover:

- WHPA = variable shape based on local information and combination of delineation methods
- WHPA may be divided into zones, with an immediate protection zone surrounding the well determined by fixed radius, and a more extensive area determined with mapping and modeling
- Analytical and numerical models, developed to simulate hydrologic conditions, may be used but require site-specific aquifer characteristics data
- Hydrogeologic mapping, based on field investigations including dye trace, geophysics, and isotope aging, may also be applied

Notes ____

WHPA Delineation Methods: Combination **Slide # O-08**

(The instructor should note that the four slides on WHPA delineation methods are included in the overview to provide examples of delineation methods, not to use as teaching slides for delineation theory. The Delineation Module of this kit provides more slides and more information on WHPA delineation than that provided here.)

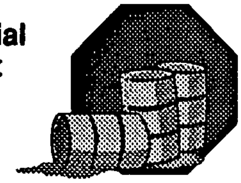
Using a combination of calculations, field mapping (ground water divide), and numerical or analytical modeling, a WHPA may be determined which more closely simulates actual conditions than one determined using the simpler methods. In the slide, the analytically derived zone is delineated by the U-shaped line which is the ground water flow divide between water that flows to the well and water that does not flow to the well. On the downgradient side of this line, "X" in the diagram, the ground water gradient is flat (ground water null point or stagnation point). Field mapping of hydrologic conditions may be based on dye trace studies, geophysics, or isotope aging. More information on analytical and numerical modeling is provided in Module 2, Delineation.

The combination of methods may result in a tiered WHPA, with a primary zone determined by the fixed radius method, a secondary zone determined with modeling, and a tertiary zone determined with hydrogeologic mapping. The combination that includes the greatest extent of land becomes the WHPA. Management measures may be applied to the whole area, or to specific zones of the WHPA.

ELEMENT THREE

IDENTIFY CONTAMINANT SOURCES :

- **Anthropogenic**
- **Existing and Potential**
- **Point and Non-Point**



3

Element Three: Identify Contaminant Sources Option A: text slide

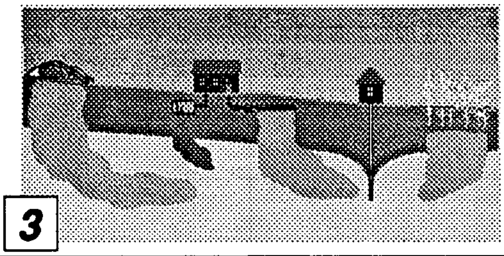
Key Points to Cover:

- Anthropogenic contaminant sources include both human-engendered contaminants and "natural" contaminants released by human actions
- Contaminants may be organic or inorganic, microbiological or radiological, liquid, solid, or gaseous
- Existing as well as potential contamination sources should be evaluated
- Contaminants may derive from point or nonpoint sources
- The City of El Paso, Texas, found use of retired volunteers for contaminant analysis to be a cost-effective method of accomplishing this task

Notes

Slide # O-09B

Identify Contaminant Sources



Element Three: Identify Contaminant Sources Option B: graphic slide

Key Points to Cover:

- Anthropogenic contaminant sources include both human-engendered contaminants and "natural" contaminants released by human actions
- Contaminants may be organic or inorganic, microbiological or radiological, liquid, solid, or gaseous
- Contaminants may derive from point or nonpoint sources
- Existing as well as potential contamination sources should be evaluated
- The City of El Paso, Texas, found use of retired volunteers for contaminant analysis to be a cost-effective method to accomplish this task

Notes ______________________________

Element Three **Slide # O-09**
Identify Contaminant Sources **(A or B)**
Options A or B

According to the Safe Drinking Water Act, contaminants to be identified in the wellhead protection program are anthropogenic contaminants, which may be generated by humans, or released by human actions. These contaminants may take any of various forms: solid, liquid, gas; inorganic, organic; microbiological or radiological. The instructor may wish to give examples of common ground water contaminants, such as:

- nitrates from lawn, golf course, and agricultural fertilizers;
- volatile organic compounds like toluene and benzene from petroleum spills;
- bacteria and viruses from septic systems;
- heavy metals from industrial discharge and urban runoff.

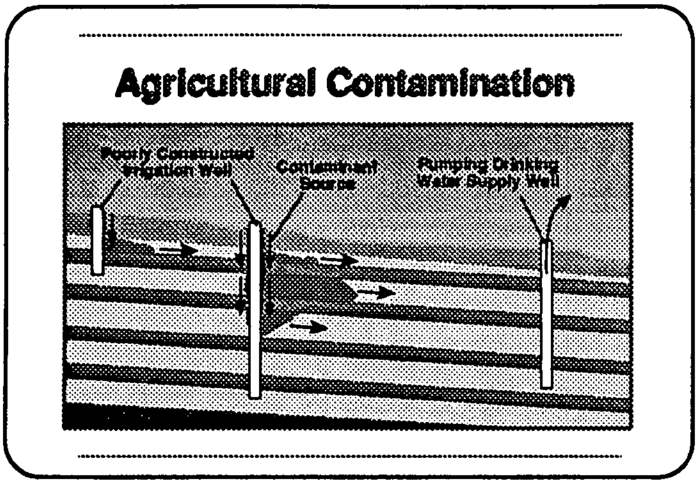
Contaminants may derive from point sources, such as industrial discharge pipes and sewage treatment plant effluent pipes. Contaminants may also derive from nonpoint, or diffuse, sources such as runoff, individual septic systems, agricultural practices, leaking underground storage tanks (USTs), and landfills.

Contaminant source identification may begin with preparation of a list of possible sources of ground water contamination in the community, based on local land uses. An inventory of sources within the WHPA may then be conducted, investigating all possible sources of contamination. Existing records on underground storage tanks (often kept by the local fire department or health board), use of agricultural fertilizers (often kept by the local extension agent), and other contaminants may be helpful in the inventory. Discharge permits under state or federal programs (RCRA, state ground water discharge programs, underground injection control programs, etc.) may also provide information on contamination sources. Interviews with senior citizens who remember historic land uses may provide valuable information on past contamination sources.

Volunteers may be used successfully, such as high school classes, boy and girl scout troops, and retired citizens, to complete this task of wellhead protection The WHPA can be divided into areas, and volunteers given sections to inventory. Use of volunteers lowers costs and increases public participation in the project.

All existing and potential contamination sources noted in the inventory may be placed on a master contamination source map. Such a map is extremely important for management and protection of ground water. It provides not only an easily understood summary of the local conditions, but also a valuable planning tool.

Contaminant source identification should not be limited to existing water supply sources, but should also consider possible future sources. For example, the zoning map or master plan for the community/tribe may show that industrial or commercial activities may be possible within the WHPA, or that particularly dense residential development is possible close to the wellhead. Identification of potential threats allows these threats to be kept in check.



Agricultural Contamination of Groundwater

Key Points to Cover:

- Agriculture may be a source of nonpoint pollution: nutrients from fertilizers and animal wastes, and organic chemicals from pesticides, spread on the land
- Agricultural activities may also include point sources of contamination, as shown in this slide, where wells may be conduits for pollutants to enter ground water
- Agricultural activities may be exempt from many existing pollution control mechanisms, so new management strategies may be required for wellhead protection
- Irrigation can worsen pollution, by leaching recently applied chemicals
- Contaminants can move from the surface down the annular space between the well casing and the rock and into the aquifer, if the well is not properly constructed with a seal
- One leaky well could do it

Notes ____

Aquifer Contaminated by Agricultural Runoff **Slide # O-10**

(The instructor should note that this slide is included in the overview as an example of a contamination source. Further information on contamination of ground water is provided in the Contamination Module.)

Agriculture, like many other land uses, may and does cause contamination of ground water. Use of fertilizers, whether organic (manure) or inorganic (ammonia, nitrogen-phosphorus-potassium salts) may result in release of excessive amounts of nitrogen to the aquifer, causing nitrate contamination of drinking water. Use of pesticides such as herbicides, fungicides, rodenticides, nematicides, and insecticides, may cause release of toxic organic compounds to ground water. Irrigation or heavy rain following application of pesticides and fertilizers can worsen pollution, by infiltrating chemicals.

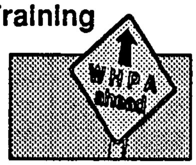
Petroleum compounds from agricultural machinery or storage tanks can also be a source of ground water pollution. Irrigation wells are often constructed without proper seals or screening, allowing surface runoff, perhaps laden with animal wastes or pesticides, to directly enter the aquifer. Drainage wells are intended to transport surface water into an aquifer.

Local/tribal agricultural practices should be carefully evaluated during the contaminant inventory.

ELEMENT FOUR

MANAGE THE WHPA :

- Management Tools
- Public Education and Training
- Demonstration Projects



4

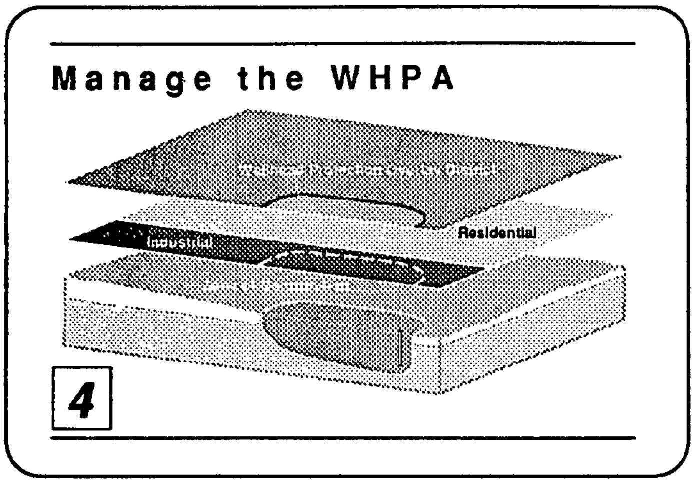
Element Four: Manage the WHPA Option A: text slide

Key Points to Cover:

- Management approaches may include technical and financial assistance, education, training, demonstration projects, and control measures
- Control measures are the actual WHP tools, including regulatory, non-regulatory, and legislative options
- Regulatory options include zoning, health, subdivision, and conservation ordinances or bylaws
- Non-regulatory options include land acquisition, land donation, monitoring, conservation restrictions, public education, and hazardous materials collection
- Management approaches must be adopted and implemented in order to be effective

Notes

Slide # O-11B



Element Four: Manage the WHPA Option B: graphic slide

Key Points to Cover:

- Management approaches may include technical and financial assistance, education, training, demonstration projects, and control measures
- Control measures are the actual WHP tools, including regulatory, non-regulatory, and legislative options
- Regulatory options include zoning, health, subdivision, and conservation ordinances
- Non-regulatory options include land acquisition, land donation, monitoring, conservation restrictions, public education, and hazardous materials collection
- Management approaches must be adopted and implemented in order to be effective

Notes ____________________

Element Four **Slide # O-11**
Manage the WHPA **(A or B)**
Options A or B

Management of the wellhead protection area can take many guises, including technical and financial assistance, demonstration projects, education, training, and control measures. Control measures are designed to limit the entry of contaminants to the WHPA, and may be regulatory, non-regulatory, or legislative.

Regulatory options include zoning, health, subdivision, and conservation ordinances or bylaws. Zoning tools include the following:

- WHPA overlay districts;
- Prohibition of various land uses;
- Special permitting;
- Large lot zoning;
- Transfer of development rights;
- Cluster/PUD design;
- Growth controls/timing
- Performance standards.

Health tools include regulation of the following:

- Underground storage tanks (USTs);
- Privately owned wastewater treatment plants;
- Septic system maintenance;
- Hazardous waste and solid waste handling and disposal.

Subdivision tools include the following:

- Drainage requirements;
- Environmental impact assessments;
- Performance standards;
- Site design/landscaping;
- Nitrogen loading criteria.

Conservation tools include:

- Natural vegetated buffers;
- Surface water discharge regulation;
- Erosion and sedimentation control;
- Restrictions on pesticides and fertilizers.

Instructors should note that more information on these techniques is provided in the Tools Module (Module 4).

Non-regulatory control measures include land acquisition, land donation, water quality monitoring, conservation restrictions, public education, and hazardous materials collection.

Legislative measures may be required for regional resources, to allow all communities sharing the aquifer to coordinate management strategies.

The instructor may wish to emphasize that any control measures selected must be adopted and implemented in order to have any effect. The effort required to develop, adopt, and implement any of the above techniques will vary with the type of tool and with the local conditions. For example, non-regulatory tools are frequently easier to implement than regulatory tools since public review and approval may not be necessary.

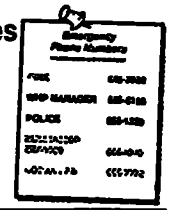
Note that use of the graphic slide, Option O-11B, requires a more technical background than Option O-11A.

Slide # O-12A

ELEMENT FIVE

PLAN FOR EMERGENCIES :

- Alternative Water Supplies
- Emergency Contacts



5

Element Five:
Plan for Emergencies
Option A: text slide

Key Points to Cover:

- Contingency planning includes knowing who to call for backhoe services in the middle of the night, which lab will open at 3:00 a.m. Saturday, and who acts as emergency officer
- Contingency planning is a critical step in wellhead protection: accidents may occur before or despite WHP program implementation
- Alternate drinking water supplies are specified for each existing supply
- Financial and time considerations are part of contingency planning

Notes

Slide # 0-12B

Photo of fuel storage tank fire with subtitle, "Plan for Emergencies"

Element Five:
Plan for Emergencies
Option B: picture slide

Source: D. Hall, City of Dayton, OH, 1990

Key Points to Cover:

- Contingency planning includes knowing who to call for backhoe services in the middle of the night, which lab will open at 3:00 a.m. Saturday, and who acts as emergency officer
- Contingency planning is a critical step in wellhead protection: accidents may occur before or despite WHP program implementation
- Alternate drinking water supplies are specified for each existing supply
- Financial and time considerations are part of contingency planning

Notes ______________________________

Element Five **Slide # O-12**
Plan for Emergencies **(A or B)**
Options A or B

Despite protection efforts, a public drinking water supply may become temporarily or permanently contaminated. Therefore it is important to plan for emergencies, or to develop a contingency plan. The instructor may wish to provide examples of emergency water supply scenarios, such as:

- Release of diesel fuel from an underground storage tank at an automobile service station within the WHPA;
- Sodium contamination to well from use of road salt on a highway adjacent to the wellhead;
- Presence of cadmium in drinking water due to use of fungicides on a golf course upgradient of the public supply well.

Under the Safe Drinking Water Act Amendments, contingency plans are to be developed for all major public water supplies. "Major" is defined by each state, and may be based on population density, water use patterns, responsibility for water provision, etc. (The instructor may wish to provide his/her state's definition.) For each major water supply source, alternate supplies should be planned, for both temporary emergencies and for permanent contamination situations.

Emergency planning includes practical, logistical information, such as telephone numbers for the fire department, wellhead protection manager, police, backhoe services, water quality laboratories, and so on. Planning also includes financial considerations, such as how the expense of bottled water, or chlorination in bacterial contamination incidents will be covered. Coordination mechanisms and responsible individuals or agencies should be specified.

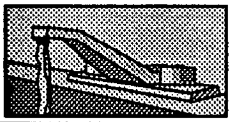
NON-TEXT PAGE

Slide # O-13A

ELEMENT SIX

PLAN FOR NEW WELLS :

- Project Future Needs
- Develop Management Strategies for New WHPA's



6

Element Six:
Plan For New Wells
Option A: text slide

Key Points to Cover:

- WHP planning includes analysis of potential future wellfield areas

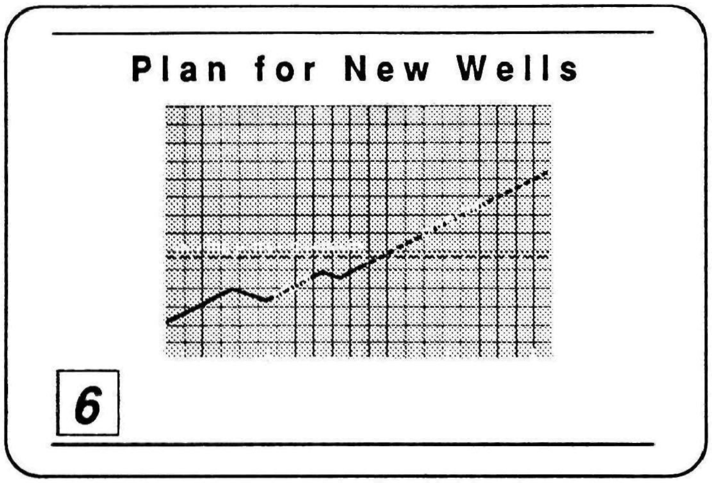
- New wells may be sited in existing wellfields or in previously undeveloped water supply areas

- Wells added to existing wellfields or modification of existing wells (increased with-drawal rates may necessitate adjustment of wellhead protection areas

- New wells represent the opportunity to avoid contaminant threats impacting existing wells through knowledgable location selection. Therefore new wells should be carefully planned and installed. For example, if a town's existing well has be come surrounded by such potential groundwater-contaminating land uses as air ports, service stations, and drycleaners, a new well may perhaps be sited in a cur-rently undeveloped tract of land, and preventative protection measures set in place to prevent development of conflicting land uses

- Water conservation plans as alternatives or adjuncts to development should be considered at this stage

Notes ______________________________



Element Six:
Plan For New Wells
Option B: graphic slide

Key Points to Cover:

- WHP planning includes analysis of potential future wellfield areas

- New wells may be sited in existing wellfields or in previously undeveloped water supply areas

- Wells added to existing wellfields or modification of existing wells (increased with-drawal rates may necessitate adjustment of wellhead protection areas

- New wells represent the opportunity to avoid contaminant threats impacting existing wells through knowledgable location selection. Therefore new wells should be carefully planned and installed. For example, if a town's existing well has be come surrounded by such potential groundwater-contaminating land uses as air ports, service stations, and drycleaners, a new well may perhaps be sited in a cur-rently undeveloped tract of land, and preventative protection measures set in place to prevent development of conflicting land uses

- Water conservation plans as alternatives or adjuncts to development should be considered at this stage

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Element Six **Slide # O-13**
Plan for New Wells **(A or B)**
Options A or B

Community growth, water use changes, or permanent wellfield contamination may result in the need for new wells. These wells may be sited in existing wellfields, necessitating adjustments in existing WHPAs, or they may be sited in a previously undeveloped water supply area, necessitating delineation of a new WHPA.

New wells should be sited to maximize well yield while minimizing contamination threats. For example, an area zoned for large lot residential development is a better location for a new well than an area zoned for commercial use, provided the aquifer characteristics are equivalent.

Alternative control measures may be possible for new wells, and public interest in protection may be generated as part of the siting process. Careful planning for new wells may be begun in advance of their need, and be incorporated into the overall WHP program.

The majority of states, including all those with EPA-approved WHP programs, have specific requirements to ensure a safe location for new water supplies. These requirements include water quality and quantity testing prior to site approval. Requirements vary with the well's size and the type of service it will provide. As in other tasks of the WHP process, coordination with the state is recommended.

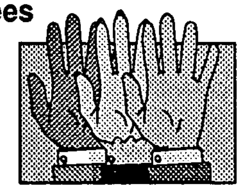
Water conservation to reduce demand is an alternative to development that should be included as an element of development planning. Although water suppliers are required to meet demand, management of demand is an effective alternative.

NON-TEXT PAGE

ELEMENT SEVEN

INVOLVE THE PUBLIC :

- Technical Committees
- Citizen Groups
- Encourage Broad Involvement



7

Element Seven: Involve the Public Option A: text slide

Key Points to Cover:

- Public participation is not the final element of WHP, but should be ongoing during the WHP process
- Passive participation may take the form of disseminated information
- More interaction may be elicited with workshops or citizen monitoring programs
- The City of El Paso, Texas, tapped the resource of knowledgeable, interested, retired citizens to conduct contamination identification tasks
- High school and college classes also represent potential sources of volunteer, quality assistance for WHP tasks
- Local/tribal officials and active citizens may play a major role in eventual adoption of WHP control measures
- Effective public participation in a WHP develops public commitment to and support of the plans that the public participated in developing, thereby lessening the potential for opposition to the plans.

Notes

Slide # O-14B

Photo of public site visit with subtitle, "Involve the Public"

Element Seven: Involve the Public Option B: picture slide

Key Points to Cover:

- Public participation is not the final element of WHP, but should be ongoing during the WHP process
- Passive participation may take the form of disseminated information
- More interaction may be elicited with workshops or citizen monitoring programs
- The City of El Paso, Texas, tapped the resource of knowledgeable, interested, retired citizens to conduct contamination identification tasks
- High school and college classes also represent potential sources of volunteer, quality assistance for WHP tasks
- Local/tribal officials and active citizens may play a major role in eventual adoption of WHP control measures
- Effective public participation in a WHP develops public commitment to and support of the plans that the public participated in developing, thereby lessening the potential for opposition to the plans.

Notes

Element Seven
Involve the Public
Options A or B

Slide # O-14
(A or B)

Throughout the wellhead protection process, public participation should be encouraged. The public may be involved in a variety of ways--both passive and interactive. Brochures may be distributed and posters displayed, illustrating WHP program steps as they are planned or completed. Workshops may be held and water awareness events planned.

Public involvement may also take the form of assistance with WHP tasks. Use of volunteers not only educates and motivates the public, but also reduces program costs. Volunteers may be used in contamination source identification, development of control measures, and in water quality monitoring programs. For example, El Paso, Texas, successfully used retirees to conduct its contaminant source inventory. High school and college classes are other sources of volunteers.

Public interest in WHP may be critical for adoption of control measures, since many of these may be more restrictive than existing ordinances. Involvement of local/tribal officials and active citizens may speed the adoption and implementation processes for management tools. Broad public support and support from a communities leaders will tend to lessen the potential opposition to the plans.

NON-TEXT PAGE

INTEGRATION OF WHP WITH
OTHER SDWA REQUIREMENTS

- Vulnerability Assessments
- Sanitary Surveys
- Watershed Control Programs
- Ground Water Under the Direct Influence of Surface Water

Safe Drinking Water Act and Wellhead Protection Integration

Key Points to Cover:

- Other SDWA programs include components of WHP; integration avoids duplication of efforts
- Information gathering, an important component of resource protection, may be transferable from one program to another
- The Underground Injection Control Program (UIC) may provide information on location of contaminant threats to public water supplies as may sanitary surveys conducted under the Total Coliform Rule
- Monitoring required under various programs may form part of a WHP contingency plan
- WHP Actions may replace treatment requirements under the Surface Water Treatment Act

Notes

SDWA and WHP Integration **Slide # O-15**

Under the Safe Drinking Water Act Amendments, three programs address protection of drinking water:

- the Public Water Supply Supervision Program (PWSS);
- the Underground Injection Control Program (UIC);
- the Wellhead Protection Program (WHP).

Integration of these programs (and applicable state programs) saves duplication of efforts. All three programs may include such tasks as: information collection, sanitary surveys, monitoring, contaminant source inventories, vulnerability assessments, contingency planning, and management measures. Task completion may be distributed between programs, and results transferred to all.

The UIC program keeps records of injection wells, which may be threats to WHPAs. Similarly, sanitary surveys conducted under the PWSS Program may also provide contaminant source information to the WHP project.

Monitoring conducted under the PWSS program may replace monitoring needed for WHP evaluation, and WHP programs may reduce the required monitoring frequency.

Because the programs overlap considerably, it is important to explore coordination of efforts between programs, and to include representatives from related programs on the WHP planning team. Other federal programs may also provide useful information to the WHP process, such as RCRA, FIFRA, NPDES, and so on. More information on these programs may be obtained from the Annotated Bibliography, Module 9. (The instructor may wish to give examples of relevant state/tribal programs here.)

If the instructor prefers to keep the Overview presentation general, he/she may wish to merely point out that there are several ongoing programs that a WHP effort should consider as information sources, and not mention programs by name. This slide may be omitted entirely to keep the presentation general.

STATE PROGRAM GOAL

SDWA ESTABLISHES
THE FUNDAMENTAL GOAL

"... to protect wellhead areas within their jurisdiction from contaminants which may have any adverse effect on the health of persons."

State Program Goal

Key Points to Cover:

- Summarize WHP program process and goals

Notes

State Program Goal **Slide # O-16**

The SDWA wellhead protection goal provides a succinct summary of the material discussed above, in that the seven elements, or five steps, are designed to meet this goal. This slide is placed for the instructor to summarize his/her presentation, make concluding remarks, and entertain questions.

The instructor may also use the Ground Water Task Force Policy Goal to summarize the WHP process. This goal is as follows:

"The overall goal of EPA's ground water policy is to prevent adverse effects to human health and the environment and to protect the environmental integrity of the nation's ground water resources; in determining appropriate prevention and protection strategies, EPA will also consider the use, value, and vulnerability of the resource, as well as social and economic values."

NOTE: Avoid using this slide for local government groups