

1 Introduction

Three out of four New Hampshire residents receive their drinking water from public water systems and everyone expects water in public places to be safe to drink. The federal law that regulates public drinking water is the Safe Drinking Water Act (SDWA) and amendments. The most recent amendments, passed by Congress in 1996, gave EPA a clear directive to protect the sources of public drinking water. Under the amendments, the States are required to assess the protection area of every source of public drinking water. In New Hampshire, this includes 59 surface water sources and 2900+ wells.

Each state must submit a plan describing how it will carry out a Source Water Assessment Program to assess each source. For the sake of clarity, New Hampshire is calling its program the Drinking Water Source Assessment Program (DWSAP). An assessment, according to the SDWA amendments, includes:

- C **Delineation** of the protection area for each drinking water source (e.g., identifying the land area from which water--and potentially contaminants--flows to the water supply well or intake),
- C **Inventory** of all significant potential and known contamination sources, and
- C Determination of the source's **relative susceptibility**. Relative susceptibility is the potential for a public water system to draw water contaminated by the inventoried contamination sources at concentrations that could pose public health concerns.

New Hampshire has been carrying out the first two steps since 1990 when it began implementation of its Wellhead Protection Program (which has undergone a name change to Drinking Water Source Protection Program). Currently, protection areas have been defined for all but the transient systems, (i.e., those that supply water to restaurants, hotels, campgrounds, etc.). A Geographic Information System has been developed that contains extensive land use inventory information for delineated protection areas.

This historic assessment activity has led to source water protection measures being implemented at 80% of the non-transient water supply systems. Accordingly, this Drinking Water Source

The 1996 SDWA amendments require NH to assess each of its 3000 sources of public drinking water by May 2003.

Assessment Program (DWSAP) Plan will function to increase resources available for delineation, inventory, and assessment to further Federal, State and local source water protection efforts. Responsibility for the implementation of protection measures will not change as a result of this program. For instance, local land use decisions will continue to be made at the local level.

The purpose of this document is to explain the steps NH intends to take to assess each source of public drinking water. The document is organized to describe the Department of Environmental Services (DES) approach to each of the major components of an assessment: delineation, land use inventory and susceptibility determination. A section is also included to describe how the public was involved in the development of the DWSAP Plan and how implementation will be achieved.

1.1 Goal

The State's source water protection goal has been to have source water protection programs in place at all of the sources of public drinking water that supply community and non-transient, non-community¹ water systems. The Drinking Water Source Assessment Program functions, in part, to further state and local protection efforts by preparing and disseminating assessment reports regarding the susceptibility of each source of public drinking water. These assessments will be performed to benefit public water suppliers and the public. The assessments will be designed to:

- C Provide a tool for use by local entities to evaluate the appropriateness of current protection efforts, and
- C Provide information to select and implement additional protection programs.

Therefore, the primary goal of the DWSAP is to improve protection of all public water supply sources, including those serving transient systems, and by doing so to enhance the overall quality of drinking water to the public, thus helping to safeguard the health of New Hampshire's citizens. The information will also be useful to further existing protection efforts at the federal, state and local levels as described below.

The goal of the DWSAP is to safeguard the health of New Hampshire's citizens by improving protection of all public water supply sources.

¹ See section 2.1 for definitions of each type of public water system.

1.2 Connections with Existing Protection Programs

As noted above, New Hampshire DES has been assessing source waters as part of its Drinking Water Source Protection Program since 1990. Since 1996, the Drinking Water Source Protection Program has been part of the Water Supply Engineering Bureau, which is part of the Department's Water Division. The DWSAP will augment current source water assessment efforts with more complete information about significant potential and known sources of contamination and about the vulnerability of public water supply sources. This new information, in addition to assisting local entities in their source water protection planning efforts, will help DES determine which types of threats should receive highest priority in the state's Comprehensive Source Water and Groundwater Protection Program (CSGWPP).

As explained in section 1.3, a number of existing protection programs were involved in the DWSAP Advisory Committee, which advised DWSAP staff on the approaches included in this plan. However, as far as coordinating various stakeholders and government agencies on all levels in drinking water *protection*, the CSGWPP is the primary coordination mechanism. (Appendix K contains a summary of CSGWPP participants and activities.) For example, through its involvement in the DWSAP Advisory Committee, DES's Surface Water Quality Bureau has a role in the development of this plan and in monitoring the progress of its implementation. Through the CSGWPP work group, the Surface Water Quality Bureau will be able to coordinate its watershed programs, which include nonpoint source management and the development of total maximum daily loadings (TMDLs), with the DWSAP and other programs. In this way, for example, information on land cover, nonpoint sources, other potential sources of contamination, water quality monitoring data, and nutrient loading analyses can be employed, where appropriate, in the development of TMDLs.

The DWSAP information will also help DES and US EPA to target and prioritize regulatory prevention programs, outreach, and technical and financial assistance. Figure 1-1 illustrates the connections between the DWSAP and other programs.

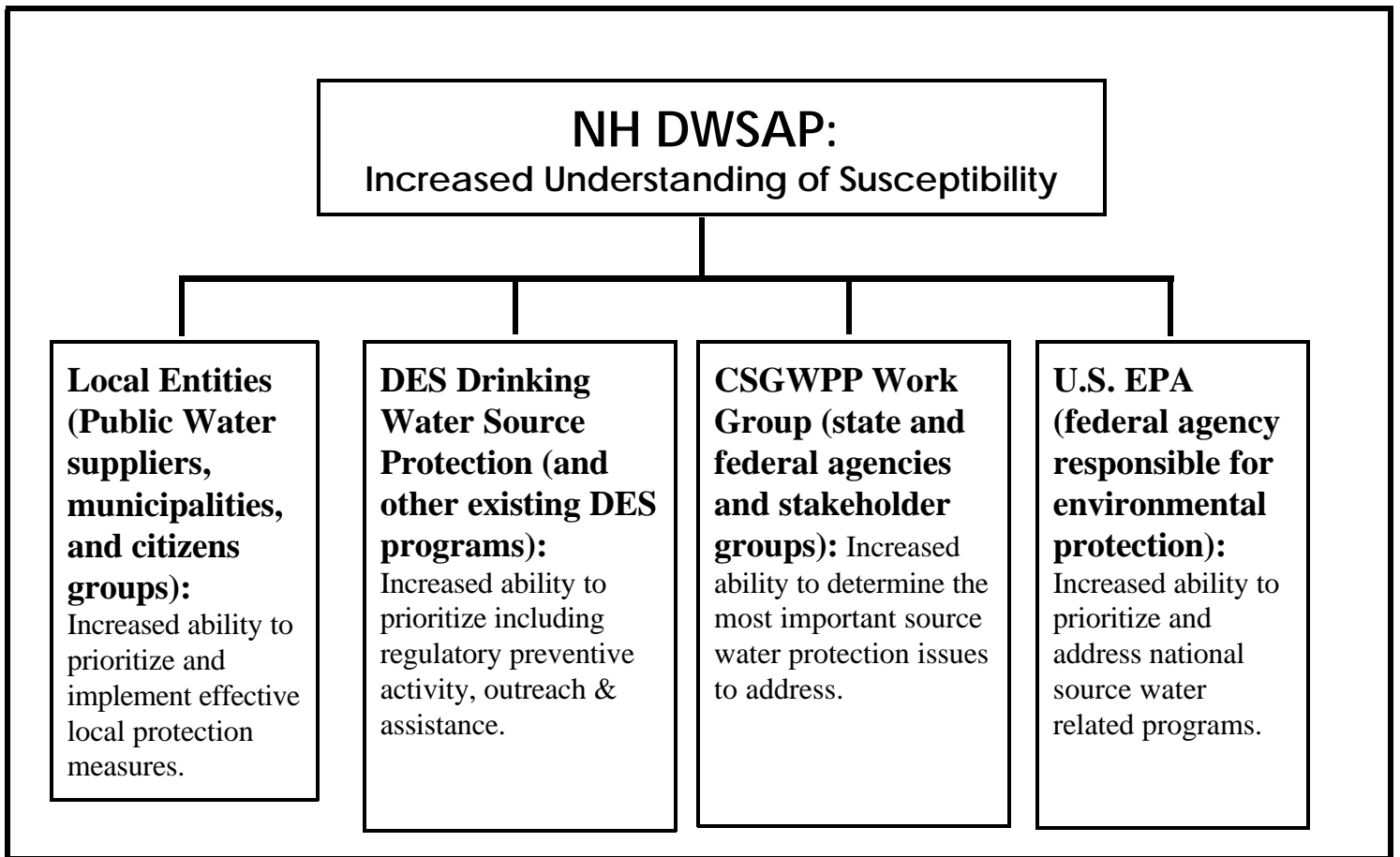
1.3 DWSAP Development Process

DES developed the program described in this plan with assistance

DES developed this DWSAP plan with the active participation of an advisory committee.

from an advisory committee, comprised of a diverse group of interests, meeting over the spring and summer of 1998. For issues related to surface waters, a separate technical subcommittee advised DES (see Appendix A list of advisory committee members). The active participation of committee members greatly improved the approach that DES intends to take in assessing all sources of public drinking water in New Hampshire by May 2003. Comments by advisory committee members and others, as well as DES's response to those comments, are summarized in Appendix H.

Figure 1-1
Connections with Existing Protection Programs



2 Delineation Methodology

Delineating the protection area for each source is an essential component of assessing the source's susceptibility. The New Hampshire approach is described in the sections below.

2.1 Groundwater Sources (wells and springs)

Delineation of protection areas for groundwater sources consists of defining the area through which groundwater and groundwater

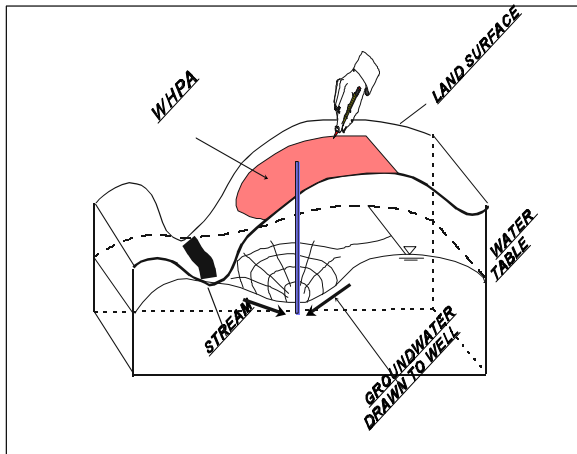


Figure 2-1. Delineating the Source Protection Area for a well.
WHPA = Wellhead Protection Area.

contaminants are likely to flow towards a well. The approach for delineating groundwater sources of public drinking water was discussed at the second meeting of the DWSAP Advisory Committee. It should be noted that New Hampshire is currently evaluating utilizing recent bedrock lineament mapping being performed by USGS to enhance the knowledge of water's movement towards sources. Because of time deadlines, the existence of intersections of major water bearing fractures with sources will not necessarily be explained in the source susceptibility determinations developed under this plan. However, this information will be made available and explained in terms of impact on susceptibility as soon as the analysis is completed. Explanations of the approach that will be used based on system and well type follow. These approaches are consistent with the States Wellhead Protection Program Plan.

Transient Systems (restaurants, etc.)²

Groundwater is the source of all public drinking water provided by transient systems. Nearly all of the 1192 wells that serve transient systems are bedrock wells. Currently the protective radius for

² A transient system is a public water system serving 25 or more people per day for 60 days or more per year, but not the same 25 people every day. Examples include restaurants and hotels with fewer than 25 employees. There are 1051 of these systems and 1192 sources serving them.

***Methodology
approved under New
Hampshire's Wellhead
Protection Program
has been used to
complete delineations
for all but the transient
wells.***

transient system wells, which ranges from 75 to 150 feet, is assessed for threats during the sanitary survey that is conducted by DES at these sources once every 5 years. Beginning in the summer of 1998 DES sanitary surveyors began extending the assessment radius to 500 feet around each transient well, resulting in a broadened assessment for each of these wells. DES anticipates that the assessed area for all transient wells will be 500 feet by the end of 2002. DES believes 500 feet is sufficient for the following reasons:

- C These sources are treated differently under the Safe Drinking Water Act. They are acknowledged as lower risk to the public because of the limited exposure associated with their transient use. Because of this, they have minimal sampling requirements under the SDWA.
- C These sources comprise mostly bedrock wells withdrawing small quantities of water.
- C It is generally acknowledged that the most common threat to transient sources is leach fields and underground storage tanks located on the same premises as the well.
- C These systems have little ability to control off-property threats.
- C DES will furnish maps to municipalities that include these sources and land use information. The municipality will be urged to include transient source water protection areas in local source water protection efforts. (See Drinking Water Resource Map Cover Letter in Appendix B).
- C This approach will not divert resources from implementing protection programs for community and non-community, non-transient systems where people are routinely drinking the water.

Community³ and Non-Community, Non-Transient Systems⁴ (residential systems , schools, hospitals, large work places, etc.)

History and Status of Delineation Efforts

DES has recently completed delineating wellhead protection areas (WHPAs) for all wells used by community and non-community, non-transient systems . The “Phase I” method used was developed with an advisory group. It allowed DES to prepare delineations using available information so that limited resources could be spent on implementing protection rather than delineating protection areas. It was acknowledged that WHPAs derived using this methodology were sometimes larger than might result from more site-specific hydrogeologic investigation and modeling and that there was sometimes a local need for a more “sophisticated” delineation. A number of grants have been provided by DES for this purpose.

The majority of existing delineations were developed using the Phase I approach, which uses existing information. For overburden wells, the uniform flow equation was applied. Parameters were largely derived from stratified drift aquifer maps developed by the USGS where site-specific information such as pumping test data did not exist. Bedrock wells were delineated using volume-dependent circles that assumed water was coming from one major water bearing fracture.

A default maximum distance of 4000 feet was used as a cutoff for both overburden and bedrock wells. The default 4000-foot radius is considered conservative from a protection perspective for two reasons;

- C In New Hampshire settings, 4000 feet correlates with a 20-year time of travel for relatively fast moving groundwater, and
- C 4000 feet is farther than contamination is known to have traveled in groundwater in New Hampshire, in all but the rarest of circumstances.

³ Community systems include public water systems which serve at least 15 service connections used by year-round residents or regularly serve at least 25 year-round residents. There are 686 of these systems and 1262 sources serving them.

⁴ Non-Transient, Non-Community Systems are systems which are not community water systems and which serve the same 25 people or more over 6 months per year. There are 443 of these systems and 498 sources serving them.

In general, DWSAP resources will not be dedicated to enhancing delineations unless there is a clear local intent to protect these areas.

Large community wells sited after 1981 and a handful of other municipal wells have more sophisticated delineations which are derived from site-specific hydrogeologic investigations.

Future Delineation Efforts

Future delineation efforts will be based on one of two methods:

1. Enhancements Based on New Information Using Current Method

As resources will allow, DES will reevaluate WHPAs for large overburden wells where the current method produced the default 4000 foot circular WHPA. In many cases, USGS stratified drift mapping was not yet available and there was little or no local information available when these delineations were performed. With a small amount of additional, site-specific information, DES will enhance these delineations. DWSAP resources will not be specifically dedicated for this purpose except where there is a clear local intent to protect these areas.

2. Enhancement for Specific Protection Goals

These enhancements will generally be performed with DWSAP funding only where there is a local need for a more site-specific delineation. For instance, the current Phase I delineation may limit protection efforts because it extends across a river and there was insufficient site-specific data to eliminate this potential area of contribution. The desire to implement restrictive land use ordinances or to acquire land would also be examples of local needs that would justify enhanced delineations.

To make municipalities aware of grant funding (and time limits, i.e. 2001), DES is providing all municipalities with maps of their current delineations and an explanation of why they might want to reevaluate existing delineations and how to apply for grant funding. This is occurring during early to mid 1999. The mailing also stresses that if a local entity has a need for a more sophisticated delineation, they need to make a request within three years (See Appendix B for the Drinking Water Resource Map cover letter). Quality control and assurance measures will be implemented by DES to ensure that scientifically valid SWPAs are delineated and properly documented.

Oversight will include review of the appropriateness of the method selected, scope of work review, and review of the results. Funding for delineation enhancement projects will be prioritized based on demonstrated local need. Priority will also be given to those projects

Large community wells sited after 1981 and some other municipal wells already have delineations which are derived from site-specific hydrogeologic investigations.

that assist DES in addressing a number of technical issues that will benefit future delineation efforts. For that reason, projects that include one or more of the elements in Table 2-1 will receive priority consideration for available funding.

DES may fund some advanced delineations of bedrock wells in order to improve its delineation methodology.

In general, DWSAP resources will only be spent where there is a local intent to protect the area that results from the reevaluation of the current delineation. However, DES reserves the right to use DWSAP resources to fund one or more well planned delineation studies of large bedrock wells even if there is not a local need for the more sophisticated delineation. This will only be done after every effort is made to generate local interest. Because of the many unknowns associated with bedrock, these studies may result in significant improvements to this type of delineation and therefore may warrant the expense even without local interest.

Table 2-1. Priorities for Enhancement of WHPA Delineations

Project Elements for Priority Funding	Justification/Benefit to Future Delineation Efforts
<p>Detailed field data used to quantify the amount of water contribution from bedrock to an overburden well.</p> <p style="text-align: center;"><i>or</i></p> <p>The area of bedrock that contributes water to an overburden well included in the delineation.</p>	<p>In New Hampshire, fractured bedrock is frequently connected to the overburden aquifer materials. In some circumstances, bedrock contributes a significant portion of the water withdrawn from overburden wells. However, bedrock is often not considered in the design of field programs or in the delineation of SWPAs.</p>
<p>Detailed field data collected about regional groundwater flow patterns, particularly changes in hydraulic head with depth.</p>	<p>The regional flow pattern has a significant influence on the size of a SWPA. Most SWPAs are based on regional patterns inferred from topography.</p>
<p>A pumping test program designed using tools that predict the aquifer's response to pumping.</p>	<p>There are several such tools available yet they are rarely used for public water supplies in New Hampshire. Using these tools, the pumping period and the frequency and location of monitoring can be selected to maximize data gathering efforts.</p>
<p>Temperature and/or chemistry data used to evaluate connection to surface water.</p> <p style="text-align: center;"><i>or</i></p> <p>Seepage meters used to measure flow rates between the aquifer and surface water.</p>	<p>The contribution of surface water to production wells is critical to delineating the SWPA. This contribution is infrequently based on direct measurements of these parameters.</p>
<p>Undisturbed and/or split-spoon soil samples from the aquifer.</p>	<p>Typically, the aquifer is described using washed samples. Projects with this element demonstrate that the undisturbed or split spoon samples provide a more accurate picture of aquifer stratigraphy.</p>
<p>Hydraulic testing in individual boreholes or monitoring wells.</p>	<p>This testing evaluates a discrete portion of the aquifer, as opposed to a pumping test of the whole aquifer. This information provides a clearer understanding of aquifer stratigraphy and the range of hydraulic values.</p>
<p>Geophysical methods used to assist in defining boundary conditions and the three dimensional nature of the aquifer system.</p>	<p>These methods are infrequently used in the delineation of SWPAs, particularly for overburden sources. Information identified using these methods will enhance understanding of the aquifer. DES will look for projects that demonstrate the value of these methods applied at reasonable costs. "Reasonable cost" is a relative term and will be determined on a cost-to-benefit basis.</p>
<p>Remote sensing information used to assist in delineation of a SWPA for a small bedrock well.</p>	<p>Projects of this type would serve to demonstrate the usefulness of such efforts. Most large bedrock wells are sited using remote sensing data that can then be used in delineation of a SWPA. However, typically small wells are sited where there is available land and no remote sensing is conducted. DES will look for projects that apply this element at reasonable costs.</p>
<p>An alternative delineation method used where there is a high degree of uncertainty with the existing SWPA because the underlying assumptions of the delineation method used are poorly satisfied by actual field conditions.</p>	<p>The accuracy of a SWPA delineation method relies on the accuracy of a set of assumptions about the aquifer (e.g., homogeneous, no vertical flow). The better the assumptions fit the aquifer of concern the more accurate the SWPA delineated. In the past, these violations have generally been handled by using very conservative aquifer values.</p>
<p>Comparison of SWPA predicted from a 5-day pumping test to flow conditions observed during long-term monitoring actual well operations.</p>	<p>Projects of this type would provide information for evaluating the practical nature of the shorter-term test and the conservative nature of the resulting SWPA.</p>
<p>Multiple well fields in a single aquifer.</p>	<p>Often another water system has a well or wells in the same aquifer "system." However, in most instances this is not factored into the SWPA delineation for a particular system.</p>

2.2 Surface Water Sources

All of the surface water sources of public drinking water serve community water systems. Of the 59 sources, most are rivers, lakes or reservoirs.

General Delineation Approach

The approach for delineation of surface water sources was discussed at a technical advisory subcommittee meeting and the third and final meeting of the DWSAP Advisory Committee (DWSAPAC). New Hampshire DES will take a two-tiered approach to delineating these assessment areas.

First, the entire watershed area (based on 1:24,000 topographic maps) for each source will be examined; nearly all of these delineations have already been completed. A simplified view of a watershed is shown in Figure 2-2. The entire watershed will be the focus of a GIS-based land use inventory, as described in the next chapter. Second, a hydrologic area of concern, which may or may not be the entire watershed, will be further inventoried via a windshield survey.

The decision to define hydrologic areas of concern is based on a desire to maximize the usefulness of the assessments, within the limits of what is practical. New Hampshire DES recognizes that, although its well-developed Geographic Information System (GIS) is probably adequate to satisfy EPA's guidance for DWSAP Plan approval, the assessments will be of greater value if DES augments GIS information with land use data derived from windshield surveys. However, as shown in Figure 2-3, water supply watersheds cover most of the state's land area, rendering windshield surveys of the entire area impractical. Therefore, there is a need to focus windshield survey efforts in more narrowly defined areas.

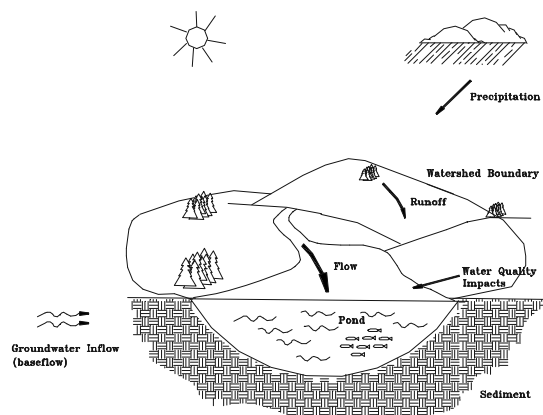


Figure 2-2. Simplified Watershed (adapted from A Watershed Approach to Urban Runoff: Handbook for Decisionmakers)

DES will take a two-tiered approach to delineating assessment areas for surface sources. The entire watershed area will be used for all sources. In addition, a smaller hydrologic area of concern (HAC) will be delineated for some sources.

Figure 2-3 - ws watersheds in NH

The New Hampshire DWSAP relies on two rationales for focusing windshield survey activities within so-called hydrologic areas of concern (HAC): response time and natural attenuation processes.

Response time comes into play for catastrophic events such as hazardous material spills; failures of impoundments containing manure, septage, or wastewater; and unpermitted releases of sewage resulting from events such as sewer line breaks or failures of sewage pumping stations. Because these types of events will have a more immediate effect on river intakes than on intakes in impoundments or groundwater sources, the DWSAP will identify critical areas for rivers in terms of times of travel. The area where the inventory will be focused will be defined primarily in terms of the water supplier's ability to respond to a catastrophic event by shutting down the intake. Because potential sources of contamination located closer to the intake will affect the PWS source sooner than PCSs located farther from the intake, the inventory will focus on PCSs located closer to the intake. The upstream distance from the intake will be determined according to the time of travel for soluble contaminants as determined by dye tracer studies.

Natural attenuation processes, in addition to dilution, can significantly reduce concentrations of contaminants over time and distance and particularly by trapping in upstream impoundments or wetlands. Following is a brief discussion of some of the more significant processes affecting the more significant contaminants. This list is intended to be illustrative, not comprehensive.

Pathogens: Bacteria and viruses tend to die off over time in aquatic environments, due in part to predation and to their inability (at least for enteric bacteria) to survive in low temperatures. Therefore most bacterial and viral pathogens tend to become less of a threat over time and distance. Factors affecting the die-off of pathogenic protozoan cysts and oocysts are less well understood, and they may survive for long periods in aquatic environments. They also do not settle out well since they have near neutral buoyancy. This means they may not become less of a threat over distances, but will certainly become more dilute as additional water enters the system from tributaries.

Nutrients: Plant uptake can be significant for some species of nitrogen in the terrestrial root zone and in aquatic environments. Phosphorus, however, tends to be adsorbed to soil particles and is then carried into watercourses with the soil particles where it becomes available to encourage aquatic plant and algae growth.

Time of travel will be used for rivers since response time for catastrophic events is critical in this type of system. Natural attenuation will also be used as a basis for determining hydrologic areas of concern.

However, it does tend to settle out where there is upstream detention.

Organic contaminants: For many organic pollutants such as aromatic or halogenated aliphatic hydrocarbons, volatilization can be an important attenuation process. For others, including some pesticides, aromatics, and phthalate esters, attenuation processes include sorption, biodegradation, photolysis, and hydrolysis. Some organic contaminants are associated with particles that are large enough to settle out in quiet environments.

Metals: Adsorption to soil and organic particles and subsequent settling help attenuate concentrations of some metals.

HAC Delineation Approach by Category

The approach to delineating the hydrologic area of concern depends on the category of the source. The categories are:

Small undeveloped watersheds

Sources with small (approximately 5,000 acres or less) or relatively undeveloped watershed areas. Windshield surveys of these watershed areas should take a day or less; therefore, there will be no need to delineate a smaller HAC. The criterion that determines whether a watershed belongs in this category is DES's estimate (based on size of the watershed and number of PCSs as suggested by a preliminary GIS analysis) of how long it will take to conduct a windshield survey of the watershed. If the estimated time is a working day or less, the watershed has been placed in this category and the entire watershed will be windshield-surveyed.

Large watershed areas with completed plans

Sources with large watershed areas that have been or will soon be addressed by studies sponsored by the water supplier. Some of these studies have been funded solely by the water supplier, while others have been funded by grants provided by the New Hampshire DWSAP in 1998. Additional studies may be funded by DWSAP grants in the next two years. For these studies, the water suppliers have defined hydrologic areas of concern. DES will review each study to ensure that the delineation rationale and the inventory are consistent with the federal SWAP requirement of inventorying all significant sources of significant contaminants. Windshield surveys will not be conducted by DES if this requirement has been met. If a

The approach to delineating the hydrologic area of concern depends primarily on the type of source (river, lake, etc.), the size of the watershed, and how developed the watershed is.

source falls into this category it will not be covered under the following approaches.

Reservoirs and lakes with large watersheds

The contamination sources likely to have the most significant impact on such a PWS source are those that contribute contaminants directly to the source or to tributaries that do not flow through large wetlands or impoundments before reaching the PWS source.

Such contaminant sources are said to be located in the direct or primary watershed (see Figure 2-4). In contrast, contaminants released by sources in the indirect watershed will experience greater attenuation (in upstream impoundments) before reaching the PWS source. Therefore, windshield surveys will be conducted only in the direct or primary watershed areas.

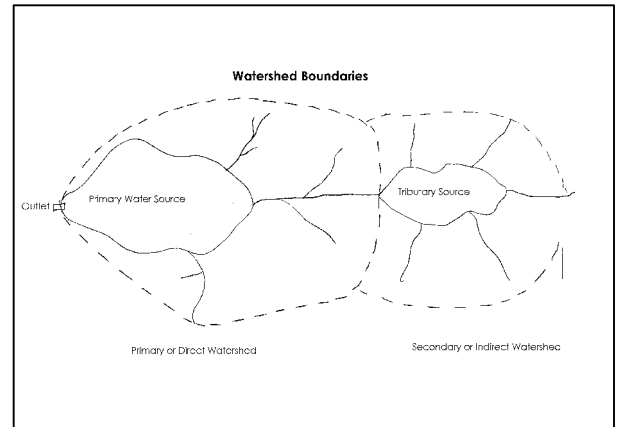


Figure 2-4. Primary Watershed of a Source.

Several sources in this category have direct watersheds that are too large to complete windshield surveys within a day. With the exception of Lake Sunapee, these sources have or will have water supplier-sponsored studies. For Lake Sunapee, the windshield survey will be limited to the direct watershed of the bay in which the intake is located.

Rivers with large, developed watersheds

Because some natural treatment occurs during overland flow and in the river channel, contaminant sources located closer to the intake can be expected to have a more significant impact than those located farther upstream. For this reason windshield surveys will focus on areas immediately upstream of the intake. To delineate these areas, DES will begin by conducting dye tracer studies to determine the time of travel to the intake during high flow periods. The time-of-travel information produced by these studies will also be useful to water suppliers in conducting emergency response planning. A survey of all systems using surface sources identified spills as the second greatest contamination concern, after wildlife. A survey of water suppliers with large river sources indicated support for the time-of-travel approach to delineating HACs, even with times of travel as little as six hours.

For rivers with large watersheds, dye tracer studies will be used to help define the hydrologic area of concern.

To delineate the HAC, DES will draw an arc (within the boundaries of the watershed area) centered on the intake. The radius of the arc will be the six-hour time-of-travel distance. The number, locations, and types of potential sources of contamination within the HAC, thus defined, will be the basis for the vulnerability rating, as explained in section 4.1 (specifically, Table 4-2). For sources with very large or heavily developed HACs (such as Pennichuck Water Works' intake on the Merrimack River), there will be a need to further limit the scope of the windshield survey to limit the amount of time required to one or two days. While the HAC will remain unchanged, the windshield-survey areas for these sources will be modified, based on GIS analysis, to focus on areas nearest the source. *DES expects to be able to apply the criteria in Table 4-2 consistently even with geographically limited windshield surveys, by concentrating windshield survey efforts in areas that are critical to the vulnerability rating (e.g. within 500 feet of surface water) and in areas where GIS data indicate a greater likelihood of finding land uses of concern (e.g. concentrations of farm animals).*

Time-of-travel studies will also be conducted for large river sources that fall into category two (water supplier-sponsored studies), but additional windshield surveys will not be conducted in these areas.

Groundwater under the influence of surface water

Sources that are considered to be under the influence of surface water (i.e. the geologic formation between the well and the river is not acting as an adequate filter) will have conjunctive delineations. Currently, overburden wells within 50 feet of surface water are tested for microparticulate matter to determine whether an adequate filter exists. Four sources have currently been identified as being under the influence of surface waters. If others are identified prior to the end of the 2001 field season, their delineations will be revised. For wells that are under the influence of surface water based on this testing, the area to be inventoried by GIS will include the wellhead protection area plus the watershed area of the associated surface water body. The HAC will include the wellhead protection area plus that portion of the watershed area that would be inventoried based on which of the preceding categories applies.

Table 2-2 lists the surface sources and wells under the influence that will be assessed and indicates which delineation method has been or will be used for each source.

For groundwater sources under the influence of surface water, DES will use conjunctive delineations, including both the wellhead protection area and the watershed area.

**Table 2-2
Delineation Methods for Surface Sources**

EPAID		Source Name	HAC Delineation Method
0081010	001	BRADLEY LAKE	Entire watershed
0151010	001	SWAIN'S LAKE	Entire watershed
0161010	001	ALBANY RIVER	Entire watershed
0231010	001	AMMONOOSUC RIVER	Entire watershed
0231010	002	ANDROSCOGGIN RIVER RAW	Recently studied or underway
0241010	001	GALE RIVER	Entire watershed
0241010	002	ZEALAND RIVER	Entire watershed
0351010	001	CANAAN STREET LAKE	Entire watershed
0461010	004	WHITE WATER (RAW)	Entire watershed
0461010	006	SUGAR RIVER (RAW)	Dye tracer study
0461010	007	DOLE RESERVOIR (RAW)	Entire watershed
0461010	008	RICE RESERVOIR (RAW)	Entire watershed
0501010	002	PENACOOK LAKE RAW	Entire watershed
0501010	003	CONTOOCOOK RIVER	Dye tracer study
0691010	002	OYSTER RIVER-RES.	Direct watershed
0691010	003	LAMPREY RIVER	Dye tracer study
0801010	002	DEARBORN BR. & RES.	Entire watershed
0801010	003	EXETER RIVER (RAW)	Dye tracer study
0911010	003	WHITTLE BROOK RESERVOIR	Entire watershed
0921010	003	ICY GULCH	Entire watershed
0921010	004	PERKINS BROOK	Entire watershed
0991010	002	TOBY RESERVOIR	Direct watershed
1061010	001	JUGGERNAUT POND	Entire watershed
1071010	001	HANOVER RESERVOIRS	Entire watershed
1101040	003	AMMONOOSUC RIVER	Recently studied or underway
1141010	001	LOON POND	Entire watershed
1191010	001	BEAR POND	Entire watershed
1211010	002	INFILTRATION WELL	Conjunctive
1241010	005	BABBIDGE POND RESERVOIR	Entire watershed
1281010	001	PAUGUS BAY SURF (RAW)	Recently studied or underway
1291010	001	GARLAND BROOK	Entire watershed

**Table 2-2
Delineation Methods for Surface Sources**

1321010	002	MASCOMA RIVER SURF, RAW	Recently studied or underway
1351010	002	LOON POND BROOK	Entire watershed
1351010	006	EAST BRANCH OF	Dye tracer study
1381010	001	NORTH GALE RIVER	Entire watershed
1381010	003	GALE RIVER, SOUTH	Entire watershed
1471010	001	LAKE MASSABESIC (RAW)	Recently studied or underway
1521010	001	LAKE WAUKEWAN (RAW)	Direct watershed
1621010	002	HARRIS POND (PENNICHUCK)	Recently studied or underway
1621010	004	MERRIMACK RIVER	Dye tracer study
1621010	005	SUPPLY POND (PENNICHUCK)	Recently studied or underway
1691010	001	MOUNTAIN POND/GORDON	Entire watershed
1731010	002	FOLLETT'S BROOK	Entire watershed
1731010	003	LAMPREY RIVER	Dye tracer study
1731010	004	PISCASSIC RIVER	Dye tracer study
1741010	001	GILMAN POND (SURFACE)	Entire watershed
1798090	001	DUG WELL	Conjunctive
1831010	001	INFILTRATION WELL	Conjunctive
1911010	001	BERRY POND	Entire watershed
1951010	009	BELLAMY RESERVOIR	Direct watershed
2001010	001	BERRY RIVER (ROCH. RES)	Direct watershed
2051010	001	CANOBIE LAKE SURF	Entire watershed
2051010	010	ARLINGTON MILL	Direct watershed
2151010	007	SALMON FALLS (RAW)	Dye tracer study
2271010	001	LAKE SUNAPEE	Direct watershed for bay
2272010	003	INFILTRATION WELL	Conjunctive
2361010	001	FASSETT BROOK	Entire watershed
2494010	007	CONNECTICUT RIVER	Dye tracer study
2561010	001	UPPER BEACH POND	Entire watershed

3 Land Use Inventory Approach

The approach to performing inventories was discussed at both the second and third DWSAP Advisory Committee meetings. A great deal of inventory work is already complete or underway. An explanation of the approach is provided below.

3.1 Contaminants of Concern

Significant sources of all contaminants (including *Cryptosporidium*) regulated by the Safe Drinking Water Act will be identified. A list of SDWA regulated contaminants is in Appendix F.

3.2 Land Use Inventories

Since 1990, DES has been developing geographically referenced land use inventories for source water protection. Since 1992, water suppliers have also been developing land use inventories under the Chemical Monitoring Waiver Program⁵. DES will utilize both of these databases for the DWSAP and will generate additional land use data through windshield surveys, sanitary surveys, and other means. Appendix G lists land uses that will be inventoried for the DWSAP and indicates the associated contaminants and risks.

The following land uses are already located statewide and are in our Geographic Information System (GIS)⁶:

- C Aboveground storage tank facilities
- C Cemeteries
- C Superfund sites
- C Leaking bulk storage facilities containing fuel oil
- C Sites with groundwater release detection permits and no other defined project type
- C Hazardous waste projects
- C Non-hazardous, non-sanitary holding tanks
- C Junk yards
- C Lined landfills
- C Proposed landfill
- C Existing landfill or landfill closure
- C Leaking above ground bulk storage facilities containing motor fuel

⁵The Chemical Monitoring Waiver Program enables community and non-transient, non-community public water suppliers to reduce their frequency of monitoring for volatile organic chemicals and synthetic organic chemicals. To qualify for reduced monitoring, the water supplier must conduct an inventory (by means of a windshield survey) of potential contamination sources within the delineated protection area for the well or intake and institute a management program to minimize the likelihood of releases of those chemicals.

⁶Information about each of the data layers in DES's GIS is available from DES at (603) 271-2975. A publication containing this information is currently in press.

Much of the data that will be used for the land use inventory portion of the DWSAP is already available from existing databases.

Most of the available data layers are updated on at least an annual basis.

- C Leaking underground storage tank projects
- C Lined wastewater lagoon
- C Leaking motor oil storage tank
- C Old dump sites (non-landfill)
- C Leaking residential or commercial heating tanks
- C Pesticide application areas
- C Rapid infiltration basins
- C Resource Conservation & Recovery Act (RCRA)- registered hazardous waste handlers
- C Remediation groundwater discharged to groundwater
- C Septage lagoons
- C Subsurface wastewater disposal systems >20,000 GPD
- C Unsolicited site assessment
- C Sludge lagoons
- C Sludge application sites
- C Class B sludge storage sites
- C Spill or release of petroleum
- C Spray irrigation projects
- C Municipal or commercial stump or demo dump
- C Solid waste transfer stations which have groundwater permits
- C Underground injection control-discharge of benign wastewaters not requiring a groundwater discharge permit or request to cease a discharge (i.e. floor drain closure requests)
- C Underground storage tank facilities
- C Unlined wastewater lagoons
- C Protected lands

Most of these except the RCRA, sludge application, cemeteries, protected land, pesticides, and junkyard sites are updated on an annual basis. DES is moving towards having the RCRA data layer, which is five years old, quality controlled and updated. DES also intends to update the sludge application and storage sites layers. For layers where there is no planned statewide update these sites will be identified under local inventories (see discussion below). DES is also developing statewide data layers for the following land uses:

- C Sewage collection systems
- C Water distribution systems
- C Farms with greater than 10 animal units that are kept outdoors or where manure storage is outdoors. This will be derived from four sources: a geo-referenced database of dairy farms inspected by the NH Department of Health and Human Services Bureau of Food Protection, a database of all cattle farms in the NH Department of Agriculture, Markets and Food's (DAMF) brucellosis and tuberculosis testing program, a DAMF database

of all farms with animals imported from or exported out of state, and from input from the County Conservation Districts. The 10 animal units criterion was chosen as a practical approach to inventorying this source of pathogens. It is not meant to be used as a threshold for any other purpose.

The windshield surveys for 80% of non-transient sources have been completed by water systems applying for monitoring waivers.

In addition to these statewide coverages, windshield surveys have been done at the 80% of source water protection areas that have monitoring waivers. These inventories are currently being put into the GIS. The land uses inventoried for the waiver program are:

- C Underground and Aboveground Storage Tank Facilities - gasoline stations, petroleum bulk storage, chemical storage
- C Vehicle Service and Repair Shops - automobile, truck, and equipment service or repair shops, autobody shops
- C General Service and Repair Shops - furniture stripping, painting, and refinishing; photographic processing; printing; appliance and small engine repair; boat repair; refrigeration, heating, ventilating and air conditioning shops
- C Metalworking Shops - machine shops, metal plating, heat treating, smelting and jewelry making shops
- C Manufacturing Facilities - electronics and chemical manufacturing, processing and reclamation; paper, leather, plastic, fiberglass, rubber, silicon and glass making; pharmaceutical production; pesticide manufacture; chemical preservation of wood and wood products
- C Waste and Scrap Processing and Storage - junkyards, scrap yards, and auto salvage yards; wastewater treatment plants; dumps, landfills, transfer stations and other solid waste facilities; wastewater or septage lagoons
- C Laboratories and Professional Offices - medical, dental, veterinary offices; research and analytical laboratories
- C Salt Storage and Use - for winter road and parking lot maintenance
- C Cleaning Services - dry cleaners; laundromats; beauty salons; car washes
- C Food Processing Plants - meat packing and slaughterhouses; dairies; processed food manufacture
- C Fueling and Maintenance of Excavation and Earthmoving Equipment
- C Concrete, Asphalt and Tar Manufacture
- C Hazardous Waste Facilities - regulated under the Resource Conservation and Recovery Act, as implemented by RSA 147-A.111

**Windshield surveys
will supplement the
database
information and
compilation.**

DES will perform windshield surveys within wellhead protection areas for groundwater sources that are not currently involved in the waiver program and within hydrologic areas of concern for surface water sources as described in section 2.2. The windshield surveys performed for the DWSAP will be carried out as follows:

1. For each area to be surveyed, a 1:24,000 scale map will be generated from DES's GIS. The map will depict roads, hydrography, land uses in the GIS listed on pages 3-1 to 3-2, sewer lines, and areas to be surveyed (wellhead protection areas, hydrologic areas of concern, a 500 ft. and 1,000ft. radius around each PWS well, a 300 ft. and a 500 ft. setback from surface waters in hydrologic areas of concern).
2. DES personnel will drive all public roads within the areas to be surveyed, stopping to use Global Positioning System (GPS) units to locate the land uses listed on pages 3-1 to 3-2 and making note of the presence or absence of other land uses necessary to complete Tables 4-1 and 4-2 (i.e. estimated density of buildings in areas served by septic systems within 500 ft. of wells or surface waters, estimated number of septic systems within a WHPA, estimated number of outdoor animal units within 1,000 feet of a well or 300 ft. of a surface source). If the nature of a business is not clear from the outside appearance, DES personnel will consult a directory which identifies the SIC code of each business.
3. DES personnel will upload data from the GPS units for differential correction before transferring the data to DES's GIS.

To provide the information needed to complete the vulnerability assessments (Table 4-1) for non-transient groundwater sources in the chemical monitoring waiver program, DES will add questions to the monitoring waiver application regarding the estimated number of septic systems within 500 feet of the well and within the wellhead protection area, and the number of outdoor animal units within 1,000 feet of the well.

Stormwater discharges will not be inventoried for all source water protection areas. Instead, a narrative will be included in the assessment that explains that these occur in most SWPAs and local ordinances that require treatment of storm water are encouraged.

Inventories have been or will be performed in the source water

protection areas described in chapter 2. For clarity these areas and the inventory activity to occur are summarized in Table 3-1.

Table 3-1. Summary of Delineation and Inventory Approaches		
Source Type	Delineation Approach	Inventory Approach
Groundwater		
Community and non-community, non-transient wells (e.g. residential systems, schools, workplaces)	Phase 1 or Enhanced Delineation	DES will use DES GIS and the local inventory/windshield survey developed by DES or by the water supplier to obtain a monitoring waiver. The septic system survey included in the sanitary survey will also be used.
Transient wells	500' Radius	DES will use DES GIS and during DES sanitary surveys an inventory will be completed.
Surface Water		
Small watershed (5,000 acres or less) or undeveloped watershed	Entire Watershed	DES will use DES GIS and will perform a local inventory/windshield survey. The septic system survey will also be used.
Sources that have been or will be studied by water supplier	Entire Watershed	DES will use DES GIS
	Case-specific	DES will review studies prepared by the water suppliers and their consultants and will conduct windshield survey if necessary
Impoundments, lakes, or ponds with large or developed watersheds	Entire Watershed	DES will use DES GIS
	Direct Watershed (which excludes portions of the watershed area which drain to large wetlands or impoundments before reaching the source)	DES will perform a local inventory/windshield survey (unless system is doing it). The septic system survey will also be used.
Rivers with large watersheds which do not fall into the previous categories	Entire Watershed	DES will use DES GIS
	Emergency Response Area (determined through dye tracer studies)	DES will perform a local inventory/windshield survey (unless system is doing it). The septic system survey will also be used.

Note: The inventory for wells that have been proven to be under direct influence of surface water will be performed in the wellhead protection area and the watershed protection area, as stipulated above, for the connected surface water source.

3.3 Additional Inventory and Assessment Activities for Surface Water Sources

To aid in the inventory of potential contamination sources for surface sources, DES will review existing inventories, including the following:

- C Storm water inventories conducted for most coastal urban areas
- C Shoreline survey data compiled by river, lake, and watershed organizations
- C Nonpoint source inventories developed by the New Hampshire Coastal Program and New Hampshire Estuaries Project

DES will assess the trophic status of water supply lakes to address two key water quality concerns of water suppliers: color/turbidity and nutrients/algae.

DES also plans to prepare lake assessments for lakes, ponds, and lake-like impoundments to aid water suppliers in understanding and evaluating the impact of phosphorus loads on source water quality. Phosphorus, which comes from a variety of natural and human sources within a watershed, is a major determinant of algae and other plant growth in aquatic ecosystems. Excessive algae growth not only creates aesthetic (taste, odor and color) problems, but is also linked to the formation of disinfection byproducts in water treated with chlorine. Disinfection byproducts, particularly trihalomethanes, are a major concern of the Disinfectants and Disinfection By-Products Rule being developed under the SDWA Amendments of 1996. In a 1997 DES survey, color/turbidity and nutrients/algae were two of the top four contaminant categories of concern to water suppliers using surface sources. The lake assessments involve gathering field measurements of lake bathymetry and physical/chemical water quality parameters to assess the trophic status of a lake. Trophic status is related to water clarity by virtue of algae density. Lakes with high concentrations of phosphorus (determined by phosphorus loading, cycling, and throughput) tend to have higher trophic status and hence higher turbidity.

In addition to preparing the lake assessments, DES will evaluate the feasibility of preparing phosphorus loading projections for all water supply lakes. Several water supply lakes will be chosen as pilot projects. For these lakes, DES will calibrate a phosphorus loading model based on lake assessment data and then develop phosphorus loading (and trophic status) projections based on future watershed development scenarios.

Table 3-2 lists the sources for which a phosphorus loading analysis may be prepared. This list includes all active surface sources that are lakes or ponds or are listed in DES's water supply database as reservoirs or impoundments. In the table, "Source Name" is the source name as listed in the database, while "Water Body Name" may be another name by which the water body is more commonly known. "P loading" indicates the current status of DES's plans to

Phosphorus loading models will be calibrated based on water quality monitoring data.

prepare a lake assessment . “YES” means that DES’s Limnology Bureau has performed a lake assessment within the past ten years or assessment data are believed to be available from other sources. If data are not available, DES expects to do a lake assessment in 2000 or 2001. The designation “99” or “2000” indicates the year in which DES expects to do a lake assessment. A question mark indicates that more information is needed to determine whether a lake assessment and phosphorus loading analysis would be appropriate. DES expects to perform lake assessments for those sources that meet the following criteria; sources may be removed from this list if they do not meet all of these criteria:

- C Areal loading (ratio of watershed area to lake area) must not be outside the bounds of the model to be used. Too high a ratio means that throughput is too high and the impoundment behaves more like a river than a lake.
- C The watershed must not be completely protected. If no changes are expected in phosphorus loading then the analysis serves no purpose in terms of source protection.
- C Flow patterns must be known. Diversions into and withdrawals from the source and the watershed must be quantified.

Table 3-2 Candidates for Phosphorus Loading Analysis				
EPAID		Source Name	Water Body Name	P Loading
0081010	001	BRADLEY LAKE	BRADLEY LAKE	YES
1521010	001	LAKE WAUKEWAN (RAW)	LAKE WAUKEWAN	YES
1471010	001	LAKE MASSABESIC (RAW)	LAKE MASSABESIC	YES
2271010	001	LAKE SUNAPEE	LAKE SUNAPEE	YES
2051010	010	ARLINGTON MILL RESERVOIR	ARLINGTON MILL RESERVOIR	YES
0801010	002	DEARBORN BR. & RES. (RAW)	EXETER RESERVOIR	YES
2051010	001	CANOBIE LAKE SURF	CANOBIE LAKE	YES
0351010	001	CANAAN STREET LAKE	CANAAN STREET LAKE	YES
0151010	001	SWAIN'S LAKE	SWAIN'S LAKE	YES
0501010	002	PENACOOK LAKE RAW	PENACOOK LAKE (LONG POND)	99
1741010	001	GILMAN POND (SURFACE)	GILMAN POND	99
1061010	001	JUGGERNAUT POND	JUGGERNAUT POND	99

Table 3-2 Candidates for Phosphorus Loading Analysis				
1691010	001	MOUNTAIN POND/GORDON HILL	MOUNTAIN POND	99
1911010	001	BERRY POND	BERRY POND	99
2561010	001	UPPER BEACH POND (SURFACE)	UPPER BEACH POND	99
1191010	001	BEAR POND	BEAR POND	99
1241010	005	BABBIDGE POND RESERVOIR	BABBIDGE POND RESERVOIR	99
1951010	009	BELLAMY RESERVOIR	BELLAMY RESERVOIR	99
1141010	001	LOON POND	LOON POND	99
2001010	001	BERRY RIVER (ROCH. RES.)	ROUND POND	2000
0991010	002	TOBY RESERVOIR	TOBY RESERVOIR	2000
1281010	001	PAUGUS BAY SURF (RAW)	PAUGUS BAY	2000
0231010	001	AMMONOOSUC RIVER (BERLIN)	AMMONOOSUC RIVER	?
1621010	005	SUPPLY POND (PENNICHUCK P	SUPPLY POND	?
0691010	002	OYSTER RIVER-RES.	OYSTER RIVER-RES.	?
1621010	002	HARRIS POND (PENNICHUCK)	HARRIS POND	?
1351010	002	LOON POND BROOK RESERVOIR	LOON POND BROOK RESERVOIR	?
0461010	007	DOLE RESERVOIR (RAW)	DOLE RESERVOIR	?
0461010	008	RICE RESERVOIR (RAW)	RICE RESERVOIR	?
2001010	001	BERRY RIVER (ROCH. RES.)	ROCHESTER RESERVOIR	?
2361010	001	FASSETT BROOK IMPOUNDMENT	FASSETT BROOK IMPOUNDMENT	?
0911010	003	WHITTLE BROOK RESERVOIR	WHITTLE BROOK RES - LOWER	?
1071010	001	HANOVER RESERVOIRS	UPPER RESERVOIR	?
0461010	004	WHITE WATER (RAW)	WHITE WATER	?
1621010	002	HARRIS POND (PENNICHUCK)	BOWERS POND	?
1071010	001	HANOVER RESERVOIRS	LOWER RESERVOIR	?

Finally, for lakes and impoundments, DES will conduct an analysis of the threat from MTBE, which is a gasoline additive that has been detected in certain sources. DES is currently investigating models that could be used to correlate amount of usage by boats with twin-stroke engines with likely MTBE concentrations. It is unclear at this time if sufficient data is available to make modeling worthwhile. At the very least, an explanation of this threat will be provided in the assessments for these sources.

Water suppliers and municipalities will be encouraged to supplement the information in the assessment reports with other relevant land use information.

3.4 Additional Local Inventories Encouraged

In the narrative provided in the susceptibility determination, local entities will be encouraged to supplement the mapped information with other relevant land use information, such as the following:

- C agricultural land
- C urban stormwater discharges
- C septic systems on well-drained soils near surface waters
- C pesticide application sites
- C accelerated erosion sites on streambanks and lakes
- C livestock not included in statewide inventory (e.g. hobby farms).

4 Susceptibility Assessment Approach

Susceptibility is the potential for a public water supply system to draw water contaminated by inventoried sources at concentrations that would pose concerns. The approach to assessing susceptibility was discussed at the first DWSAP Advisory Committee meeting. The geology of New Hampshire makes virtually all groundwater hydrogeologically vulnerable to contamination. Similarly, all surface waters are vulnerable. Therefore, susceptibility will be determined based on the density, proximity, and types of significant sources of contamination present in the protection area. In general, effectiveness of mitigation measures is not part of the determination because it could not be meaningfully quantified. The assessment will consist of a map (for most surface water sources, two maps will be provided: a small-scale map showing the entire watershed and a larger-scale map of the hydrologic area of concern) showing the source and all inventoried features, a table showing the source's status with respect to each source ranking criterion, and a susceptibility determination narrative. The appendices contain sample susceptibility determinations for transient sources, non-transient groundwater sources, and surface water intakes. A description of how susceptibility determinations will be made follows.

4.1 Susceptibility Ranking for In-State Source Water Protection Areas

Table 4-1 summarizes how the initial susceptibility determination for non-transient groundwater sources will be made. Table 4-2 explains how the susceptibility determination will be made for surface water intakes. Table 4-3 explains how the susceptibility determination will be made for transient sources. The susceptibility rating that each source receives will be based on the number and type of potential sources of contamination that are inventoried within specified distances of the drinking water source. The distances were considered by DES staff (in consultation with DES's DWSAP contractor and the DWSAP Advisory Committee) to be conservative estimates of how far each potential source of contamination had to be separated from the drinking water source to substantially reduce the risk of impacting water quality. These were not necessarily considered "safe" distances, but were felt to represent a reasonable way to rate the relative vulnerability of each drinking water source, taking into account likely pathways of contamination while being straightforward enough to make sense to the general public.

For transient sources, which are all wells, the ranking will be "low" or "relatively susceptible." The decision to have only two rankings for transient sources stems from a desire to simplify the assessments for these water systems. Accordingly, a "low" ranking will equate

The geology of New Hampshire makes virtually all groundwater and surface water vulnerable to contamination.

to low characteristics in Table 4-3 and relatively susceptible will correlate with having one or more land uses of concern within the assessment area.

For all sources where DES has additional knowledge regarding the source's susceptibility, additional narrative will be added. In some cases, where it will be less confusing and more helpful to water suppliers and the public, this may take the place of the standard narrative shown in Appendix D. In addition, the susceptibility determination will provide the reader with information on the following (see Appendix D).

- C risk associated with the land uses inventoried (Appendix G),
- C protection options, and
- C resources to implement protection programs.

Each assessment report will include a susceptibility determination table and a narrative.

Table 4-1 Non-Transient Ground Water Source Ranking Criteria

Criterion	Susceptibility			Justification
	Low (if all of these criteria are met)	Medium (if any of these criteria is met and none of the high criteria is met)	High (if any of these criteria is met)	
Contaminant detects	No current detects from anthropogenic sources (e.g. VOC, SOC or metals) G	<i>No medium criterion - source will rank either low or high for this concern.</i>	Current detects from anthropogenic sources (e.g. voc, soc or metals) G	Does not include naturally occurring substances.
Well integrity	No problems noted during sanitary survey. G	<i>No medium criterion - source will rank either low or high for this concern.</i>	Problems noted and remain since last sanitary survey. G	Problems would include insufficient sanitary seal, drainage problems, or violations of the sanitary radius. particularly the
Known sources of VOC or SOC contamination within the wellhead protection area (WHPA)	None present in source water protection area. G	One or more within the protection area but not within 1000' of the well. G	One or more within the protection area and within 1000' of the well. G	Proximity of contamination to supply source is critical. Distance based on experience and consensus of advisory group.
Potential sources of VOC or SOC contamination within the wellhead protection area (WHPA)	None present in source water protection area. G	10 or fewer within the portion of the protection area that is within 1000' of the well. G	More than 10 within the portion of the protection area that is within 1000' of the well. G	Proximity of contamination to supply source is critical. Distance based on experience and consensus of advisory group.
Numbered state highways or active railroads in WHPA	None present in source water protection area. G	One or more within the protection area but not within 1000' of the well G	One or more within the protection area and one or more located within 1000' of the well. G	Roadways/railways increase the risk of accidental releases reaching the source. Distance based on experience and consensus of advisory group.
Routine pesticide application in WHPA	No application site in protection area G	Application sites in protection area but not within 500 feet of the well. G	Application sites in protection area within 500 feet of the well. G	Distance based on experience and consensus of advisory group. Impact of sites can be mitigated by working with farmer. Few detects in groundwater in NH. Application not allowed in sanitary radius.

	criteria are met)	Medium none of the high criteria is met)	High (if any of these criteria is met)	
Septic systems	No septic system(s) or sewer line(s) within 500 feet of septic systems (fewer than 30) in remainder of protection area.	any sewer line(s) within 500 feet systems in the remainder of the protection area.	10 or more septic system(s) 500 feet of well. Or, less than 10 septic systems remainder of protection area	500' was chosen because this is the largest sanitary radius used by any state high level of protection from treated wastewater.
density)	No sewer in area	Sewer 1000 feet or more from the well	from the well	Water quality impacts are imperviousness levels of
Urban landcover	Less than 10% of landcover and less than 10% of WHPA within 1000 feet of landcover.	urban landcover but 10% or more of WHPA within 1000 feet of well has urban landcover.	10% or more of WHPA has urban landcover.	Water quality impacts, levels of 10% or more.
Agricultural landcover in WHPA	landcover	Less than 10% agricultural land	10% or more agricultural landcover.	problem where agricultural areas occur
Farms with _ 10	None present in wellhead protection area.	protection area but none within	One or more within the and within 1000 feet of the	Nitrates and pathogens such as viruses travel well in groundwater and are associated with livestock concentrations.
treatment, spray irrigation, lagoons	None within the	One or more within the wellhead protection area but none within 1000 feet of the source.	wellhead protection area source	Unplanned upsets are leach nitates and groundwater.
Dry Weather Sewage	None detected.	One or more within the wellhead protection area but none within 1000 feet of the source.	source	Dry-weather discharges are likely to contain untreated sewage.
(75'-400')	Free from that associated with the well.	Development other than that associated with the well but not a sewer pipe, septic system or	or regulated substance associated with the well.	Development within the contaminate sources.

	Low (if all of these criteria are met)	Medium (if any of these criteria is met and none of the high criteria is met)	High (if any of these criteria is met)	
	G	G	G	

¼ Susceptibility is....ranked low when...all low criteria are met.

¼ Susceptibility is....ranked medium when...any medium criteria and no high criteria are met.

¼ Susceptibility is....ranked high when...any of the high criteria are met.

VOC: Volatile Organic Compound (such as gasoline, solvents, etc)

SOC: Synthetic Organic Compound (mostly pesticides)

Table 4-2 Surface Water Source Ranking Criteria

Criterion	Susceptibility			Justification
	Low (if <u>all</u> these criteria are met)	Medium (if any of these criteria is met and none of the high criteria is met)	High (if any of these criteria is met)	
Contaminant detects in treated water	No detects from anthropogenic sources (e.g. VOC, SOC or metals) G	<i>No medium criterion - source will rank either low or high for this concern.</i>	Detects from anthropogenic sources (e.g. VOC, SOC or metals) G	A detect would indicate presence of contaminants that aren't being removed (e.g. MTBE)
Intake integrity	No problems noted during sanitary survey. G	<i>No medium criterion - source will rank either low or high for this concern.</i>	Problems noted and remain since last sanitary survey. G	Problems with an intake, particularly the screen, can result in contaminants entering the distribution system.
Known sources of VOC or SOC contamination within the hydrologic area of concern	None present within the hydrologic area of concern. G	One or more within the hydrologic area of concern but not within 1,000 feet of intake. G	One or more in the hydrologic area of concern within 1,000 ft of intake. G	Proximity of contamination to supply source and intakes is critical. Distance based on experience and consensus of advisory group.
Potential sources of VOC or SOC contamination within the hydrologic area of concern	None present within the hydrologic area of concern. G	One or more within the hydrologic area of concern but not within 1,000 feet of intake. G	One or more in the hydrologic area of concern within 1,000 ft of intake. G	Proximity of contamination to supply source and intakes is critical. Distance based on experience and consensus of advisory group.
Numbered state highways or active railroads within the hydrologic area of concern (includes only numbered state highways)	None present in the hydrologic area of concern. G	None present within 300 ft of the source in the hydrologic area of concern. G	Highways or active railroads within 300 feet of the source in the hydrologic area of concern. G	Roadways/railways increase the risk of accidental releases. Roadways also are a significant non-point source of pollution. Distance based on experience and consensus of advisory group.
Pesticide application within the hydrologic area of concern	No application sites within the hydrologic area of concern. G	Application site(s) within the hydrologic area of concern but not within 300 ft of intake. G	Application site(s) within 300 ft of intake. G	Distance based on experience and consensus of advisory group. No detections to date. Impact of sites can be mitigated by working with farmer.

	Low (if <u>all</u> these criteria are met)	Medium (if any of these criteria is met and none of the high criteria is met)	High (if any of these criteria is met)	
Septic systems (within windshield survey area – see footnote below)	No septic systems within 500 ft of surface water. G	Low density of septic systems (lots of 2 acres or more) within 500 ft of surface water. G	Dense (lot sizes <2 acres) shoreline (within 500 feet of surface water) with septic systems on source water. G	500' was chosen because this is the largest sanitary radius used by any state and this radius offers a high level of protection from
Density of development based on road density and windshield survey	No densely developed areas within the hydrologic area of concern. G	Less than 10% of the hydrologic area of concern is impervious. G	10% or more of the hydrologic area of concern is impervious. G	Water quality impacts are associated with imperviousness levels of 10% or more.
Urban land cover based on hydrologic area of concern	Less than 10% of the hydrologic area of concern has urban land cover. G	≥ 10% but <20% urban. G	20% or more is urban. G	Water quality impacts are associated with imperviousness levels of 10% or more.
Agricultural land cover based on GIS and windshield survey	No agricultural land cover within 300 ft of surface water in the hydrologic area of concern. G	Less than 10% agricultural land cover within 300 ft of surface water in the hydrologic area of concern G	10% or more agricultural land cover within 300 ft of surface water in the hydrologic area of concern G	A buffer of 300 ft, unless channelized, will probably remove most nutrients and pathogens.
Farms with ≥ 10 outdoor animal units	None within 300 ft of surface water in entire watershed. G	None within 300 ft of surface water in the hydrologic area of concern. One or more in entire watershed. G	One or more within 300 ft of surface water in the hydrologic area of concern. G	Nutrients and pathogens such as <i>Cryptosporidium</i> are associated with livestock concentrations.
Wastewater treatment, spray irrigation, lagoons	None within the watershed. G	None in the hydrologic area of concern. One or more in watershed. G	One or more in the hydrologic area of concern. G	Unplanned upsets are possible; lagoons may overflow during high runoff.
Dry weather sewage discharges	None detected. G	One or more in watershed but not in the hydrologic area of concern. G	One or more in the hydrologic area of concern. G	Dry-weather discharges are likely to contain untreated sewage.
Combined sewer overflows	None in watershed. G	One or more in watershed but not in the hydrologic area of concern. G	One or more in the hydrologic area of concern. G	May contain untreated sewage, but at high levels of dilution.

	Low (if <u>all</u> these criteria are met)	Medium (if any of these criteria is met and none of the high criteria is met)	High (if any of these criteria is met)	
Trophic status based on water quality monitoring	Oligotrophic (deep, cold water, clear with low nutrients). G	Mesotrophic (moderate depth, moderate nutrients and periodic algae blooms, reduced clarity). G	Eutrophic (shallow, warm water with high nutrients, aquatic weed growth and algae blooms, low clarity). G	High turbidity, increased organic precursors and taste and odor problems are common in eutrophic water bodies.

¼ Susceptibility is....ranked low when...all low criteria are met.

¼ Susceptibility is....ranked medium when...any medium criteria and no high criteria are met.

¼ Susceptibility is....ranked high when...any of the high criteria are met.

“Windshield survey area” is the area in which DES performed a drive-through survey of land uses for this assessment. See the narrative accompanying this assessment for a description of the windshield survey area.

VOC: Volatile Organic Compound (such as gasoline, solvents, etc)

SOC: Synthetic Organic Compound (mostly pesticides)

Table 4-3 Transient Sources: Source Ranking Criteria

Criterion	Susceptibility		Justification
	Low (if all of these criteria are met)	Relatively Susceptible (if any of these criteria is met)	
Contaminant detects	No current detects from anthropogenic sources (e.g. VOC, SOC or metals) G	Current detects from anthropogenic sources (e.g. VOC, SOC or metals) G	Does not include naturally occurring substances.
Well integrity	No problems noted during sanitary survey. G	Problems noted and remain since last sanitary survey. G	Problems would include insufficient sanitary seal, drainage problems, or violations of the sanitary radius..
Known sources of VOC or SOC contamination within the assessed area.	None present. G	One or more present. G	Proximity of contamination to supply source is critical.
Potential sources of VOC or SOC contamination within the assessed area.	None present. G	One or more present. G	Proximity of contamination to supply source is critical.
Numbered state highways or active railroads in the assessed area	None present. G	One or more present. G	Roadways/railways increase the risk of accidental releases reaching the source.
Routine pesticide application in the assessed area	None present. G	One or more present. G	Few detects in groundwater in NH. Application not allowed in sanitary radius.

	criteria are	Relatively Susceptible (if any of these criteria is met)	
Septic systems in the assessed area	No septic system(s) or sewer line(s). G	G	Septic systems within the sanitary risk to well.
≥ 10 outdoor area	G	One or more present.	Nitrates and pathogens such as viruses travel well in groundwater concentrations.
Wastewater treatment, spray irrigation, lagoons in the assessed area	None present.	G	Unplanned upsets are possible; pathogens into groundwater.

¼

¼ Susceptibility is....ranked relatively susceptible when...all the low criteria aren't met.

VOC: Volatile Organic Compound (such as gasoline, solvents, etc)

SOC: Synthetic Organic Compound (mostly pesticides)

4.2 Susceptibility Ranking for Source Water Protection Areas Crossing State and National Borders

For protection areas that extend into other states, DES plans to include information on land uses and protection techniques in those states.

The presence of state or international boundaries will not affect how protection areas or hydrologic areas of concern are delineated, although such boundaries will affect the inventory process. While windshield surveys will be conducted regardless of the presence of such boundaries, the GIS portion of the inventory is dependent on the geographic extent of the coverages already in DES's GIS and those that can be readily obtained.

New England Interstate Water Pollution Control Commission (NEIWPCC) has received a grant to provide states with land use inventories for portions of protection areas that extend beyond state borders. Susceptibility determinations will be done as described above using this information. NEIWPCC will also provide summary information for protection techniques available in other states. This information will be provided in Part 3 of the susceptibility determinations.

5 Public Participation and DWSAP Implementation

5.1 Public Participation

Advisory Committee

New Hampshire DES formed a DWSAP Advisory Committee (DWSAPAC) and had three advisory committee meetings. In addition to this a Surface Source Technical Advisory Subcommittee was formed and met once to advise DES on the approach for surface water systems. The attendance at the DWSAP meetings was very good.

The advisory committee was asked at the first meeting if other entities should be added to the group and a number of additional invitations were extended. Appendix E contains all the minutes from the meetings that were held. After the final meeting, the advisory committee was sent a draft DWSAP Plan for comment. The final draft was then taken to two public hearings.

Public Hearings

The DWSAP was presented at two hearings, one in Lincoln on November 19, 1998 and the other in Manchester on November 23, 1998. Prior to the hearing 2500+ postcards were sent to public water suppliers, advisory committee members and municipal officials. Notice for these hearings was also provided through newspapers, newsletters and the DWSAP homepage (In August, New Hampshire's DWSAP home page was established which invites the public to become involved in the developmental stage of the DWSAP.).

Response to this notice was small. Five individuals, including the EPA New England representative, attended the Lincoln hearing. The Manchester hearing was slightly better attended with close to a dozen participants. Despite the limited response, the hearings provided some excellent ideas for improvement of the plan. See Appendix H for a description of the comments recieved.

Other Outreach Activities

DES also conducted the following outreach and public involvement related to the DWSAP:

DES had four advisory committee meetings and two public hearings on the draft plan.

DES has created a variety of opportunities for public participation in the development of the DWSAP.

- C Hearings. Held four hearings throughout the state in the spring of 1997 regarding the state's Intended Use Plan for the DWSRF set-asides and notifying attendees about public participation opportunities in DWSAP development.
- C Mail Survey. Conducted a mail survey of 53 public water suppliers in the summer of 1997 to gather information about their opinions regarding vulnerability of their surface water sources and related protection programs. Participants were invited to sign up for the DWSAPAC Surface Source Technical Subcommittee and were sent a copy of survey results.
- C Presentation. Delivered a presentation regarding the DWSAP at New Hampshire Estuaries Environmental Network Conference in November 1997
- C Training. Discussed the DWSAP and opportunities for input at meetings of New Hampshire DES water supply operator training course during spring 1998.
- C Requested Participation. Sent a letter to all known river and lake advocacy groups related to surface water sources inviting their participation in DWSAP development prior to the Surface Source Technical Advisory Subcommittee meeting.
- C Meetings with Key Groups. Met with the Board of Directors of the New Hampshire Rivers Council to discuss the DWSAP, DES's approach to assessing surface water sources, and opportunities for public involvement.
- C Telephone Survey. Conducted a telephone survey of all water suppliers using large rivers as sources following the Surface Source Technical Subcommittee meeting to gather information regarding the usefulness of dye tracer studies and the use of time of travel to define the hydrologic area of concern.

DWSAP Plan Distribution

When the plan is approved by the Environmental Protection Agency, a copy of the approved version will be provided to all members of the advisory committee and to appropriate legislative committees. DES will offer to provide a legislative briefing. Copies of the plan will be available from the DES Public Information and Permitting Office and via the DWSAP homepage.

Assessment Distribution

When the source water assessments are complete, DES will issue a press release and create a fact sheet. DES anticipates an annual release of assessments beginning in 2000. Assessments will be

available upon request from the Department and via New Hampshire's DWSAP home page. Every public water system will be furnished with a copy of their assessment and the Planning Board in each municipality will receive a copy of the assessments for the water sources located in that municipality. Conservation Commissions, Boards of Selectmen, and Town and City Councils will also be informed by letter that source water assessments are available.

Summary of Comments Received

A summary table of comments received and responses and copies of the letters and telephone logs are included in Appendix H. In addition, as noted in the public participation section, DES contacted all of the water supply systems using large river sources to obtain their comments regarding the proposed approach to delineating hydrologic areas of concern for those sources. A summary of the interviews is also included in Appendix H.

5.2 Roles, Responsibilities, and Financing

Preparation of Assessments

DES will be responsible for preparing the assessments. This will be accomplished using funding from the Drinking Water State Revolving Fund set-asides. The budgets for the SRF for 1997 and 1998 are in Appendix I. A projection through 2001 for the one-time delineation and assessment set-aside is also included. DES will be making grant money available each year (\$200,000) that water systems can use to perform delineation and assessment activities. (See Appendix J for 1998 Local Water Protection Grant Application). All delineation and assessment activity performed by others will be reviewed by DES and used in completing the assessment reports.

Public Role in Conducting Inventories

DES has an established procedure for obtaining PCS inventory information from local entities (water suppliers and municipalities) as part of the Phase II/V waiver program and the groundwater reclassification program. Local entities are required to indicate PCS locations on a map with a scale of 1:25,000 or larger; the map is accompanied by a list of PCS business names, types, and addresses. As explained in section 3.2, these inventories are currently being entered into DES's GIS by digitizing locations and keying in the accompanying information about each PCS. This same procedure

DES is employing information developed by local entities in the DWSAP.

can be used to augment and correct existing GIS information for the DWSAP. DES has been awarded a supplemental EPA grant to conduct a pilot project involving citizens groups in conducting shoreline surveys; the results of this project (expected at the end of 1999) will help DES determine how to employ this information in the DWSAP.

Reporting Progress on DWSAP Implementation

DES will provide annual updates to the advisory committee and EPA through written communications, meetings or briefings, the Wellhead Biennial Report to EPA, and the DWSAPP website.

Request for Time Extension

DES requests an 18-month time extension. DES has determined a schedule to complete a source water assessment for each of the 2900+ sources of public drinking water by May 2003 (see schedule below). Assessments will be completed using existing DES staff with fieldwork being completed by summer interns (see Appendix I for budget and staffing). This schedule allows DES to continue Source Water Protection and Comprehensive Groundwater and Source Water Protection Program implementation activity while still meeting the SWAP requirements.

Without the 18 month extension, resources which now allow source water protection (versus just assessment) to occur would have to be dedicated to assessment alone. For instance, workload related to local source water protection grants, internal and external coordination of protection activities, outreach to municipalities, and development of the second Comprehensive Source Water and Groundwater Protection Program workplan would need to be significantly reduced to focus only on assessment. This would detract New Hampshire from its critical path and would delay achieving our overall goal of getting source water protection implemented at all sources serving community and non-community, non-transient systems.

5.3 Schedule

The following schedule will allow DES to develop a source water assessment for every source of public drinking water by May 2003 while still allowing resources to be expended on source water protection implementation and the Comprehensive Source Water and Groundwater Protection Program.

DES is requesting a time extension in order to keep source protection activities on track while implementing the DWSAP.

Schedule of DWSAP Activities

- C 10/97-2/98 Hire Contractor and Develop Preliminary DWSAP Approach
- C 4/98-7/98 Hold Advisory Committee Meetings
- C 8/98-11/98 Create Final Draft and Hold Public Hearings
- C 12/98-1/99 Make Final Edits and Submit DWSAP Plan to EPA
- C 10/97-6/99 Create New Statewide GIS Data Layers
- C 6/99-1/03 Obtain Local Inventories and Bring into GIS
- C 6/99-5/03 Produce and Distribute Assessments (1000/yr)