Guide to Updating Source Water Assessments and Protection Plans Version 3 – December 2010

Secret Lake, North Kingstown RI

Rhode Island Department of HEALTH

Rhode Island NEMO

RI HEALTH and University of Rhode Island Cooperative Extension
NEMO Program in partnership with the RI Water Resources Board
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1.0 INTRODUCTION

This document provides guidance to community water suppliers in updating Water Supply System Management Plans (WSSMP), and specifically Section 8.03, the Water Quality Protection Component of the plan. Our goal is to assist water suppliers in evaluating susceptibility of source waters to contamination as one element of the WSSMP update, while maintaining consistency with the 2003 Source Water Assessments. This document is update 3 of the 2008 document (version 3). The major changes between version 1 and version 2 of this update document relate to the new land use and impervious surface data available from the Rhode Island Geographic Information System (RIGIS). The major changes between version 2 and version 3 of this update document are the addition of new explanatory text intended to clarify sections of this document.

To make the assessment method straightforward and accessible to all water suppliers, this guide simplifies the original Pollution Risk Rating applied in the 2003 Source Water Assessments. The revised rating system is slightly different for Wellhead Protection Areas and Surface Water Supplies. Separate and complete instructions are given for each type of source area. This update uses simplified data input requirements and can be completed without use of a Geographic Information System (GIS). GIS is a method to view data graphically, allowing the visualization of the study area and the data upon it. Specialized software is needed to view GIS data. The State of Rhode Island provides much of the data needed to update Source Water Assessments through the Rhode Island Geographic Information System (RIGIS). However, both GIS and non-GIS methods are described in this document, for those water suppliers without access to such specialized software. Even if a supplier has access to GIS software, due to either age of the coverage or resolution of data in RIGIS, field surveys or other direct inventory is also required for evaluating potential contaminant sources.

The revised method provides a relatively simple, low-cost, standard assessment procedure that water suppliers can use in updating Water Supply System Management Plans. Using this approach will:

- Ensure consistency in assessment results among water supplies,
- Create a uniform method that is easily updated, and
- Allow comparison with previous assessments to track progress in reducing pollution risks to source waters.

The method described in this document represents the minimum in evaluating susceptibility to pollution. As described in the 2003 source water assessments for major community supplies, a wide variety of indicators may be used in evaluating change in pollution risk and guiding selection of management practices. These include risk factors used in the 2003 assessment such as percent impervious cover, forested cover, and estimated nutrient loading, which are not part of this basic update method. As required under Section 8.03, Requirements of the Water Quality Protection Component, a complete source water protection plan must also include a description of management actions taken to protect the source area, appropriate strategies for the future, efforts to coordinate with municipal officials, and a strategy for implementing protection measures.

1.1 Background on 2003 SWAP Assessment Method

In 2003, through the Rhode Island Source Water Assessment Program, RI HEALTH and the University of Rhode Island Cooperative Extension assessed and ranked all public water supplies according to their susceptibility to contamination using RIGIS as the primary source of data. For major community water supplies, volunteers were trained to field-check mapped RIGIS land use data and potential sources of contamination.

The assessment considers potential sources of pollution and natural features that promote movement of pollutants to groundwater and surface waters. For Wellhead Protection Areas, a total of 9 factors were used, with 8 used for Surface Water Reservoirs. These included: high intensity land uses such as highway, commercial, industrial and dense residential uses; potential sources of pollution such as landfills and underground storage tanks; hydrologically active soils and monitored water quality of reservoirs, tributaries and well water. A simple scoring system was created which assigned a numerical value to each factor, which categorizes the water supply's overall risk of pollution from low to high. For major community water suppliers, additional assessment measures were used in many cases, including for example: percent impervious cover, nutrient loading and build out analysis with these projected future indicators. The original risk rating method is included as an attachment to this guide as a reference.

1.2 The 2006 Updated Pollution Risk Rating

The 2006 updated assessment factors for evaluating susceptibility of contamination to Wellhead Protection Areas and Surface Water Supplies are shown in the Pollution Risk Rating tables provided in Sections 2 and 3 of this report. Detailed instructions for gathering the data and completing the risk ranking are described in these sections. A separate Excel spreadsheet with the same risk ranking, and supporting data tables, are provided for ease in organizing, calculating and reporting results. The factors used to evaluate susceptibility to pollution risk in this updated assessment include the following:

Wellhead Protection Area Risks

1. High intensity land use throughout the WHPA.
2. Pollution sources within inner protective radius (400' or 200') of well.
3. Pollution sources per acre throughout WHPA, excluding inner protective radius.
4. History of contaminant detects within last 5 years.
5. Bacteria detects in source water within 5 years.
6. Maximum nitrogen (NO_3-N) concentration in last 5 years.

Note: Average nitrogen (NO_3-N) concentration in last 5 years is also reported but not included in the pollution risk rating spreadsheet.

Surface Water Supply Reservoir Risks

1. High intensity land use throughout the watershed or subwatershed.
2. Pollution sources within a 200 ft. buffer to the reservoir and tributaries.
3. Pollution sources per acre throughout the watershed, including the 200 ft. buffer to the reservoir and tributaries.
4. Reservoir nutrient enrichment status.
5. Compliance with water quality criteria.
6. History of contaminant detects within last 5 years.

Water supply monitoring data is taken from untreated source water, except where noted in the instructions. Information on soil characteristics affecting movement of pollutants, which were discussed in the previous (2003) Source Water Assessment reports, are not included in the updates due to difficulty in obtaining this information without GIS capability.

The updated method as presented here is designed for updating an existing source water assessment where the delineated source area is the same. For new Wellhead Protection Area delineations, more extensive baseline data gathering will be needed following methods used in developing the original source water assessments.

1.3 Getting Started - Gathering Existing Data on Land Use and Potential Pollution Sources

Baseline land use data are available from the 2003 Source Water Assessment reports. For major community water suppliers providing more than 50 Million Gallons (MG) per year, the land use data are include in a table located in Appendix F of the 2003 Source Water Assessment Program (SWAP) report. This is available in the following formats:

- PDF format at the URI Cooperative Extension NEMO website at the URI SWAP homepage at http://www.uri.edu/ce/wq/RESOURCES/dwater/Assessments/index.htm (click onto Full Reports, find report for your supply, then select Appendix).

- CDs distributed to water suppliers containing the final SWAP report, factsheet, GIS maps and data files. The CD should have the report and appendix in word format, where the land use table in Appendix F may be converted to an Excel spreadsheet.

Land use types. In the 2003 SWAP reports, the Appendix F land use table lists 21 land use types, acreage of each type, and percent area of each type based on the total study area. Eleven of the 21 land use types are shaded to indicate classification as a high intensity land use. Note that these data are for the 1995 land use data and there are a few new categories of land use in the updated 2003/2004 land use data. These new categories are defined in Sections 2 and 3 of this document.

Land use data updated from 1995 to 2003. For most major water supplies, the 1995 RIGIS land use data was updated to existing 2003 conditions with the assistance of volunteers as part of the 2003 SWAP process. A summary of the training and update method used is available at http://www.uri.edu/ce/wq/RESOURCES/dwater/Assessments/index.htm . For those using GIS, the same method can be used to update 1995 RIGIS land use or the new 2003/2004 RIGIS land use as well as to locate potential sources of pollution in preparation of the new SWAP.

Future land use. For most water supplies, a buildout analysis was conducted to evaluate the potential change in land use and pollution risk with future development. If a build out analysis was conducted, results are reported in Appendix F of the 2003 Source Water Assessment.

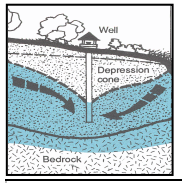
2.0 INSTRUCTIONS FOR UPDATING THE WELLHEAD PROTECTION AREA POLLUTION RISK RATING

This section describes the process used to complete an updated Source Water Assessment for Wellhead Protection Areas (WHPAs). The final report should include: several maps; a narrative explaining results and changes observed in the updated document when compared to the 2003 assessment; and the Wellhead Protection Area Risk Spreadsheet with supporting data tables for each well.

The factors used to evaluate and rank susceptibility of a wellhead protection area to contamination, as shown in the following Pollution Risk Rating table, are categorized according to land use, potential sources of pollution, and water quality. **This example table is for reference only. For ease in calculating and reporting results, a separate "Wellhead Protection Area Risk Spreadsheet" is provided in Excel format.** The Excel file includes two supporting data tables: 1) WHPA Nitrogen Trend Table, which is used to organize annual maximum and average nitrogen monitoring results; and 2) Potential Sources of Contaminants, which is used to inventory potential pollution sources. Final summary results are entered into the Pollution Risk Rating spreadsheet; however, all Excel data tables should be included in the report. Assessment findings should also be described in the report narrative. Sample language for use in interpreting monitoring results and ratings is incorporated into these instructions, and are also provided in Section 5 (Attachments) and in the Risk rating Excel file.

Different methods for data collection are given wherever possible. Use of GIS is optional. For water suppliers (or their consultants) with basic computer mapping capability, using GIS is ideal because data can be easily displayed and analyzed, with results mapped for outreach to local decision makers, water consumers and study area residents. However, since the RIGIS database may not reflect current land use at the scale needed, RIGIS mapping must be updated or confirmed through inspection of the study area or other means.

NOTE: The method for updating the Surface Water Reservoir Pollution Risk Rating is similar to that discussed above, but is a separate section of this document. Refer to Section 3 for information on updating the Source Water Assessment for Surface Water Reservoirs.



Wellhead Protection Area Pollution Risk Rating
Revised October, 2006

Wellhead Protection Area RISK INDICATOR	Instructions See page numbers:	RATING				2003		Update	
		Low	Medium	High	Extreme	Input	Rating	Input	Rating
		0	5	10	25				
Wellhead Protection Area land use									
1. High intensity land use.	pp. 6 – 10	< 10%	10 - 24%	25 - 40%	> 40%				
Existing or potential pollution sources									
2. Pollution sources within inner protective radius (400' or 200') of well.	pp. 11	0	1	2 - 3	> 3				
3. Pollution sources per acre throughout WHPA, excluding inner protective radius. Multiply this number by 10.	pp. 12 - 16	< 0.1	0.1 - 0.5	0.5 - 1	> 1				
Water quality									
4. History of contaminant detects within last 5 years.	pp. 17 - 21	Trace [1]	≤1/2 MCL	>1/2 MCL	Violation				
5. Source water Bacteria detects within 5 years.	pp. 17 - 21	none	Total coliform detection	Fecal coliform detected; cause identified and corrected	Fecal coliform violation				
6. Maximum nitrate-nitrogen (NO_3-N) concentration in last 5 years.	pp. 17 - 21	≤.5 mg/l	.5 - 2 mg/l	> 2 - 5 mg/l	> 5 mg/l				
Maximum		*0*	*30*	*60*	*150*				
Overall Ranking - Sum of all risk ratings.	pp. 22	**0 – 19**	**20 – 59**	**60 – 100**	> 100				

Note: [1] Trace = Less than 10% of the contaminant MCL

Risk Indicator 1: High Intensity Land Use throughout the WHPA

Introduction

This parameter should only be updated if a major change in land use has occurred that would affect the overall percentage of High Intensity Land use in the WHPA. **There are several methods to update the land use changes that have occurred since the last Source Water Assessment. These methods are outlined below, choose only one method and be sure to indicate in the final report which method was chosen to complete this task.**

Land use information for the original Source Water Assessments (2003) was taken from the RIGIS land use layer, which was based on 1995 data. Ground-truthing of this data was undertaken as part of the initial SWAP to determine if there were any undocumented land use changes from 1995 to the date the assessment was initiated, generally between 2000 and 2002. Therefore, major land use changes up to approximately 2000-2002 have already been documented, including high intensity land uses. High intensity land uses were defined for purposes of the 2003 Source Water Assessments as described below:

High Intensity Land uses include:
Description / RIGIS code in **1995 land use data**

- High Density Residential (>8 homes/acre) / 111
- Medium High Density Residential (4-7.9 homes/acre) / 112
- Commercial uses / 120, 147, 150
- Industrial uses / 130
- Transportation: roads, airports, railroads / 141, 142, 143
- Waste disposal areas (ie: junkyards) / 145
- Institutional land: water and sewage treatment facilities, schools, universities / 144, 170
- Cropland and confined feeding operations / 220 , 240
- Orchards, groves and nurseries / 230

Since the 2003 Source Water Assessments were completed, RIGIS has released updated land use data. The updated 2003/2004 land use data available on RIGIS were processed differently than the 1995 land use data, therefore the land use codes in the new data do not match those of the 1995 data. High intensity land use codes for the 2003/2004 land use data are provided below.

Additionally, **you can not compare the 1995 land use data to the 2003/2004 land use data to look for changes in land use** due to processing differences between the two data sets. One of the main differences between the two data sets is that forested wetlands in the 2003/2004 data were included in the “forest” land use category; forested wetlands in the 1995 land use data were included in the “wetlands” category. Due to this change, there may be major differences in wetlands and forest acreage between the 1995 and 2003/2004 land use data for a given area.

High Intensity Land uses include:
Description / Anderson code in **2003/2004 land use data**

- High – Medium High Density Residential / 111, 112, 151
- Commercial uses / 120, 147, 152

- Industrial uses / 130
- Transportation: roads, airports, railroads / 141, 142, 143
- Waste disposal areas (ie: junkyards) / 145
- Institutional land: water and sewage treatment facilities, schools, universities / 144, 170
- Cropland and confined feeding operations / 220 , 240
- Orchards, groves and nurseries / 230

Required deliverables for this task:

1. An updated map exhibiting any changes in land use in the WHPA since the last SWAP report. This map may be computer generated or be created by printing a copy of the original SWAP land use map and then marking by hand any updates. Review *Rhode Island Rules and Procedures for Water Supply System Management and Planning Section 8.04: Mapping Requirements* for information on required map elements.

2. An updated table of land use types based on the previous SWAP report table. The previous SWAP land use table is available on the SWAP CD, attached.

Methods

1.) Method 1 (GIS) –

a) Method 1a (using RIGIS 1995 land use data)

i) If GIS capacity is available, obtain the updated 1995 Land Use data from the previous SWAP. The GIS files are available on the SWAP CD provided to water suppliers or by contacting the URI Cooperative Extension NEMO program.

(1) Land use data were updated as part of the previous SWAP based on information obtained from volunteers completing windshield surveys in the study areas. These data were then input into shapefiles by RI NEMO.

(2) Note that this information was collected by volunteers and as such does not meet strict MetaData or mapping standards. This information may be used in the SWAP program but may not be appropriate for other uses.

ii) Next, overlay the RIDOT 2003/2004 Orthophotographs available through RIGIS (http://www.edc.uri.edu/rigis/) to evaluate any changes. Any acreage changes would then need to be estimated using the tools in the GIS software package being used.

(1) ArcView is the most popular GIS software package, but other GIS software can be used to accomplish the procedures outlined here.

(2) Remember that only land use changes to High Intensity Land Use types listed above are necessary for this analysis. For example, conversion of forest to low density residential may be of interest, but does not factor into the rating. On the other hand, conversion of agricultural land – considered a high intensity land use – to low density residential does factor into the rating and should be noted.

iii) Any changes in land use to High Intensity Land Use types are then used to update the land use table from the previous SWAP (located on SWAP report CD).

(1) The total acreage of the WHPA should not change. When adding acreage to High Intensity Land Uses, subtract acreage from the category that the land previously fell into.

(2) It is also important to note that this method will not generally pick up changes such as infill development that could change low density residential to high density residential or changes in residential areas to commercial uses. Be alert for these types of changes.

iv) Calculate the updated percentage of High Intensity Land Use and input the percentage into the appropriate risk rating on the Wellhead Protection Area Risk Spreadsheet.

v) Compare the new percentage of High Intensity Land Use throughout the WHPA to the previous value and discuss any changes.

b) Method 1b (using RIGIS 2003/2004 land use data)

i) If GIS capacity is available, obtain the new 2003/2004 Land Use data from RIGIS.

ii) Determine the acreages of each High Intensity Land Use type in your study area. High Intensity Land Uses are defined above.

(1) ArcView is the most popular GIS software package, but other GIS software can be used to accomplish the procedures outlined here.

(2) Remember that only High Intensity Land Use types listed above are necessary for this analysis. Other land use types do not factor into the rating system.

(3) **Since the updated land use available from RIGIS was completed in a different manner then the 1995 land use, the data should not be compared between the two years.** Expect the values to be different from 1995 to 2003/2004, even if there were not any observed land use changes in your study area. One of the main differences between the two data sets is that forested wetlands in the 2003/2004 data were included in the "forest" land use category; forested wetlands in the 1995 land use data were included in the "wetlands" category. Due to this change, there may be major differences in wetlands and forest acerage between the 1995 and 2003/2004 land use data for a given area.

(4) The total acreage of the WHPA should not change.

iii) Calculate the percentage of High Intensity Land Use and input this updated percentage into the appropriate risk rating on the Wellhead Protection Area Risk Spreadsheet.

iv) Discuss where the percentage of High Intensity Land Use falls in the pollution risk rating chart.

2.) Method 2 (Orthophotographs)

a) Review 2003/2004 RIDOT 1:5,000 digital true color orthophotographs for the study area on the RIGIS site without GIS software. The following site allows you to download MrSID files containing orthophotographic images. Click on the part of the state you are interested to download the file. (http://www.edc.uri.edu/orthosf/orthos/200304RIDOT/mrsid.html)

b) Compare the appropriate orthophotograph to the land use maps in the first SWAP. If any major changes have taken place, determine the acreage of these changes by either estimating the acreage from the map or looking at building permits at town hall.

   i) Remember that only land use changes to High Intensity Land Use types listed above are necessary for this analysis.

   ii) For example, conversion of forest to low density residential may be of interest, but does not factor into the rating. On the other hand, conversion of agricultural land – considered a high intensity land use – to low density residential does factor into the rating and should be noted.

c) Any changes in land use to High Intensity Land Use types are then used to update the land use table from the previous SWAP (located on SWAP report CD).

   i) Remember that the total acreage of the WHPA should not change; when adding acreage to High Intensity Land Uses, you must subtract acreage from the category that the land previously fell into.

   ii) It is also important to note that this method will not generally not pick up changes such as infill development that could change low density residential to high density residential nor changes in residential areas to commercial uses. Be alert for these types of changes.

d) Calculate the updated percentage of High Intensity Land Use and input the percentage into the appropriate risk rating on the Wellhead Protection Area Risk Spreadsheet.

e) Compare the new percentage of High Intensity Land Use throughout the WHPA to the previous value and discuss any changes.

3.) Method 3 (Use tax assessors database)

a) Query the tax assessors database for any major change in land use since last SWAP report.

   i) Building permits might also be a good place to check to identify changes in land use before querying the tax assessors database.

b) Check for infill development that might have occurred, changing medium intensity residential land us to medium high density residential.

c) Any changes in land use to High Intensity Land Use types are then used to update the land use table from the previous SWAP report (located on SWAP report CD). Remember when you update the table that the total acreage of the WHPA should not change, when adding acreage to High Intensity Land Uses, you must subtract acreage from the category that the land previously fell into.

d) Calculate the updated percentage of High Intensity Land Use and input the percentage into the appropriate risk rating on the Wellhead Protection Area Risk Spreadsheet.

e) Compare the new percentage of High Intensity Land Use throughout the WHPA to the previous value and discuss any changes.

Risk Indicator 2: Pollution sources within inner protective radius (400 or 200 ft) of well.

Introduction

Update the location and number of potential pollution sources within the inner protective radius of each well. Potential pollution sources include any activity or source that may contaminate the well including but not limited to: salt storage, chemical storage, dry cleaning, stormwater discharges and other abandoned wells that have not been properly decommissioned. A list of high risk potential sources of pollution is included in Section 5. Attachments.

Required Deliverables for this task:

1) An updated map of any pollution sources found within the inner protective radius of each well.

    a) The map(s) may be computer generated or be created by printing a copy of the original SWAP potential sources of pollution map and then marking by hand any updates. Additionally, the map included as part of your Sanitary Survey may also be used to mark updated information. Review *Rhode Island Rules and Procedures for Water Supply System Management Planning Section 8.04: Mapping Requirements* for information on required map elements.

    b) Indicate the location of the inner protective radius for each well.

    c) Information on each potential pollution source can be added to the Potential Sources of Contaminants table. Keeping this information in a table will allow ease of data access in the future.

2) An updated count of the number of pollution sources within the inner protective radius of each well. This value should be input into the Wellhead Protection Area Risk Spreadsheet. If evaluating more than one well take the maximum number of pollution sources found in an inner protective radius and input this value into the Wellhead Protection Area Risk Spreadsheet.

    a) The potential pollution sources can be entered in either a GIS or the Potential Sources of Contaminants table. Either the GIS table or the Potential Sources of Contaminants table should be printed out and included as part of the final report.

    b) In addition to updating the risk rating, evaluate and discuss risk to the well(s) based on the proximity, type of source and management measures in place to reduce risk of contamination from identified potential sources of contaminants.

Methods

1) There is only one method of obtaining this information: you must complete a visual survey of the WHPA within the inner protective radius of the well. Type (chemical storage, salt storage, etc) and location of pollution source must be indicated on the map.

2) Much of this information in included in your last Sanitary Survey. If you do not have a copy of your last Sanitary Survey contact RI HEALTH (401-222-6867) for more information.

Risk Indicator 3: Mapped pollution sources per acres throughout the WHPA, excluding inner protective radius. Then multiply this value by 10.

Introduction

Update the location and number of potential pollution sources within the WHPA, excluding the inner protective radius (as this was done under risk indicator 2). Potential pollution sources include any activity or source that may contaminate the well including but not limited to: salt storage, chemical storage, dry cleaning, gas stations, funeral homes, hair dressing salons, stormwater discharges and other abandoned wells that have not been properly decommissioned.

Required Deliverables for this task:

1) An updated map of any pollution sources found within the WHPA. These sources may be indicated on the same map as that indicating pollution sources within the inner protective radius of the wells.

    a) This map may be computer generated or be created by printing a copy of the original SWAP potential sources of pollution map and then marking by hand any updates. Review *Rhode Island Rules and Procedures for Water Supply System Management Planning Section 8.04: Mapping Requirements* for information on required map elements.

2) An updated count of the number of pollution sources in the WHPA, excluding the inner protective radius of the well should be completed and divided by the total number of acres in the WHPA (excluding the inner protective radius) and then multiplied by 10. This value should be input into the Wellhead Protection Area Risk Spreadsheet.

    a) This calculation equalizes the number of potential point sources on a per acre basis. Because the total number of sites is typically low, increasing the total result by a factor of 10 generates a number that is easier to work with.

    b) Pollution sources/acre (excluding inner protective radius) x 10 =

$$\frac{\text{Total Number of Point Sources outside inner protective radius}}{\text{Total Number of acres outside inner protective radius}} \times 10$$

3) In addition to updating the risk rating, evaluate and discuss risk to the well based on proximity, type of source and management measures in place to reduce risk of contamination.

4) Indicate in the narrative which method was utilized to update Potential Pollution Sources, and include either the GIS or Potential Sources of Contaminants table with the location and type of sources identified.

Methods

1.) Method 1 (GIS)

a) If GIS capability is available, obtain the Potential Sources of Pollution source shapefile from RI NEMO and update as discussed below.

b) Check with RIDEM and EPA to determine if updated data for Leaking Underground Storage Tanks (LUSTs), Rhode Island Pollutant Discharge Elimination System (RIPDES), Comprehensive Environmental Response Compensation and Liability Act (CERCLA) data are available. Check with RIDEM Office of Waste Management (http://www.dem.ri.gov/programs/benviron/waste/index.htm) for a list of hazardous waste generators. Note that "small generators" do not have to report to RIDEM, so they may be more difficult to find.

   i) A visual survey of the WHPA is still the best way to determine if there are new businesses in the WHPA that are potential pollution sources (dry cleaners, gas stations, etc.).

   ii) Information on a method to utilize volunteers to complete the visual survey can be found at http://www.uri.edu/ce/wq/RESOURCES/dwater/Assessments/index.htm . This document is entitled "Using Volunteers to Complete Land Use Inventories".

c) Input any new potential sources of pollution into the GIS including type of source and create a new map with the new point sources.

d) Update the Wellhead Protection Area Risk Spreadsheet with the number of pollution sources and evaluate and discuss the risk to the wells based on the proximity, type of source and management measures in place using the Potential Sources of Contaminants table.

2.) Method 2 (Wind shied survey of WHPA)

a) Complete a windshield survey of WHPA. The visual survey should indicate all potential sources of pollution in the study area. Potential sources of pollution include any business or activity that generates or uses chemicals (gas stations, dry cleaners, hair dressers, funeral homes, salt storage, etc.)

   i) Note that this method will not allow for the update of any new Leaking Underground Storage Tanks, Rhode Island Pollutant Discharge Elimination System (RIPDES) sites nor Comprehensive Environmental Response Compensation and Liability Act (CERCLA) sites.

   ii) This information can potentially be updated by contacting RIDEM Office of Waste Management.

b) Information on a method to utilize volunteers to complete the visual survey can be found at http://www.uri.edu/ce/wq/RESOURCES/dwater/Assessments/volunteers.htm . This document it entitled "A Model for Public Education and Participation".

c) Update the Wellhead Protection Area Risk Spreadsheet with the number of pollution sources identified. Use the Potential Sources of Contaminants spreadsheet to rank and record identified point sources.

3.) Method 3 (Building permits)

a) Review building permits issued since last SWAP report. This should provide some information on possible point sources, but might miss property transfers resulting in a potential pollution source, such as dry cleaner moving into former pizzeria.

b) This method will not allow for the update of any new Leaking Underground Storage Tanks, Rhode Island Pollutant Discharge Elimination System (RIPDES) sites nor Comprehensive Environmental Response Compensation and Liability Act (CERCLA) sites.

   i) This information can potentially be updated by contacting RIDEM Office of Waste Management.

c) Update the Wellhead Protection Area Risk Spreadsheet with the number of pollution sources and evaluate and discuss the risk to the wells based on the proximity, type of source and management measures in place using the Potential Sources of Contaminants table.

Risk Indicator 3a. OPTIONAL Mapped pollution sources throughout the WHPA including within inner protective well radius (400 to 200 ft) on highly permeable soils.

Introduction

This is a useful but **optional** risk indicator used in the original 2003 Source Water Assessments. Review of pollution sources on highly permeable soils provides an excellent way to understand which pollution sources have the greatest potential to affect well water quality. Permeable soils allow surface pollution to quickly enter groundwater reservoirs and potentially affect water quality.

Deliverables for this task:

1.) A count of the number of pollution sources on highly permeable soils.

2.) Update the rating system to incorporate and update this factor, using the rating from the original 2003 SWAP Risk Rating, included as an attachment to this document.

   i) The rating for potential sources of pollution on highly permeable soil is as follows:
   0 sources = low risk
   1 source = medium risk
   2 – 3 sources = high risk
   > 3 sources = extreme risk.

3.) Discuss any risks associated with pollution sources on highly permeable soils and management measures in place to reduce risk of contamination.

4.) Indicate in the narrative which method was utilized to update Potential Pollution Sources on highly permeable soils.

Methods:

1.) Method 1 (GIS)

   a) Obtain the RIGIS soils coverage and overlay your map of pollution sources to determine if any of the pollution sources are located on highly permeable soils.

   b) Update the rating system and discuss any risks related to the location of pollution sources on the highly permeable soils.

2.) Method 2 (non-GIS methods)

   a) Non-GIS users can identify the location of mapped pollution sources on highly permeable soils using either:

      i) The Soil Survey of Rhode Island (paper copies available at the USDA Natural Resources Conservation Service, Warwick, RI) or

ii) The RIDEM Geographic Data Viewer Environmental Resource Map (http://www.dem.ri.gov/maps/index.htm#GV).

(1) Interactively create a soils map of your study area according to soil permeability and water table depth.

(2) Highly permeable soil is defined as Hydrologic soil group A. These generally have a watertable greater than 6 ft.

b) Using the soils mapping information from above (either in paper form or on the data viewer) identify the location of each new potential pollution source and estimate if any are on permeable soils.

c) Update the rating system and discuss any risks related to the location of pollution sources on the highly permeable soils.

Risk Indicator 4: History of contaminant detects in source water within the last 5 years
Risk Indicator 5: Bacteria detects in source water within the last 5 years
Risk Indicator 6: Maximum nitrogen (NO3-N) concentration in source water in the last 5 years.

Note: Average nitrogen (NO3-N) concentration in source water in the last 5 years is reported in the WHPA Nitrogen Trend Table only, not in the WHPA Risk spreadsheet.

Introduction

The water quality of each well is described and ranked in this section. Periodic review of water quality data is imperative to determine any potential contamination issues before they become problematic.

If evaluating multiple wells determine the distance between the wellheads. If the wells are >1,000 ft apart, develop a separate risk rating for each well and then use the highest risk rating observed for each Risk Indicator (contaminants, bacteria and nitrogen) to set the total risk rating for the WHPA. If the wells are ≤1,000 ft apart, pool all the data and develop only one risk rating for the group of wells.

Required Deliverables for this task

1) The number of bacteria detections in source water within 5 years for each well in the WHPA

2) The maximum and average nitrate-nitrogen concentration in source water for each well in the WHPA for the last 5 years

3) Any detections of contaminants in source water for each well in the last 5 years.

4) A narrative describing potential risks.

Method

There is only one method to accomplish these tasks.

1.) Collect water supply monitoring data provided to RI HEALTH or if unavailable, obtain data from RI HEALTH

   a) To obtain data reports from RI HEALTH contact Deb LaFleur (database manager) RI HEALTH 3 Capitol Hill, Room 209, Providence, RI 02908-5097 fax: 401-222-6953 phone:401-222-6867

   b) Submit a data request form – you need to know:
      i) Each well ID number

      ii) The dates you are requesting data from; request all water quality information from the well(s) in question for the period after the previous SWAP was completed.

iii) The format that you would like the data in. We suggest obtaining the data in electronic form.

c) Note that most of the data available from RI HEALTH were collected at the source, before treatment (source water). Distribution samples (after treatment) were collected to evaluate the level of disinfection by-products such as total trihalomethanes.

i) Where distribution samples are not available, the available consumer confidence reports can be used to determine the maximum level of disinfection by-products.

2.) Data analysis

a) Water quality data are segregated into three categories:

i) contaminants (organics, metals, pesticides, radionuclides, etc)

ii) nitrate-nitrogen

iii) bacterial contamination at the source

b) If evaluating multiple wells determine the distance between the wellheads. If the wells are >1,000 ft apart, develop a separate risk rating for each well and then use the highest risk rating observed for each Risk Indicator (contaminants, bacteria and nitrogen) to set the total risk rating for the WHPA. If the wells are ≤1,000 ft apart, pool all the data and develop only one risk rating for the group of wells.

c) All analyte values reported as less than the detection limit or as non-detections are removed from the analysis **except those associated with bacteria monitoring and nitrate-nitrogen samples.**

d) Calcium, sodium and magnesium data are not analyzed as they are naturally occurring. However, sodium is reviewed when levels consistently approach or exceed 20 mg/L because sodium and chloride are indicators of contamination from road salt and can also indicate the presence of other runoff pollutants. The EPA listed sodium on the "drinking water advisory" list (EPA, 2004) with 20 mg/L as the guidance level for those on a restricted sodium diet. This is not an official contaminant level; however, sodium concentrations approaching or exceeding 20 mg/l should be reported and discussed in the assessment narrative.

3.) History of contaminant detects in source water within the last 5 years

a) Detected contaminant values are compared to the National Primary and Secondary Drinking Water Standards from the Office of Water in the EPA and the Rhode Island Public Drinking Water Standards.

i) The EPA Primary Drinking Water Standards set enforceable limits to the amount of specific contaminants that may be present in drinking water; these limits are referred to as Maximum Contaminant Levels (MCLs). http://water.epa.gov/drink/contaminants/index.cfm

ii) States are able to adopt more stringent MCLs at their discretion, but are unable to relax the MCL as put forth by the EPA. Rhode Island standards are reported in "Rules and Regulations Pertaining to public Drinking Water R46-13-DWQ As Amended April 2009". http://www.health.state.ri.us/drinkingwaterquality/for/watersuppliers/index.php

iii) The National Secondary Drinking Water Standards are non-enforceable guidelines for contaminants that may cause cosmetic effects (ie: skin or tooth discoloration) or aesthetic effects (ie: taste, odor or color) in drinking water (EPA, 2003). http://water.epa.gov/drink/contaminants/index.cfm#Secondary

iv) Not all contaminants have established MCLs, often due to insufficient evidence of human health impact. These include dacthal (a herbicide used by commercial strawberry growers) and MTBE (a highly soluable fuel additive).

(1) Where RI HEALTH has requested monitoring of contaminants without an MCL, detection of these contaminants should be reported and ranked using an established health advisory level instead of an established MCL.

(2) If MCLs are not available in the EPA or Rhode Island documents, check the Agency for Toxic Substances and Disease Registry http://www.atsdr.cdc.gov/

(3) If detection of unregulated contaminants are observed then the report narrative should include the following language indicating that low level detections of an unregulated contaminant have occurred.

"Low level detections of unregulated contaminant ____(fill in blank with contaminant name)____ have occurred, suggesting that the water supply is susceptible to contamination."

v) Risk is determined for each contaminant where a value is reported using the table below. Contaminant risk for the well is set at the highest observed value for detected contaminants.

b) Risk is assigned based on the table below:

Risk Rating	**Observed Contaminant Concentration**	**Standard text for narrative describing risk**
Low	Trace (maximum value is less than 10% of the MCL)	There has been no detection of regulated contaminants (excluding bacteria and nitrates).
Medium	Less than ½ MCL	No violations of the standards for regulated contaminants (excluding bacteria and nitrates) have been identified. However, there have been detections below levels considered acceptable by US EPA. This indicates the need for continued monitoring.

Risk Rating	Observed Contaminant Concentration	Standard text for narrative describing risk
High	Greater than ½ MCL	No violations of the standards for regulated contaminants (excluding bacteria and nitrates) have been identified. However, there have been detections greater than half the levels considered acceptable by US EPA. This indicates the need for continued monitoring and may indicate the need for future management and/or treatment.
Extreme	Greater than the MCL (violation)	There was a violation of the __(fill in blank)__ standard. A violation indicates that the sample exceeded the amount deemed acceptable by the US EPA. For more information contact the system identified above.

3) Bacteria detects in source water within the last 5 years

   a) The maximum pollution risk rating for bacteria is based on the number of positive detects at the source per the number of total coliform samples collected over the five year period. It is assumed that routine bacterial analysis is for total coliform bacteria with analysis of fecal coliform only occurring with increasing numbers of total coliform detections. Heterotrophic Plate Count (HPC) values are not used in this analysis.

   b) Risk for the well is based on the values below:

Risk Rating	Observed Contaminant Concentration	Standard text for narrative describing risk
Low	Less than 5% of samples have detected total coliform in last 5 years	Bacteria have not been detected.
Medium	Greater than 5% of samples have detected total coliform	Fecal coliform bacteria were not detected. Coliform bacteria was detected x times during this period. However, re-sampling revealed that the problem had been corrected.
High	One or more Fecal coliform sample exhibits a detection	Fecal coliform bacteria were detected x times. Corrective action was taken and re-sampling revealed that the problem had been corrected.
Extreme*	One or more Fecal coliform sample is above water quality standards.	Fecal coliform bacteria were detected x times. This resulted in a system violation. Re-sampling revealed that the problem had been corrected.

*It is assumed for the purposes of the SWAP that if fecal coliform samples are found to be in violation that the cause of the contamination was identified and corrected. Therefore, no bacterial samples are ranked in the extreme category.

4) Maximum and average nitrogen (NO_3-N) concentration in source water in the last 5 years

a) For each well the maximum nitrate nitrogen values reported over the last 5 years is used as the basis for assigning risk. Pay attention to any trends in the data, especially increasing trends. Average nitrate level over the last 5 years is reported only in the nitrogen trend table.

b) Risk for the well is based on the values below:

Risk Rating	**Observed Contaminant Concentration**	**Standard text for narrative describing risk**
Low	<0.5 mg/L NO_3-N	Nitrate levels in groundwater have been consistently low.
Medium	0.5 – 2 mg/L NO_3-N	Nitrate levels in groundwater are somewhat higher than background levels, which may indicate contribution from human activity.
High	2-5 mg/L NO_3-N	Nitrate levels in groundwater are higher than background levels, which may indicate contribution from human activity.
Extreme	>5 mg/L NO_3-N	Nitrate levels in groundwater are higher than half the US EPA standard for nitrate. This indicates significant contribution from human activity. A program to reduce nitrate may be helpful.

c) Average and maximum nitrogen (NO_3-N) concentration of each well for each year in the last five years should also be reported on the Nitrogen Trend table. The Excel spreadsheet will automatically graph the data to allow review of any trends. Values Below the Detection Limit (BDL) can be graphed at etiher ½ of the detection limit (if known) or 0.

TOTAL RANKING (FINAL RISK RATING)

Introduction
A final risk ranking for WHPA should be completed.

Deliverables

1) The final risk ranking are determined using the Wellhead Protection Area Risk Spreadsheet.

2) A discussion of any changes in the overall ranking of the well in comparison to the past SWAP report.

Method

There is only one method to accomplish this task:

1.) Sum the total of all the risks on the WHPA Risk Spreadsheet to determine the final risk rating. The following standard notes apply to the final risk rating. Be sure to add the appropriate note to your final report.

   a) Note: A LOW rating does NOT mean that the source is free from contamination risk. Without sufficient protection, ANY water supply can become contaminated.

   b) Note: A ranking of MODERATE means that the water could become contaminated one day. Protection efforts are important to assure continued water quality.

   c) Note: A ranking of HIGH does NOT mean that the water is unsafe to drink. It DOES mean that we must be especially aggressive in protecting the water supply.

2.) Then compare the new information with previous SWAP report to determine if there have been any changes in the pollution risk rank for each factor assessed.

3.) Discuss any reasons for the change and trends.

4.) Also describe other factors affecting susceptibility to contamination such as the management practices in place or needed to minimize risk, and actions taken since the last assessment.

3.0 INSTRUCTIONS FOR UPDATING THE SURFACE WATER RESEVOIR POLLUTION RISK RATING

This section describes the process used to complete an updated Source Water Assessment for a Surface Water Reservoir. The final report should include: several maps; a narrative explaining results and change from the 2003 assessment; and the Surface Water Reservoir Risk Spreadsheet with supporting data tables for each surface water reservoir watershed or subwatershed. Large watersheds should be evaluated by subwatershed, using subwatershed boundaries consistent with the 2003 Source Water Assessment. If the water supplier wishes to combine subwatersheds or use different delineations, evidence should be provided to support the proposed change.

The factors used to evaluate and rank susceptibility of a surface water reservoir to contamination, as shown in the following Pollution Risk Rating table, are categorized according to land use, potential sources of pollution, and water quality. **This example table is for reference only.** For ease in calculating and reporting results, **a separate "Surface Water Reservoir Risk Spreadsheet" is provided in Excel format.** The Excel file includes the supporting data table "Potential Sources of Contaminants", which is used to inventory potential pollution sources. Final summary results are entered into the Pollution Risk Rating spreadsheet; however, all Excel data tables should be included in the report. Assessment findings should also be described in the report narrative. Sample language for use in interpreting monitoring results and ratings is incorporated into these instructions, and also provided in Section 5 (attachments) and in the Risk rating Excel file.

Different methods for data collection are given wherever possible. Use of GIS is optional. For water suppliers (or their consultants) with computer mapping capability, using GIS is ideal because data can be easily displayed, analyzed and shared with local decision makers, water consumers and study area residents. However, since the RIGIS database may not reflect current land use at the scale needed, RIGIS data must be updated or confirmed through inspection of the study area or other means.

NOTE: The method for updating the Wellhead Protection Area Pollution Risk Rating is similar to that discussed above, but is a separate section of this document. Refer to Section 2 for information on updating the Source Water Assessment for Wellhead Protection Areas.

Surface Water Reservoir Pollution Risk Rating
Revised September, 2006

Surface Water Reservoir RISK INDICATOR	Instructions See page numbers:	RATING				2003		Update	
		Low	Medium	High	Extreme	Input	Rating	Input	Rating
		0	5	10	25				
Watershed (or subwatershed) land use									
1. High intensity land use.	pp. 25 - 30	< 10%	10 - 14%	5 - 25%	> 25%				
Existing or potential pollution sources									
2. Pollution sources within the 200 ft. buffer to reservoir and tributaries	pp. 31	None			Presence of one or more sources				
3. Pollution sources per acre throughout watershed, including 200 ft. buffer to reservoir and tributaries. Multiply this number by 10.	pp. 32 - 34	< 0.1	0.1 - 0.5	0.5 - 1	> 1				
Water quality									
4. Reservoir nutrient enrichment status (clarity, phosphorus, dissolved oxygen).	pp. 35 - 36	Low	Moderate		Eutrophic				
5. Compliance with water quality criteria. Based on 305(b) and 303(d) lists.	pp. 37	No impairment	Impaired tributary draining indirectly into reservoir	Impaired tributary draining directly into reservoir	Surface water supply impairment				
6. History of contaminant detects within last 5 years at outflow sampling station (except TTH).	pp. 38 - 40	Trace [1]	≤ 1/2 MCL	> 1/2 MCL	Violation				
Maximum		***0***	***30***	***60***	*150*				
Overall Ranking - Sum of all risk ratings.	pp. 41.	**0 – 19**	**20 – 59**	**60 – 100**	**> 100**				

Note: [1] Trace = Less than 10% of contaminant MCL

Risk Indicator 1: High Intensity Land Use throughout the watershed

Introduction
This parameter should only be updated if a major change in land use has occurred that would affect the overall percentage of High Intensity Land use in the watershed. There are several methods to update the land use changes that have occurred since the last Source Water Assessment. These methods are outlined below, choose only one method and be sure to indicate in the final report which method was chosen to complete this task.

Land use information for the original Source Water Assessments (2003) was taken from the RIGIS land use layer, which was based on 1995 data. Ground truthing of this data was undertaken as part of the initial SWAP to determine if there were any undocumented land use changes from 1995 to the date the assessment was initiated, generally between 2000 and 2002. Therefore, major land use changes up to approximately 2000-2002 have already been documented, including high intensity land uses. High intensity land uses were defined for purposes of the 2003 Source Water Assessments as described below:

High Intensity Land uses include:
Description / RIGIS code in **1995 land use data**

- High Density Residential (>8 homes/acre) / 111
- Medium High Density Residential (4-7.9 homes/acre) / 112
- Commercial uses / 120, 147, 150
- Industrial uses / 130
- Transportation: roads, airports, railroads / 141, 142, 143
- Waste disposal areas (ie: junkyards) / 145
- Institutional land: water and sewage treatment facilities, schools, universities / 144, 170
- Cropland and confined feeding operations / 220 , 240
- Orchards, groves and nurseries / 230

Since the 2003 Source Water Assessments were completed, RIGIS has released updated land use data. The updated 2003/2004 land use data available on RIGIS were processed differently than the 1995 land use data, therefore the land use codes in the new data do not match those of the 1995 data. High intensity land use codes for the 2003/2004 land use data are provided below.

Additionally, **you can not compare the 1995 land use data to the 2003/2004 land use data to look for changes in land use** due to processing differences between the two data sets. One of the main differences between the two data sets is that forested wetlands in the 2003/2004 data were included in the “forest” land use category; forested wetlands in the 1995 land use data were included in the “wetlands” category. Due to this change, there may be major differences in wetlands and forest acerage between the 1995 and 2003/2004 land use data for a given area.

High Intensity Land uses include:
Description / Anderson code in **2003/2004 land use data**

- High – Medium High Density Residential / 111, 112, 151
- Commercial uses / 120, 147, 152
- Industrial uses / 130
- Transportation: roads, airports, railroads / 141, 142, 143

- Waste disposal areas (ie: junkyards) / 145
- Institutional land: water and sewage treatment facilities, schools, universities / 144, 170
- Cropland and confined feeding operations / 220 , 240
- Orchards, groves and nurseries / 230

Required deliverables for this task:

1) An updated map exhibiting any changes in land use in the surface waters supply watershed since the last SWAP report. This map may be computer generated or be created by printing a copy of the original SWAP land use map and then marking by hand any updates. Review Rhode Island Rules and Procedures for Water Supply System Management Planning Section 8.04: Mapping Requirements for information on required map elements.

2) An updated table of land use types based on the previous SWAP report table. The previous SWAP land use table is available on the SWAP CD.

Methods

1.) Method 1 (GIS)

a) Method 1a (using RIGIS 1995 land use data)

i) If GIS capacity is available, obtain the updated 1995 Land Use data from the previous SWAP. The GIS files are available on the SWAP CD provided to water suppliers or by contacting the URI Cooperative Extension NEMO program.

(1) Land use data were updated as part of the previous SWAP based on information obtained from volunteers completing windshield surveys in the study areas. These data were then input into shapefiles by RI NEMO, which are available from RI NEMO and on the SWAP CD provided.

(2) Note that this information was collected by volunteers and as such does not meet strict MetaData or mapping standards. This information may be used in the SWAP program but may not be appropriate for other uses.

ii) Next, overlay the RIDOT 2003/2004 Orthophotographs available through RIGIS (http://www.edc.uri.edu/rigis/) onto the updated land use layer to evaluate any changes. Any acreage changes would then need to be estimated using the tools in the GIS software package being used.

(1) ArcView is the most popular GIS software package, but other GIS software can be used to accomplish the procedures outlined here.

iii) Remember that only land use changes from low to High Intensity Land Use types (as listed above) are necessary for this analysis. For example, conversion of forest to low density residential land use may be of interest, but does not factor into the rating. On the other hand, conversion of agricultural land – considered a high intensity land use – to low density residential does factor into the rating and should be noted.

iv) Any changes in land use to High Intensity Land Use types are then used to update the land use table from the previous SWAP (located on SWAP report CD).

(1) The total acreage of the watershed should not change. When adding acreage to High Intensity Land Uses, subtract acreage from the category that the land previously fell into.

(2) It is also important to note that this method will generally not pick up changes such as infill development that could change low density residential to high density residential or changes in residential areas to commercial uses. Be alert for these types of changes.

v) Calculate the updated percentage of High Intensity Land Use and input the percentage into the appropriate risk rating on the Surface Water Reservoirs Risk Spreadsheet.

vi) Compare the new percentage of High Intensity Land Use throughout the Surface Water Reservoir watershed to the previous value and discuss any changes.

b) Method 1b (using RIGIS 2003/2004 land use data)

i) If GIS capacity is available, obtain the new 2003/2004 Land Use data from RIGIS.

ii) Determine the acreages of each High Intensity Land Use type in your study area. High Intensity Land Uses are defined above.

(1) ArcView is the most popular GIS software package, but other GIS software can be used to accomplish the procedures outlined here.

(2) Remember that only High Intensity Land Use types listed above are necessary for this analysis. Other land use types do not factor into the rating system.

(3) **Since the updated land use available from RIGIS was prepared in a different manner then the 1995 land use data, do not compare data between the two years.** Expect the values to be different from 1995 to 2003/2004, even if there were not any observed land use changes in your study area. One of the main differences between the two data sets is that forested wetlands in the 2003/2004 data were included in the "forest" land use category; forested wetlands in the 1995 land use data were included in the "wetlands" category. Due to this change, there may be major differences in wetlands and forest acerage between the 1995 and 2003/2004 land use data for a given area.

(4) The total acreage of the Surface Water Reservoir watershed should not change.

iii) Calculate the percentage of High Intensity Land Use and input this updated percentage into the appropriate risk rating on the Surface Water Reservoirs Risk Spreadsheet.

iv) Discuss where the percentage of High Intensity Land Use falls in the pollution risk rating chart.

2.) Method 2 (Orthophotographs)

a) Review 2003/2004 RIDOT 1:5,000 digital true color orthophotographs for the study area on the RIGIS site without GIS software. The following site allows you to download MrSID files containing orthophotographic images. (http://www.edc.uri.edu/orthosf/orthos/200304RIDOT/mrsid.html)

b) Compare the appropriate orthophotograph to the updated land use maps in the first SWAP. If any major changes have taken place, determine the acreage of these changes by either estimating the acreage from the map or looking at building permits at town hall.

   i) Remember that only land use changes from low to High Intensity Land Use types are necessary for this analysis.

   ii) For example, conversion of forest to low density residential may be of interest, but does not factor into the rating. On the other hand, conversion of agricultural land (considered a high intensity land use) to low density residential, does factor into the rating and should be noted.

c) Any changes from low to High Intensity Land Use types are then used to update the land use table from the previous SWAP (located on SWAP report CD).

   i) Remember that the total acreage of the surface water reservoir watershed should not change; when adding acreage to High Intensity Land Uses, you must subtract acreage from the category that the land previously fell into.

   ii) It is also important to note that this method will not generally pick up changes such as infill development that could change low density residential to high density residential or changes in residential areas to commercial uses. Be alert for these types of changes.

d) Calculate the updated percentage of High Intensity Land Use and input the percentage into the appropriate risk rating on the Surface Water Reservoirs Risk Spreadsheet.

e) Compare the new percentage of High Intensity Land Use throughout the surface water reservoir watershed to the previous value and discuss any changes.

3.) Method 3 (Use tax assessors database)

a) Query the tax assessor's database for any major change in land use since last SWAP report.

   i) Building permits might also be a good place to check to identify changes in land use before querying the tax assessors database.

b) Check for infill development that might have occurred, changing medium density residential land use to medium - high density residential.

c) Any changes in land use to High Intensity Land Use types are then used to update the land use table from the previous SWAP report (located on SWAP report CD).

   i) Remember when you update the table that the total acreage of the surface water reservoir should not change, when adding acreage to High Intensity Land Uses, you must subtract acreage from the category that the land previously fell into.

d) Calculate the updated percentage of High Intensity Land Use and input the percentage into the appropriate risk rating on the Surface Water Reservoir Risk Spreadsheet.

e) Compare the new percentage of High Intensity Land Use throughout the surface water reservoir watershed to the previous value and discuss any changes.

Risk Indicator 1a. OPTIONAL Mapped Land Use change in 200 foot buffer to surface water reservoir and tributaries

Introduction

This is a useful but **optional** risk indicator used to evaluate any increase in High Intensity Land Use in the most vulnerable portion of the water supply watershed. Changes in land use to high intensity land use types in the 200 foot buffer to the surface waters and tributaries have the greatest potential to affect water quality due to their close proximity to the supply.

Optional Deliverables for this task and method:

1) Non-GIS users – There is not a good way to determine this risk factor without using GIS. The water supplier will have to manually determine the 200 foot buffer to every body of water (lake, stream, river) in the watershed and then try to estimate the change in land use for all these areas. If the water supplier is extremely interested in this data they can contact the University of Rhode Island NEMO program for further instructions (401-874-2138).

2) GIS users can identify changes from low to High Intensity Land Use that occurred specifically in the buffer areas by mapping the 200 foot buffer of the surface water reservoir and tributaries on the map produced under Risk Indicator 1. The area of any changes can be estimated using the GIS software tools. The total acreage of the buffer can also be estimated using the GIS software tools.

   a) Update the rating system to incorporate this factor using the Surface Water Reservoirs Risk Spreadsheet from the original 2003 SWAP as a guide (see attachments). The rating is based on the percentage of High Intensity Land Use (HILU) in the 200 foot buffer and is calculated as follows:

      $$\text{Percentage of HILU In 200 ft buffer} = \frac{\text{Acres of HILU in 200 ft buffer to reservoir \& tributaries}}{\text{Total acres of 200 ft buffer to reservoir \& tributaries}} \times 100$$

   b) The rating for percentage of High Intensity Land Uses located within 200 ft of the surface water reservoir and tributaries as taken from the 2003 SWAP is as follows:
      i) Low : none
      ii) Medium : <5%
      iii) High : 5-15%
      iv) Extreme : >15%

Risk Indicator 2: Mapped pollution sources within 200 ft of the drinking water reservoir and tributaries

Introduction

Update the location and number of potential pollution sources within 200 feet of the surface water reservoir and its tributaries. Potential pollution sources include any activity or source that may contaminate the well including, but not limited to: salt storage, chemical storage, dry cleaning, stormwater discharges and abandoned wells that have not been properly decommissioned. A list is included in Section 5. Attachments.

Required Deliverables for this task:

1) An updated map of any pollution sources found within 200 feet of the surface water reservoir and its tributaries (any water body in the water supply watershed).

    a) This map may be computer generated or be created by printing a copy of the original SWAP potential sources of pollution map and then marking by hand any updates. Review Rhode Island Rules and Procedures for Water Supply System Management Planning Section 8.04: Mapping Requirements for information on required map elements.

    b) Indicate the 200 foot buffer to the surface water reservoir and its tributaries on the map.

2) An updated count of the number of pollution sources within the 200 foot buffer as well as the type of each pollution source should be included in the final report. The total number of pollution sources should be input into the Surface Water Reservoirs Risk Spreadsheet.

    a) The potential pollution sources can be entered into either a GIS or Potential Sources of Contaminants table. Either the GIS table or the Potential Sources of Contaminants table should be printed out and included as part of the final report.

    b) In addition to updating the risk rating, evaluate and discuss risk to the well based on proximity, type of source and management measures in place to reduce risk of contamination.

Methods

1) There is only one method of obtaining this information; you must complete a visual survey of the 200 foot buffer to the surface water reservoir and associated tributaries. Type of pollution source (chemical storage, salt storage, etc.) and location of pollution source must be indicated on the map and also in the final report in tabular format either using a GIS based table or the Potential Sources of Contaminants table.

2) In addition to updating the risk rating, evaluate and discuss the risk of each pollutant source to the reservoir based on proximity, type of source and management measures in place to reduce the risk of contamination. This information can also be recorded on the Potential Sources of Contaminants table`.

Risk Indicator 3: Mapped pollution sources throughout the watershed including the 200 ft buffer to the drinking water reservoir and tributaries.

Introduction

Update the location and number of potential pollution sources throughout the watershed, including within 200 feet of the surface water reservoir and its tributaries. Potential pollution sources include any activity or source that may contaminate the reservoir or tributaries including but not limited to: salt storage, chemical storage, dry cleaning, gas stations, funeral homes, hair dressing salons, stormwater discharges and abandoned wells that have not been properly decommissioned.

Required deliverables for this task

1) An updated map of any pollution sources in the watershed. This map should indicate the location of the 200 foot buffer around the surface water supply and tributaries.

    a) This map may be computer generated or be created by printing a copy of the original SWAP potential sources of pollution map and then marking by hand any updates.

    b) Review Rhode Island Rules and Procedures of Water Supply System Management Planning Section 8.04: Mapping Requirements for information on required map elements.

2) An updated count of the number of pollution sources in the watershed. The total number of pollution sources for the watershed including the 200 foot buffer to the surface water source should be divided by the total number of acres in the watershed and then multiplied by 10. This value should be input into the Surface Water Supplies Risk Spreadsheet.

    a) This calculation equalizes the number of potential point sources on a per acre basis. Because the total number of sites is typically low, increasing the total result by a factor of 10 generates a number that is easier to work with.

    b) Pollution sources/acre (including 200 ft buffer) times ten =

$$\frac{\text{Total number of pollution sources in watershed}}{\text{Total number of acres in watershed}} \times 10$$

3) The potential pollution sources can be entered into either a GIS or the Potential Sources of Contaminants table. Either the GIS table or the Potential Sources of Contaminants table should be printed out and included as part of the final report.

4) In addition to updating the risk rating, evaluate and discuss the risk of each pollutant source to the reservoir based on proximity, type of source and management measures in place to reduce the risk of contamination. This information can also be added to the Potential Sources of Contaminants Table.

5) Indicate in the narrative which method was utilized to update Potential Pollution Sources.

Methods

1) Method 1 (GIS)

a) If GIS capability is available, obtain the Potential Sources of Pollution source shapefile from RI NEMO and update as discussed below.

b) Check with RIDEM and EPA to determine if updated data for Leaking Underground Storage Tanks (LUSTs), Rhode Island Pollutant Discharge Elimination System (RIPDES), Comprehensive Environmental Response Compensation and Liability Act (CERCLA) data are available. Check with RIDEM Office of Waste Management (http://www.dem.ri.gov/programs/benviron/waste/index.htm) for a list of hazardous waste generators. Note that "small generators" do not have to report to RIDEM, so they may be more difficult to find.

   i) A visual survey of the watershed is still the best way to determine if there are new businesses in the watershed that are potential pollution sources (dry cleaners, gas stations, etc.). These sources are generally not included in the databases discussed here.

   ii) Information on a method to utilize volunteers to complete the visual survey can be found at http://www.uri.edu/ce/wq/RESOURCES/dwater/Assessments/volunteers.htm. This document is entitled "A Model for Public Education and Participation".

   iii) Building permits issued since the last SWAP report might also give you good idea of possible point sources, but this will miss transfers from one business type to another.

c) Input any new potential sources of pollution into the GIS including type of source and create a new map and data table with the new point sources.

2) Method 2 (Wind shied survey of WHPA)

a) Complete a windshield survey of WHPA. The visual survey should indicate all potential sources of pollution in the study area. Potential sources of pollution include any business or activity that generates or uses chemicals (gas stations, dry cleaners, hair dressers, funeral homes, salt storage, etc.)

   i) Note that this method will not allow for the update of any new Leaking Underground Storage Tanks, Rhode Island Pollutant Discharge Elimination System (RIPDES) sites or Comprehensive Environmental Response Compensation and Liability Act (CERCLA) sites. This information can potentially be updated by contacting RIDEM Office of Waste Management.

   ii) Information on a method to utilize volunteers to complete the visual survey can be found at http://www.uri.edu/ce/wq/RESOURCES/dwater/Assessments/volunteers.htm. This document it entitled "A Model for Public Education and Participation".

3) Method 3 (Building permits)

a) Review building permits issued since last SWAP report. This should provide some information on possible point sources, but might miss property transfers resulting in a potential pollution source, such as a dry cleaner moving into a former pizzeria.

b) This method will not allow for the update of any new Leaking Underground Storage Tanks, Rhode Island Pollutant Discharge Elimination System (RIPDES) sites or Comprehensive Environmental Response Compensation and Liability Act (CERCLA) sites.

    i) This information can potentially be updated by contacting RIDEM Office of Waste Management.

Risk Indicator 4: Reservoir nutrient enrichment status (Clarity, Phosphorus and Chlorophyll a)

Introduction

Ideally, nutrient enrichment status is determined through regular monitoring of a water body using clarity as measured by Secchi disk depth, average total phosphorus and average chlorophyll concentration. These measurements are then input into the Carlson Trophic index (shown below), a widely accepted nutrient enrichment rating system that provides a rating of trophic state. Trophic state is generally regarded as the nutrient status of a water body. There are three main trophic states: oligotrophic, mesotrophic and eutrophic. Oligotrophic lakes have very low levels of nutrients and algae, and are generally very transparent. Mesotrophic lakes have moderate levels of nutrients and algae while eutrophic water bodies have high levels of nutrients and generally very low transparency.

In general, the higher the trophic level of a surface water reservoir, the greater the required water treatment level. With greater requirements for treatment, there is greater cost. To a great extent the trophic status can be regulated by managing the types of land use within the watershed of the water supply. Therefore managing the watershed and especially the riparian zone becomes extremely important.

Further information on reservoir/lake ecology can be found on the University of Rhode Island Watershed Watch resources webpage located at http://www.uri.edu/ce/wq/ww/Factsheets.htm . The factsheet on "Phosphorus and Lake Aging" as well as the factsheet on "Measuring Water Clarity" and "Algae in Aquatic Ecosystems" are especially helpful.

Required Deliverables

1) The trophic state (or nutrient enrichment status) of the surface water supply as well as a description of the data that went into the determination of trophic state.

2) A statement of the method used to determine trophic state.

Methods

1) Method 1 (Surface water reservoir monitoring data available)

a) Surface water reservoir water quality monitoring should occur at the deepest location on the reservoir. The most useful data will be taken during the summer months (May through September).

i) Secchi Depth – take the average of all summer Secchi depth readings since the last SWAP report. Assign this average Secchi depth value to the appropriate trophic state on the Carlson's Trophic State Index.

ii) Total Phosphorus – take the average of all summer total phosphorus samples **for surface water only**, since the last SWAP report. Assign this average total phosphorus value to appropriate trophic state on the Carlson's Trophic State Index.

iii) Chlorophyll a – take the average of all summer chlorophyll a samples for the surface waters since the last SWAP report. Assign this average chlorophyll a value to the appropriate trophic state on the Carlson's Trophic State Index.

b) The final trophic status of the surface water body will be determined as the average of the indictors.

c) **Carlson's Trophic State Index**

Parameter	**Trophic State**		
	Oligotrophic	**Mesotrophic**	**Eutrophic**
Secchi Depth (meters)	> 4	2 - 4	< 2
Total Phosphorus (ppb[1])	< 12	12 - 24	> 24
Chlorophyll a (ppb[1])	< 2.6	2.6 - 7.2	> 7.2

Notes:
[1] ppb = parts per billion

2) **Method 2 (Surface Water Reservoir Data Unavailable)**

a) In the absence of sufficient monitoring data to classify trophic state, nutrient enrichment status can be estimated as follows:

i) In the absence of any data on nutrient enrichment level, a medium risk level is assigned.

ii) A extreme risk rating is assigned if any of the following have occurred on the surface water reservoir:

(1) Herbicide/algaecide/chemical application as recorded by the water supplier or an application for treatment was filed with RIDEM. Check with the RIDEM Agriculture Program (http://www.dem.ri.gov/programs/bnatres/agricult/index.htm).

(2) High (>1/2 MCL) levels of disinfection byproducts such as total trihalomethanes recorded.

(3) Impaired status for biodiversity as reported in the RIDEM 303d list (http://www.dem.ri.gov/pubs/303d/index.htm).

Risk Indicator 5: Listed on RIDEM 303d list

Introduction

The 303d list is a listing of all impaired water bodies in the state of Rhode Island. The list includes the type of impairment for each waterbody as well as if a Total Maximum Daily Loading (TMDL) has been completed. A TMDL assesses the impairments of a waterbody and then addresses tasks that should be completed to bring the waterbody back into compliance. In 2008, RIDEM will begin to submit the 303d list and the 305b report (also known as the State of the State's waters report) as an integrated report; although the 2008 303d list is still available separately from the Integrated report.

Required Deliverables

1) Rating of surface water supply

2) Discussion of any impairment to waterbodies in the surface water reservoir watershed as indicated on the 303d list.

Methods

1) Review the most recent 303d list, available from RIDEM at: http://www.dem.ri.gov/pubs/303d/index.htm.

    a) Check to see if the surface water reservoir or any tributaries in the watershed are on the list. The 303d list is organized by watershed.

        i) Make a note of any waterbodies in the watershed that are impaired and note what the impairment is for.

2) Determine the risk rating for 303d impairments

    a) The risk is ranked as "low" if there are no impairments to the surface water reservoir or any water bodies in the watershed.

    b) The risk is ranked as "medium" if there are impairments to tributaries draining indirectly into the surface water reservoir. For example, a tributary that is in the upper watershed that drains into another non-impaired tributary that then drains into the surface water reservoir.

    c) The risk is ranked as "high" if there are impairments to tributaries draining directly into the surface water reservoir

    d) The risk is ranked extreme if there are impairments to the surface water reservoir.

Risk Indicator 6: History of contaminant detects in source water within the last 5 years for reservoir outflow water.

Information
Water quality at the outflow to the surface water reservoir should be available.

Required Deliverables
1) The number and type of contaminant detections within the last 5 years for samples taken at the outflow of the surface water reservoir.

Method
1) Collect water supply monitoring data provided to RI HEALTH or if unavailable, obtain the data from RI HEALTH by following the procedure outlined below:

    a) Contact the RI HEALTH database manager Deb LaFleur at RI HEALTH 3 Capitol Hill, Room 209, Providence, RI 02908-5097 fax: 401-222-6953 phone:401-222-6867

    b) Submit a data request form for Ms. LaFleur, you will need to know the surface water reservoir ID number and the dates for which data is requested. Request the data in an electronic format.

    c) Data to request – All contaminant water quality information (organics, metals, pesticides, radionuclides, etc.) from the surface water reservoir of interest for the period after the previous SWAP was completed.

2) Data analysis
    a) All analyte values reported as less than the detection limit or as non-detections are removed from the analysis.

    b) Calcium, sodium and magnesium data are not analyzed as they are naturally occurring. However, sodium is reviewed when levels consistently approach or exceed 20 mg/L because sodium and chloride are indicators of contamination from road salt and can also indicate the presence of other runoff pollutants. The EPA listed sodium on the "drinking water advisory" list (EPA, 2004) with 20 mg/L as the guidance level for those on a restricted sodium diet. This is not an official contaminant level; however, sodium concentrations approaching or exceeding 20 mg/l should be reported and discussed in the assessment narrative.

    c) Compare detected contaminant values to the National Primary and Secondary Drinking Water Standards from the Office of Water in the EPA.

        i) The EPA Primary Drinking Water Standards set enforceable limits to the amount of specific contaminants that may be present in drinking water; these limits are referred to as Maximum Contaminant Levels (MCLs). Not all contaminants have set MCLs as some contaminants are unlikely to occur in drinking water or have not been a concern up to this point. http://water.epa.gov/drink/contaminants/index.cfm

        i) States are able to adopt more stringent MCLs at their discretion, but are unable to relax the MCL as put forth by the EPA. Rhode Island standards are reported in

"Rules and Regulations Pertaining to public Drinking Water R46-13-DWQ As Amended April 2009".
http://www.health.state.ri.us/drinkingwaterquality/for/watersuppliers/index.php

ii) The National Secondary Drinking Water Standards are non-enforceable guidelines for contaminants that may cause cosmetic effects (ie: skin or tooth discoloration) or aesthetic effects (ie: taste, odor or color) in drinking water (EPA, 2003). http://water.epa.gov/drink/contaminants/index.cfm#Secondary

iii) Not all contaminants have established MCLs, often due to insufficient evidence of human health impact. These include dacthal (a herbicide used by commercial strawberry growers) and MTBE (a highly soluable fuel additive).

(a) Where RI HEALTH has requested monitoring of contaminants without an MCL, detection of these contaminants should be reported and ranked using an established health advisory level instead of an established MCL.

(b) If MCLs are not available in the EPA or Rhode Island documents, check the Agency for Toxic Substances and Disease Registry http://www.atsdr.cdc.gov/

(c) If detection of unregulated contaminants are observed then the report narrative should include the following language indicating that low level detections of an unregulated contaminant have occurred.

"Low level detections of unregulated contaminant ____(fill in blank with contaminant name)____ have occurred, suggesting that the water supply is susceptible to contamination."

d) Risk is determined for each contaminant where a value is reported by RI HEALTH and for each surface water reservoir. The final ranking for each reservoir is the highest risk rating observed. If there is more than one surface water reservoir then rank each one separately but take the highest value and report this in the Surface Water Reservoir Risk Spreadsheet.

i) Risk is assigned based on the table below:

Risk Rating	**Observed Contaminant Concentration**	**Standard text for narrative describing risk**
Low	Trace (maximum value is less than 10% of the MCL)	There has been no detection of regulated contaminants (excluding bacteria and nitrates).
Medium	Less than ½ MCL	No violations of the standards for regulated contaminants (excluding bacteria and nitrates) have been identified. However, there have been detections below levels considered acceptable by US EPA. This indicates the need for continued monitoring.
High	Greater than ½ MCL	No violations of the standards for regulated contaminants (excluding bacteria and nitrates) have been identified. However, there have been detections greater than half the levels considered acceptable by US EPA. This indicates the need for continued monitoring and may indicate the need for future management and/or treatment.
Extreme	Greater than the MCL (violation)	There was a violation of the __(fill in blank)__ standard. A violation indicates that the sample exceeded the amount deemed acceptable by the US EPA. For more information contact the system identified above.

TOTAL RANKING (FINAL RISK RATING)

Introduction
A final risk ranking for each watershed should be completed.

Deliverables

1) The final risk ranking is determined on the Surface Water Reservoirs Risk Assessment.

2) A discussion of any changes in the overall ranking of the watershed in comparison to the past SWAP report.

Method

There is only one method to accomplish this task:

1.) Sum the total of all the risks to determine the final risk rating. The following standard notes apply to the final risk rating. Be sure to add the appropriate note to your final report.

   a) Note: A LOW rating does NOT mean that the source is free from contamination risk. Without sufficient protection, ANY water supply can become contaminated.

   b) Note: A ranking of MODERATE means that the water could become contaminated one day. Protection efforts are important to assure continued water quality.

   c) Note: A ranking of HIGH does NOT mean that the water is unsafe to drink. It DOES mean that we must be especially aggressive in protecting the water supply.

2.) Then compare the new information with previous SWAP report to determine if there have been any changes in the pollution risk rank for each factor assessed.

3.) Discuss any reasons for the change and trends.

4.) Also describe other factors affecting susceptibility to contamination such as the management practices in place or needed to minimize risk, and actions taken since the last assessment.

4.0 ADDITIONAL ASSESSMENT STEPS

In source areas subject to continued development with potential increase in susceptibility to pollution, the water supplier may wish to evaluate pollution risks using other indicators, beyond the minimum used in the rating system. Additional factors which can support selection of appropriate management practices are briefly described in this section. For a more complete description, please see the 2003 assessments for major water supplies.

1) Buildout and zoning

A simple buildout analysis was previously done for most major community water supplies under the 2003 source water assessment. In most cases, the buildout analysis was conducted using existing RIGIS land use and zoning information. Unprotected, non-wetland land was converted to the permitted zoning to simulate future land use. Areas that did not receive a buildout analysis include largely developed areas with little opportunity for additional development and source water areas with a large proportion of wetlands, with little potential for future high intensity development on remaining vacant unprotected lands.

Areas with 2003 SWAP buildout - review zoning amendments to identify approved changes and to determine the need for updating the buildout analysis. If extensive zoning changes or other development is occurring at higher density than allowed under zoning in effect at the time of the 2003 assessment, an updated build out analysis may be needed to evaluate future risks.

Areas without previous buildout – determine if zoning and building has changed enough to warrant completing a buildout analysis. One case where a buildout might now be necessary is an area with high water table previously considered unsuitable for development that might now be subject to development using advanced wastewater treatment technologies.

Areas where future development potential is a concern – because the basic 2003 buildout did not use parcel data, there may be areas where infill development is occurring resulting in more intense development without a zone change, or where substandard lots of record are being developed that don't conform to zoning. Neither of these growth areas would be identified in the previous buildout, therefore a parcel level analysis may be warranted.

2) Impervious cover

For major water suppliers, impervious cover was estimated under current and future land use in the 2003 SWAPs using land use specific impervious surface coefficients. After the 2003 SWAPS were completed, more accurate impervious cover estimates were released and used in SWAP updates completed between 2003 but prior to 2008. The updated coefficients were on average lower than coefficients used in the 2003 SWAPs. Therefore, impervious cover estimates developed for the 2003 SWAPs are likely to overestimate impervious levels, minimizing the need for refining impervious estimates where levels are only slightly elevated and projected to remain low at build out.

In source water areas where impervious levels are high enough to cause concern either under present or future land use (greater than or equal to 10% of land area), it is now possible to obtain a better estimate of impervious surfaces using high resolution photography available from RIGIS. In 2008 the Rhode Island Impervious Surface coverage for 2007 became available on the RIGIS system. This raster data set, which is published in the file geodatabase structure, can be used to determine impervious surface coverage for any location in the State of Rhode Island. The user will be required to have ArcView 9.2 or higher with a Spatial Analysis license to utilize the data. The dataset will have a column labeled "value". A value of "0" indicates a

pixel is pervious (grass, forest, wetland, water, etc.) and a value of "1" indicates the pixel is impervious (roads, buildings, dirt roads and other man-made impervious surfaces).

To determine the amount of impervious/pervious surface in a study area, use the spatial analyst tool "Extract by Mask". Set the polygon area of interest such as a Wellhead Protection Area (WHPA) as the mask to extract out the raster data of interest. This may take a few minutes of computer processing. The resulting file should have a column for "count" as well as "value". The count column indicates the number of pixels in your new clipped or extracted raster for each value (impervious/pervious area).

Each pixel in this database is 2 ft x2 ft so if you multiply the "count" value by 4 square feet this will give you the square footage of impervious (value = 1) and pervious (value = 0) area.

A guide to impervious surface value ratings is provided in Appendix J of the 2003 SWAP reports and can be used as a guide to determine relative pollution risk of a given impervious surface value. Appendix J contains ratings for both the whole study area and riparian area.

The rating for percentage of impervious surface area (taken from Appendix J of 2003 SWAP reports) is as follows:

i) Low : < 10%
ii) Medium : 10 - 14%
iii) High : 15 - 25%
iv) Extreme : > 25%

Riparian area impervious surface can be calculated by buffering the RIGIS streams and small rivers coverage as well as the lakes and large rivers coverages by 200 ft. Merge both datasets together, then use this merged coverage as a mask, use the "Extract by Mask" tool to extract out the raster data of interest. Follow the basic steps you used to determine the study area wide pervious/impervious surface area.

The rating for percentage of riparian impervious surface area (taken from Appendix J of 2003 SWAP reports) is as follows:

i) Low : < 5%
ii) Medium : 5 - 9%
iii) High : 10 - 15%
iv) Extreme : > 15%

3) Nutrient loading analysis

If there have been no major zoning or land use changes since the last SWAP, then the nutrient load estimates as presented in the 2003 SWAP should still be valid. But, if the source area has high estimated groundwater nitrogen load (Nitrogen > 5 mg/L), and observed nitrate levels in groundwater are approaching 5 mg/l, then completion of an updated nutrient loading analysis may be warranted.

In addition, potential sources of nitrogen should be further evaluated to identify easily managed inputs and to develop specific strategies for reducing inputs. New development projects in areas with elevated groundwater nitrate levels should be required to demonstrate control of nitrogen sources through site design, land acquisition, maintaining low density, use of advanced wastewater treatment systems in unsewered areas, and use of best management practices to control new lawn size, watering and fertilizing practices. Site suitability of vacant unprotected land in these areas should be evaluated to determine if there are additional constraints to development contributing to nutrient leaching or runoff, including soils, proximity to wetlands, high water table and slopes. Adequacy of local development standards and project review procedures to address these constraints and prevent future increase in nitrate-nitrogen concentrations should be evaluated, targeting both new construction and re-development.

4) Acquisition of land or development rights

Land protected through outright purchase or purchase of land development rights should be noted in the Source Water Assessment update. All water suppliers should have a system to prioritize lands for protection. For surface water reservoirs, properties located within buffers to surface waters and tributaries are a high priority for protection. In particular, lands that have marginal suitability for development due to high water table, steep slopes or other factor and which are located within shoreline riparian areas, are a very high priority for protection given the risk of pollutant movement from these sites if developed.

Contact local land trusts, municipalities and the Water Resources Board to determine if they have purchased any land for conservation.

5.0 ATTACHMENTS

2003 Source Water Assessment Pollution Risk Ratings for Wellhead Protection Areas and Surface Water Reservoirs *

Potential Sources of Pollution

Sample Language Describing Monitoring Results
Based on 2003 RI Source Water Assessment Program

*** Note**
The 2003 Risk Rating tables were used in the original Source Water Assessment and are included here for reference only. The updated rating for wellhead protection areas and surface water supply watersheds are shown in sections 2 and 3 of this report, respectively.

A separate spreadsheet has also been provided to simplify reporting. This Excel file includes:

- Rating spreadsheet for wellhead protection areas
- Rating spreadsheet for reservoir watersheds,
- Wellhead protection area nitrogen trend reporting table, and
- Potential Sources of Contamination reporting table

Rhode Island Department of HEALTH

Wellhead Protection Area Pollution Risk Rating

2003 Source Water Assessment

Wellhead Protection Area RISK INDICATOR	RATING			
	Low	Medium	High	Extreme
	0	5	10	25
Wellhead Protection Area land use and landscape features				
1. High intensity land use throughout the WHPA.	< 10%	10 - 24%	25 - 40%	> 40%
2. High intensity land use on highly permeable soils throughout the WHPA.	< 5%	5 - 14%	15 - 30%	> 30
Existing or potential pollution sources				
3. Mapped pollution sources within inner protective radius (400 or 200 ft) of well.	None	1	2 - 3	> 5
4. Mapped pollution sources per acre (x 10) throughout the WHPA, excluding inner protective radius (400' or 200') of well.	< 0.1	0.1 - 0.5	< 1	> 1
5. Mapped pollution sources throughout the WHPA, including inner protective radius on highly permeable soil.	0	1	2 - 3	> 3
Water quality				
6. Bacteria detects within 5 years.	none	Total coliform detection	Fecal coliform detected; cause identified and corrected	Fecal coliform violation
7. Maximum nitrogen (NO_3-N) concentration in last 5 years.	≤ .5 mg/l	.5 - 2 mg/l	> 2 - 5 mg/l	> 5 mg/l
8. History of contaminant detects within last 5 years.	none	≤1/2 MCL	>1/2 MCL	Violation
9. Aquifer type	Bedrock well		Sand and gravel well	
Total	*0*	*40*	*90*	*200*
Overall Ranking - Sum of all pollution risk ratings. Maximum rank for WHPA is 210.	**0 - 49**	**40 – 100**	**> 100**	

Rhode Island
Department of HEALTH

Surface Water Reservoir Pollution Risk Rating

2003 Source Water Assessment

Surface Water Reservoir RISK INDICATOR	RATING			
	LOW	MEDIUM	HIGH	EXTREME
	0	5	10	25
Watershed land use and landscape features				
1. High intensity land use throughout the watershed.	< 10%	10 - 14%	5 - 25%	> 25%
2. High intensity land use on highly impermeable soils throughout the watershed.	None	< 5%	5 - 15%	> 15%
3. High intensity land use located within 200 ft of reservoir and tributaries.	None	<5%	5 - 15%	>15%
Existing or potential pollution sources				
4. Mapped pollution sources within 200 ft. of reservoir and tributaries.	None			Presence of one or more
5. Mapped pollution sources per acre (x 10) throughout watershed including the 200 ft. buffer to reservoir and tributaries.	< 0.1	0.1 - 0.5	< 1	> 1
Water quality				
6. Reservoir nutrient enrichment status (clarity, phosphorus, dissolved oxygen).	Low	Moderate	Moderate / Enriched	Eutrophic
7. Compliance with water quality criteria. Based on 305(b) assessment for drinking water, aquatic life and swimming. Where available, stream and sub-reservoir data will be assessed.	Fully supporting (all criteria)	Tributary impaired (minor, not affecting supply).	Tributary impaired (potential to affect supply)	Not fully supporting for drinking water.
8. History of contaminant detects within last 5 years (outflow).	none	≤ 1/2 MCL	> 1/2 MCL	Violation
Total	***0***	***35***	***70***	*200*
Overall Ranking - Sum of all pollution risk ratings. Maximum is 200	**0 - 49**	**50 – 100**	**> 100**	

Potential Sources of Pollution

Agriculture – VOCs, SOCs, Microbes, Nutrients, Pesticides

1. Feed & Supply Stores
2. Greenhouses
3. Dairy and Poultry Farms, Equestrian Centers, Other Livestock Farms
4. Backyard Livestock (Horses, Fowl, etc. in Residential Areas)

Automotive - VOCs, SOCs, Solvents, USTs

5. Gas & Service Stations
6. Fuel Storage
7. Auto Repair
8. Auto Parts & Machine Shops
9. Body Shops
10. Car Washes
11. Rust Proofers
12. Junkyards & Salvage Yards

Medical Facilities -VOCs, SOCs, Microbes, Nutrients

13. Walk-in & Emergency Clinics, Hospitals
14. Dental Offices
15. Veterinary Clinics

Other Commercial -VOCs, SOCs, Solvents, Nutrients, Pesticides

16. Beauty Salons
17. Dry Cleaners/Laundromats
18. Paint Shops
19. Printing Shops
20. Photographic Processors
21. Golf Courses

Industrial/Manufacturing – VOCs, SOCs, Solvents

22. Asphalt, Coal, Tar & Concrete Companies
23. Chemical Manufacturers & Textile Manufacturers
24. Laboratories
25. Other Industrial Manufacturers
26. Road Salt Storage (Sodium, Calcium, Chloride)
27. Sand & Gravel Mining Operations

Definitions

VOCs – Volatile Organic Compounds (from fuel, industrial or chemical factories)
SOCs – Synthetic Organic Compounds (from pesticides and herbicides)
USTs – Underground Storage Tanks (store fuel or heating oil)

Source

RI HEALTH. RI Source Water Assessment Plan, Providence RI.
http://www.health.state.ri.us/environment/dwq/swap/index.php
URI Cooperative Extension, Source Water Assessment Land Use Inventory
http://www.uri.edu/ce/wq/RESOURCES/dwater/Assessments/index.htm

Sample Language Describing Monitoring Results Based on 2003 RI Source Water Assessment Program

CONTAMINANT DETECTS

Low:

There has been no detection of regulated contaminants (excluding bacteria and nitrates).

Medium:

No violations of the standards for regulated contaminants (excluding bacteria and nitrates) have been identified. However, there have been detections below levels considered acceptable by US EPA. This indicates the need for continued monitoring.

High:

No violations of the standards for regulated contaminants (excluding bacteria and nitrates) have been identified. However, there have been detections greater than half the levels considered acceptable by US EPA. This indicates the need for continued monitoring and may indicate the need for future management and/or treatment.

Extreme:

There was a violation of the _____ standard. A violation indicates that the sample exceeded the amount deemed acceptable by the US EPA. For more information contact the system identified above.

DETECTION OF UNREGULATED CONTAMINANTS

Low level detections of unregulated contaminant ____(fill in blank with contaminant name)____ have occurred, suggesting that the water supply is susceptible to contamination.

BACTERIA

Low

Bacteria have not been detected.

Medium

Fecal coliform bacteria were not detected. Coliform bacteria was detected x times during this period. However, re-sampling revealed that the problem had been corrected.

High

Fecal coliform bacteria was detected x times. Corrective action was taken and re-sampling revealed that the problem had been corrected.

Extreme

Fecal coliform bacteria was detected x times. This resulted in a system violation. Re-sampling revealed that the problem had been corrected.

NITROGEN

Low

Nitrate levels in groundwater have been consistently low.

Medium

Nitrate levels in groundwater are somewhat higher than background levels, which may indicate contribution from human activity.

High

Nitrate levels in groundwater are higher than background levels, which may indicate contribution from human activity.

Extreme

Nitrate levels in groundwater are higher than half the US EPA standard for nitrate. This indicates significant contribution from human activity. A program to reduce nitrate may be helpful.

SUMMARY RATING

Note: A LOW rating does NOT mean that the source is free from contamination risk. Without sufficient protection, ANY water supply can become contaminated.

Note: A ranking of MODERATE means that the water could become contaminated one day. Protection efforts are important to assure continued water quality.

Note: A ranking of HIGH does NOT mean that the water is unsafe to drink. It DOES mean that we must be especially aggressive in protecting the water supply.

6.0 RESOURCES AND REFERENCES

For More Information

URI Cooperative Extension
RI Nonpoint Education for Municipal Officials
Lorraine Joubert
Tel: 874-2138
l joubert@uri.edu

RI HEALTH
Office of Drinking Water Quality
Clayton Commons
Tel: 222-7769
Email: Clayton.Commons@health.ri.gov

Rhode Island Water Resources Board
Tel: 222-2217

Useful Web Sites

University of Rhode Island Cooperative Extension Links

URI Source Water Assessment Program homepage
http://www.uri.edu/ce/wq/RESOURCES/dwater/Assessments/index.htm
Includes 2003 Source Water Assessment reports and maps including baseline land use data. Links to methods used to train volunteers to update land use maps and record potential sources of pollution. This document is entitled "A Model for Public Education and Participation".

URI Cooperative Extension MANAGE Documentation
http://www.uri.edu/ce/wq/NEMO/Tools/pollution_assessment.htm
Link to information on the model originally used to generate nutrient loading estimates for SWAP reports.

University of Rhode Island Watershed Watch
http://www.uri.edu/ce/wq/ww/Factsheets.htm
Fact sheets on reservoir/lake ecology including measuring lake clarity, dissolved oxygen and temperature and nutrients. More information on the Carlson's Trophic State Index is located in the "Phosphorus and Lake Aging" fact sheet.

Rhode Island Department of Environmental Management (RIDEM) Links

RIDEM Office of Waste Management
http://www.dem.ri.gov/programs/benviron/waste/index.htm
Regulations and staff list for RIDEM Hazardous Waste Program. To obtain information on Hazardous Waste Generators, LUSTs and CERCLA sites

RIDEM – most recent 303d list of impaired waters
http://www.dem.ri.gov/pubs/303d/index.htm

RIDEM – Agriculture Program
http://www.dem.ri.gov/programs/bnatres/agricult/index.htm

RIDEM – RIPDES Program
http://www.dem.ri.gov/programs/benviron/water/permits/ripdes/index.htm
Information on stormwater and industrial discharges in Rhode Island

The RIDEM Geographic Data Viewer Environmental Resource Map
http://www.dem.ri.gov/maps/index.htm#GV
Interactive mapping website allows user to view environmental data for Rhode Island including soils and land use.

Rhode Island Geographic Information System (RIGIS) home page
http://www.edc.uri.edu/rigis/
Repository for statewide geographic data.

Orthophotography for GIS
http://www.edc.uri.edu/rigis/data/imageryBaseMapsEarthCover.html
Statewide digital orthophotography in both GIS and non-GIS compatible forms.

Orthophotography in easily viewed format (non-GIS)
http://www.edc.uri.edu/orthosf/orthos/200304RIDOT/mrsid.html
No special software required.

RI HEALTH Links

Sanitary Survey Contact
http://www.health.state.ri.us/environment/dwq/sanitarysurvey.php
Office of Drinking Water Quality 401-222-6867

Laboratory Data Reports
Deb LaFleur (database manager) RI HEALTH 3 Capitol Hill, Room 209, Providence, RI 02908-5097 fax: 401-222-6953 phone:401-222-6867

Rhode Island Rules and Regulations Pertaining to Public Drinking Water
http://www.health.ri.gov/environment/dwq/monitoring.php click on “regulations (pdf)” (on the left hand side of the web-site). This document contains Maximum Contaminant Level (MCL) values.

Other Useful Sites

Rules and Procedures for Water Supply System Management Planning. October 2002.
http://www.wrb.state.ri.us/lawsregs/wssmp.pdf
Mapping Requirements are located under Section 8.04

EPA – CERCLA sites
http://www.epa.gov/superfund/sites/
Locate CERCLA sites

USDA – Rhode Island Soil Survey
http://www.ri.nrcs.usda.gov/technical/soils.html

EPA Primary and Secondary Drinking Water Standards,
http://water.epa.gov/drink/contaminants/index.cfm
Information on EPA Primary and Secondary Drinking Water Standards including MCL information.

Agency for Toxic Substances and Disease Registry
http://www.atsdr.cdc.gov/
MCLs for non-regulated contaminants

References

EPA. 2004. 2004 Edition of the Drinking Water Standards and Health Advisories. EPA 822-R-04-005. Office of Water, EPA, Washington DC.
http://www.epa.gov/waterscience/criteria/drinking/dwstandards.pdf accessed 10/2/06.