
5.4 Mapping Pollution Risks

Map analysis of land use activities and landscape features helps target the site-specific location of pollution sources and other features that can increase or minimize pollution risk, such as the presence of vegetated shorelines. Mapping supplements the information on pollution risk indicators summarized above, which are calculated as averages for different land use types, or for the study area as whole, not by geographic location. In this section we briefly summarize the two types of map analyses conducted: pollution source “hot spot mapping” and an inventory of potential sources of contamination. Results are incorporated into the basic source water assessment ranking and provided to the town as large-format maps that are not easily reproduced here. A full list of the natural features inventory maps, pollution “hotspot” maps, and other map analyses are provided in the appendix to this report.

POLLUTION SOURCE HOTSPOTS

Contrary to popular belief, pollutants from land use activities – referred to as non-point pollution sources – are not diffusely spread throughout the landscape in random or unpredictable patterns. In fact, much of this “non-point” source pollution can be traced to: 1) high intensity land use activities that generate known pollutants; and 2) specific landscape characteristics such as soil types and shoreline buffers that promote pollutant movement, either to surface waters via stormwater runoff or to groundwater with infiltration. Fortunately, most municipalities in Rhode Island have easy access to mapped data of both land use activities and important landscape features.

When this data is in electronic form, it is relatively easy to overlay known high intensity land uses with problem soils to rapidly pinpoint pollution “hot-spots” – high-risk areas for movement of pollutants to either groundwater or surface waters. These hotspots generally comprise a relatively small land area, but may contribute the largest percent of pollutants to the environment. Directing management actions to the most serious problem sites can be a cost-effective way to prevent or remediate local pollution problems.

Results: Pollution Source Hotspots

The pollution source “hotspot analysis” completed for this assessment focused on identifying high-risk areas for pollutant movement to both surface and groundwater. This analysis used RIGIS land use (updated) and soils to map high intensity land use overlying slowly draining soils. Hard copy maps of this analysis will be made available to town planning departments. All of the study areas in Jamestown ranked in the low risk category for this indicator, with less than 5 percent of total land area characterized by high intensity land use on high water table soils. All high intensity land use activities located in

Limitations of “Hotspot” Mapping

It is important to emphasize that this assessment and “hotspot” mapping is a rapid, screening level analysis. The soils and land use information are planning level and less accurate for small areas and at boundaries of mapped data layers created at different scales, such as the overlay of soil types, wetlands included under the land use coverage, and stream boundaries. Also, estimates of high runoff areas are overshadowed by man-made drainage alterations. Follow-up field investigations are necessary to verify land use, soil conditions, and presence of potential pollution sources.

groundwater protection areas should be considered potential sources of contamination. It is also important to identify the specific type, location and extent of high risk land uses in relationship to each reservoir or tributary. These mapped locations should be investigated to determine the actual land use at the site and potential for pollutant movement.

Because RIGIS coverages are generally most suitable for planning-level analysis, it is important to understand limitations of the database. In particular, mapping potential “hotspots” based on water flow pathways is less useful where extensive drainage alterations have been made. In this analysis we did not specifically identify and map stormwater discharge locations. A comprehensive source water protection strategy should include field inspections and mapping of these potential problem areas, in coordination with storm drainage system mapping required under EPA Phase II stormwater management planning. Areas of concern include the following:

- Urban stormwater drainage systems short circuit natural water flow and pollutant removal processes. Direct tie-in of sanitary wastes to storm drains, known as illicit discharges, can be an associated contamination source, especially in older settlements.
- Subsurface drains installed in farmland and building lots to lower water tables can serve as a conduit for untreated runoff, carrying fertilizers and untreated effluent to downstream discharge points, especially in high water table areas where the practice may be widespread. These areas should be identified and impacts evaluated at least through observation.
- Water withdrawal resulting in low stream flow during summer periods is a growing concern in areas where various uses compete for limited water supplies or where direct runoff to streams results in loss of groundwater recharge. Similarly, loss of recharge through out-of-basin water supply lines or sewer service can be an additional source of stress.

MAPPED POTENTIAL SOURCES OF CONTAMINATION

The primary goal of the Source Water Assessment is to encourage more comprehensive protection of drinking water sources by providing a consistent framework for identifying and evaluating potential contamination risks. For this purpose, a susceptibility ranking system was developed by RI HEALTH and URI Cooperative Extension that incorporates information on both the vulnerability and sensitivity of each water source. Mapping the location and number of potential sources of contamination is a key component of this ranking system.

Volunteer-identified potential sources of contamination

Mapping volunteers involved in the source water assessment were asked to identify specific high-risk land uses within the individual wellhead protection areas. A master list of these land uses was developed by Rhode Island Department of Health based on the contaminants normally associated with each type of land use, to include:

- **Agricultural** operations were identified based on the likely presence of pesticides, organic compounds, bacteria from animal waste, and nutrients.
- **Automotive** businesses were identified based on the likely presence of solvents and other organic compounds and underground storage tanks.
- **Medical Facilities** were identified based on the likely presence of organic compounds, microbes and nutrients.
- **Other Commercial** including beauty salons, dry cleaners, paint shops, printing or photographic processing and golf courses were identified based on the likely presence of solvents and other organic compounds.
- **Industrial/Manufacturing** businesses were identified based on the likely presence of solvents and other organic compounds.

RIGIS-mapped sources of contamination

Known point sources of pollution included under the RIGIS database were also mapped. These were identified using three RIGIS hazardous material coverages:

- **CERCLA** (Superfund) sites—point locations of hazardous material sites designated by the U.S. EPA and RIDEM.
- **Rhode Island Point Discharge Elimination System** (RIPDES)—point locations for all sanitary waste sites where permits have been issued by RIDEM.
- **Leaking Underground Storage Tank** sites (LUSTS)—point locations for storage tanks and associated piping used in petroleum and certain hazardous substances that have experienced leaks as determined by RIDEM.

Incorporating mapped data into the basic SWAP ranking

The basic Source Water Assessment Program ranking incorporates the results of the hot spot mapping analysis and the number of identified potential sources of contamination as key elements of the ranking. A numeric rating was given to each study area based on the number of mapped pollution sites located in the study area and also the number of sites within the 400-foot inner protective radius of each wellhead or within the shoreline area of a surface reservoir.

The ranking method considers four types of pollution risks, three of which are obtained by RIGIS map analysis:

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- The extent and location of high intensity land use in the source area – including mapped “hot spots” such as high intensity land use within a shoreline area or overlying slowly permeable soil;
 - Number of potential sources of contamination such as underground storage tanks and dry cleaners;
 - Aquifer type, with stratified drift aquifers considered more vulnerable than bedrock aquifers.
 - Monitoring record, including history of contaminant detects and nitrate levels in groundwater. This is based on a review of RIHEALTH sampling data for a five-year period and is the only ranking value not obtained by RIGIS.

The SWAP ranking methodology and results for the study area(s) are included in the appendix to this report.

5.5 Summary Results

Fact Sheet

Results of the Source Water Assessment are summarized in a number of ways. To make results easily accessible to local officials and the general public, key findings were summarized in fact sheet format. This color, 4-page summary is available to view or download from the University of Rhode Island website at www.uri.edu/ce/wq and at www.HEALTH.ri.gov/environment/dwg/Home.htm, the RI HEALTH website. Paper copies are also available from RI HEALTH and the water supplier.

Basic Source Water Assessment Ranking

The basic assessment and ranking used for all public water supplies in Rhode Island synthesizes a range of risk factors potentially affecting drinking water quality. These factors include: the intensity of development, number of sites where hazardous materials are used, and location of development is soils where contaminants may move easily to surface waters, and existing water quality based on RIDEM records and the sampling history of the water supply. The SWAP ranking results are included in Appendix B of this report.

The results of this ranking show that the Jamestown water supply has a **LOW** susceptibility to contamination. According to RI HEALTH a low rating does not mean that the source is free from contamination risk. Without sufficient protection, any water supply can become contaminated.

It is important to note this is an average ranking for the supply as a whole. Individual areas may be more susceptible to contamination due to site-specific conditions and land use activities. In addition, this ranking is based on current land use only, without considering future threats with continued development.

Summary of Land Use Risks

The risk factors described in this chapter provide additional information on potential threats from land use features beyond the basic Source Water Assessment ranking. These factors, such as percent impervious cover, shoreline features and estimated nutrient inputs, were presented individually, considering current and future risks based on our build out analysis.

In this section we summarize results of several key indicators collectively to highlight areas that may be at risk from multiple factors, as shown in Table 4. This “at a glance” overview highlights relative differences in potential pollution risks among study areas. Where a build out analysis was conducted, it also indicates the expected trend between current and future land use.

The first part of Table 4 shows results obtained directly from map analysis or modeled estimates. The cell for each input value is color coded to show the pollution risk rank for current and future values. Drinking water areas are clearly at low risk overall, with intermediate results for Jamestown as a whole. As expected, Jamestown shores area ranks in the high to extreme risk level for most indicators.

The second half of the table further synthesizes results by “adding” together results of difference indicators. This is accomplished by converting low to extreme ratings to a simple numerical ranking from 0 to 3. These values are then added up for each study area to create an average value for current and future land use. Final values are then grouped into categories from low to extreme risk, and a final rating from low to extreme assigned based on total scores from less than 1 to 3, as shown below. When taking all risk factors into account collectively, water supply areas are at low risk under both current and future use.

This overview is intended to help summarize data to compare study areas and evaluate differences between current and future conditions. Since any method used to summarize and rank results can easily mask important data, even “low risk” areas may be subject to contamination. Site-specific mapping and field data should be used to guide selection of management practices.

Table 4. Summary of Current and Future Land Use Risks - Jamestown, RI.

		J. Shores *	Jamestown	J. Well-head	Watson Pond	Carr Pond
Septics /acre	Current	1.08	0.25	0.32	0.03	0.33
	Future	1.63	0.43	0.33	0.08	0.37
Intensive Land Use	Current	11%	12%	10%	12%	5%
	Future	18%	12%	9%	9%	5%
Impervious	Current	21%	13%	9%	4%	6%
	Future	24%	14%	9%	6%	8%
Nitrate to recharge lbs/ac/yr	Current	20.7	7.9	6.7	6.8	6.6
	Future	29.2	10.5	6.8	5.7	7.4
Phosphorus to surface runoff lbs/acre/yr	Current	1.3	0.9	0.6	0.7	0.5
	Future	1.4	1.0	0.7	0.7	0.6

		J. Shores	Jamestown	J. Well-head	Watson Pond	Carr Pond
Septics /acre	Current	3	1	1	0	1
	Future	3	2	1	0	2
Intensive Land Use	Current	1	1	0	0	0
	Future	2	1	0	0	0
Impervious	Current	2	1	0	0	0
	Future	2	1	0	0	0
Nitrate to recharge lbs/ac/yr	Current	3	1	1	1	1
	Future	3	2	1	1	1
Phosphorus to surface runoff lbs/acre/yr	Current	3	2	1	1	1
	Future	3	3	1	1	1
TOTAL	Current	2.4	1.2	0.6	0.4	0.6
	Future	2.6	1.8	0.6	0.4	0.8

Pollution Risk Rating	Low	Moderate	High	Extreme
	Individual risk factor score	0	1	2
Total study area score	<1	1-1.9	2-2.9	≥3

Bold = Future increase > 25% from current

* Jamestown Shores septics/acre and nitrate to recharge is greater than 95% percentile for all SWAP study sites, which would be considered very extreme risk.