

1.0 Executive Summary

This assessment found an elevated susceptibility to contamination for this source of drinking water. The amount of pasture in the assessment area results in a high potential for protozoa contamination. There are no noteworthy contamination threats associated with other discrete contaminant sources. Finally, it should be noted that relatively high flow velocities make river drinking water supplies highly sensitive to existing and new sources of microbial contamination.

2.0 Introduction

This report was completed under the NYS DOH's Source Water Assessment Program (SWAP). The purpose of this program is to compile, organize, and evaluate information regarding possible and actual threats to the quality of public water supply (PWS) sources. The information contained in assessment reports will assist the State in overseeing public water systems and help local authorities in protecting their source water quality. It is important to note that source water assessment reports estimate the potential for untreated drinking water sources to be impacted by contamination. These reports do not address the safety or quality of treated finished potable tap water.

The source water assessment reports are based on reasonably available information, primarily from statewide databases. Although efforts have been made to check each source water assessment report for accuracy, the large scope of this program and the nature of the available data makes the elimination of all errors from these reports nearly impossible.

The following steps were performed for each assessment:

1. Delineation of the source water assessment area(s) – Assessment area borders are created using topography (high points and ridgelines) to define the land area that drains water to each drinking water source. In most cases the assessment area contains only one zone. However, second zones were created where upstream impoundments and/or large geographic distances impede the movement of contaminants toward the PWS source.

Along with creating assessment area borders, all PWS sources are assigned a waterbody type category (e.g. river, spring, large lake, etc) and natural sensitivity ratings for the different contaminant categories. These sensitivity ratings are conceptually based on the waterbody's type, size, and flow characteristics, along with general fate and transport characteristics of contaminant categories. For example, while rivers can move many contaminants great distances rather quickly, solvents tend to evaporate away as they move downstream. Ultimately, natural sensitivity ratings are used along with contaminant prevalence ratings (described below) to define a drinking water source's susceptibility to contamination.

2. Inventory of Potential Contaminant Sources (PCSs) – This inventory contains areal land cover percentages and a listing of specific facilities and sites, (e.g. landfills, Superfund sites) within the assessment area(s). Information contained in contaminant inventories is used to create Contaminant Prevalence ratings in the next step.

3. Susceptibility Determination – SWAP susceptibility ratings are created using the drinking water source's sensitivity and contaminant prevalence ratings. Sensitivity is defined using the water body type assigned during the delineation step, and contaminant prevalence values are assigned based on the nature of the potential contaminant sources present in the assessment area and the location (i.e. Zone 1 Vs Zone 2) of these potential contaminant sources relative to the drinking water source.

3.0 Assessment Area

3.1 Delineation and Assessment Area Background Information

The topographic assessment area delineation for this drinking water source is presented on the attached map. Details on the SWAP delineation process are presented in the attached Methods report. Additional PWS source identification and general assessment area information is presented in Table 1.

It is important to note that this river/creek is on the NYS DEC Priority Waterbody List (NYS Division of Water Waterbody Inventory/Priority Waterbodies List, June, 2004). Excessive sediment and turbidity are entering (and filling) the drinking water impoundment.

Additional information on this water system and source contained in the NYS DOH SWAP Database is presented in Appendix 1. In addition to information on local protection efforts, the NYS DOH SWAP Database may contain information and contamination concerns pointed out by the public water system or noted during sanitary surveys. Furthermore, the water supplier and/or the local health unit may have additional information not contained in the NYS DOH SWAP database.

3.2 Swap Sensitivity Ratings

This drinking water source's assigned waterbody type and SWAP natural sensitivity ratings are presented in Table 2. These sensitivity ratings are assigned using the table presented in the attached Methods report. The rationale for these ratings are based on the size and flow characteristics of the water body types, along with the fate and transport characteristics of the contaminant categories in each contaminant type classification.

The dominant considerations for defining natural sensitivity ratings for rivers are their relatively shallow depth and high flow rate and directionality. Microbial contaminant categories are rated high for rivers, because some of these contaminants can travel great distance in flowing water with little die-off or sedimentation. The organic and other chemical categories are rated medium, because they tend to show some volatilization and inactivation. The phosphorus category is rated low, because phosphorus does not generally limit algae growth in low residence time (high flow rate) water bodies such as rivers.

4.0 Contaminant Inventory and Susceptibility

Once a watershed assessment area for a particular water supply has been delineated

(and natural sensitivity ratings assigned), contaminant inventories and contaminant prevalence and susceptibility ratings are created. To simplify these analyses and the presentation of results, the different types of available data are treated and reported separately.

The overall contaminant inventory task in the assessment for surface drinking water sources consists of the compilation of land cover types (depicted as polygons in GIS) and discrete facilities and sites (depicted as points in GIS) within the delineated assessment area(s). First, the percentages of land cover types within the assessment area(s) are calculated. Next, contaminant inventories are created separately for those facilities with permitted discharges (Permitted Discharge PCSs) and other potential contaminant sources (Other Discrete GIS PCSs). This distinction was made because facilities with permitted discharges tend to be more important potential sources of contamination for surface waters, and these facilities have more useful information contained in their GIS databases. In contrast, the Other Discrete GIS PCS database does not contain much information beyond facility type (e.g. CBS, TRI, etc.). Consequently, susceptibility determinations based on these data are very general, often with susceptibility ratings being assigned to contaminant categories not even associated with PCSs within the assessment area. The final category of PCS in this report is Additional PCSs. This category includes PCSs that are depicted as lines in GIS (e.g. roads, pipelines) and those potential sources of contamination in the NYS DOH SWAP Database (or other available data, e.g. watershed reports, PWL list, etc.) that are not accounted for in the Other Discrete GIS PCSs inventories.

In order to simplify the SWAP process and allow for the clear presentation of results, contaminant inventories utilize contaminant categories (e.g. petroleum products, halogenated solvents), rather than individual contaminant names. These contaminant categories are based on similarities in origin, chemistry, fate and transport in the environment, and consequences in drinking water. The contaminant categories that have been identified as important to surface drinking water sources are presented in the glossary in the attached Methods report.

Once contaminant inventories are compiled, susceptibility ratings are separately created for each of the above mentioned data types. This is done by first creating contaminant prevalence ratings for each contaminant category based on the types of land cover and discrete PCSs present in the assessment area. These values are then used along with natural sensitivity ratings to assign susceptibility ratings for each contaminant category.

4.1 Land Cover

The land cover percentages for this assessment are presented in Table 3.

Land cover within the assessment area is inventoried and compiled to calculate contaminant prevalence ratings for each contaminant category, and these ratings are then used along with the watershed's natural sensitivity ratings to create the susceptibility ratings for the drinking water source. More details on this methodology are presented in the SWAP Plan and the attached Methods report.

The National Land Cover Data set (NLCD) data set is used to obtain land cover data in the SWAP. This data set was derived using Landsat images obtained between 1988 and 1993. The images used were primarily collected during the spring leaves-off period, but fall leaves-off images, and various leaves-on images were also used. While this data set is generally considered to be a very good general land cover classification product, some inaccuracies still exist. The major problem with using this data set in SWAP is that it sometimes does not make accurate distinctions between row crops and pasture.

4.1.1 Contaminant Inventory

Land cover percentages within this assessment area are presented in Table 3. These percentages were compiled using the MRLC land cover data, and specific details on the SWAP land cover methodology is presented in the attached Methods report.

4.1.2 Contaminant Prevalence and Susceptibility

Contaminant prevalence and susceptibility ratings based on land cover are presented in Table 4.

The only contaminant prevalence rating greater than low is for protozoa, due to the high amount of pasture land in the watershed. However, the high mobility of microbial contaminants in rivers/streams and their tributaries results in this drinking water intake also having medium-high susceptibility ratings for enteric bacteria and viruses. These medium-high susceptibility ratings for drinking water sources with low contaminant prevalence emphasizes the high natural sensitivity of river systems to these contaminant categories. In these cases, it is possible for even small changes in land cover (or introductions of discrete PCSs) to result in substantial degradations in water quality.

4.1.3 Additional Agriculture (AEM and CAFO) Data

Data related to the Agricultural Environmental Management Program (AEM) and Confined Animal Feedlot Operations (CAFOs) summarized in Table 5 are used to supplement the SWAP land cover data analysis. Densities are reported in this table as #s (animal units and acres) per 100 square mile, even though most assessment areas are smaller than 100 square miles. These unusual density units are used here to avoid the difficulties in presenting and reading very small decimal numbers (e.g. 0.0475 vs. 4.75).

AEM is a voluntary program designed to assist farmers in conducting an environmental assessment of their operations. Planning and technical guidance are made available to farmers who want to improve the environmental performance of their operations. Since information on specific farms is confidential as prescribed by AEM legislation, only summary data prepared for specific assessment areas are utilized in SWAP.

There are some important considerations when interpreting these data. First,

summary AEM data are not available for all assessment areas, because not all counties provided information, and some delineations were not complete in time to be included. Also, not all farms participate in AEM, which means the summary AEM data may not adequately represent overall agriculture activities in some assessment areas. Overall, while this data set does have its limitations, it provides unique information for making assessments and a good starting point for local water quality protection efforts.

The DEC regulates farms engaged in animal husbandry that meet certain size criteria (i.e. large operations) through a permit program. Farms that meet the size criteria are considered CAFOs and are obligated to implement control measures to prevent discharges to water bodies. Since GIS data were not available to SWAP until recently, these facilities and sites are not depicted on assessment area maps and contaminant inventory lists.+

There are no AEM data available for this assessment area, and no CAFOs were found.

4.2 Permitted Discharges

The contaminant inventories for permitted discharges are derived from the DEC's SPDES program (and corresponding GIS layer), and two separate SWAP susceptibility determinations are performed using this data set. The first, more generalized analysis, reports the number of permitted discharges that are associated with each of the different contaminant prevalence and susceptibility ratings for each of the SWAP contaminant categories. The second type of susceptibility determination is strictly for the protozoan contaminant category. It is derived using data from the permitted discharges judged to be sanitary wastewater and estimates of total watershed wastewater and overall water flows.

4.2.1 Contaminant Inventory

The SPDES facilities located in this source's assessment area are displayed in the attached map and PD list.

4.2.2 Contaminant Prevalence and Susceptibility

General SPDES Contaminant Prevalence and Susceptibility ratings are presented on Table 6, and facility counts and densities are presented on Table 7. These ratings are derived using information contained in the DEC's GIS layer via the methodology presented in the SWAP plan and attached Methods report. It is important to note that these ratings are based on all of the contaminant categories that could be present at these facilities and sites, rather than what is actually present. Therefore, it is very likely that additional site specific information on PCSs will reduce the perceived risks to drinking water quality.

This assessment area has an elevated density of groundwater wastewater

discharges. While it is rare for this type of discharge to impact surface water quality, it is possible.

4.2.3 Cumulative Wastewater Analysis

The results of the cumulative wastewater analyses are presented in Table 8. The facilities included in these calculations are marked as “SW” in the Wastewater column on the attached PD list.

This analysis of SPDES data evaluates the cumulative potential impact of surface wastewater discharges on a surface water PWS source’s susceptibility to contamination by Protozoa (i.e. Cryptosporidium). The basic goals of these analyses are to first estimate the percentage of water that could be from wastewater effluent under low flow conditions, and then assign susceptibility based on the consequent potential levels of Cryptosporidium in the source water. It is important to note this methodology is rather crude, and these susceptibility ratings could be improved using site specific hydrologic data and more detailed information on specific wastewater facilities.

There are no surface sanitary wastewater discharges present in this assessment area.

4.3 Other GIS PCSs

The Other Discrete GIS PCSs include a variety of different types of DEC regulated facilities and sites. These facilities and sites include: Toxic Release Inventory (TRI), Landfill, Mines, Inactive Hazardous Waste Site (IHWS), Resources Conservation and Recovery Act (RCRA), Chemical Bulk Storage (CBS), Major Oil Storage Facility (MOSF), Hazardous Substances Emergency Events Surveillance (HSEES), Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS), and Oil/Gas wells. Unlike the SPDES facilities, these facilities and sites do not have regulated discharges to the environment. The potential risks they pose to drinking water quality are associated with accidents and small unregulated releases over time.

4.3.1 Contaminant Inventory

The Other Discrete GIS PCS facilities and sites located in this source’s assessment area are displayed in the attached map and CI list.

4.3.2 Contaminant Prevalence and Susceptibility

The Other Discrete GIS PCS ratings are presented in Tables 9 and 10. These ratings are derived using the methodology described in the SWAP PLAN and the attached Methods report. It is important to stress, the Other Discrete GIS PCS database generally does not contain information on the chemicals that are

actually present at individual sites, and susceptibility ratings are created for all of the contaminant categories potentially released from each particular type of PCS. Therefore, it is likely that additional information on actual risks posed by specific facilities and sites will reduce the assessed threats to drinking water quality.

In order to further describe the risks to drinking water quality, the densities of these discrete PCSs are reported on Table 10. Densities are reported as number per 100 square miles, even though most assessment areas are smaller than 100 square miles. This was done to create meaningful, easy to understand numbers (i.e. without being too many places to the right of the decimal point) that allow density comparisons between assessment areas. Regardless, additional information on particular PCSs would help to better define risks to drinking water quality.

While this assessment area does contain one or more Other Discrete GIS PCS facilities which result in an elevated susceptibility rating(s), the density is rather low. Therefore, it is unlikely these facilities represent a substantial risk to drinking water quality. However, it may be worthwhile to obtain more information, particularly if the facilities are close to the PWS intake, or if water quality problems already exist.

4.4 Additional PCSs

Additional PCSs includes transportation routes, pipelines and other potential sources of contamination sources listed in the NYS DOH SWAP Database that are not accounted for in above mentioned GIS analyses.

There are no additional PCSs noted for this assessment area and/or the listed PCSs are unlikely to significantly impact source water quality.

5.0 Overall Susceptibility Discussion

The purpose of this section of the report is to use professional judgment to synthesize the findings of the overall assessment process in order to describe the greatest risk to drinking water quality for this source. The contaminant prevalence and susceptibility ratings presented above are largely the result of automated processes and generalized criteria. Furthermore, additional site specific information or studies would improve this assessment.

This assessment found an elevated susceptibility to contamination for this source of drinking water. The amount of pasture in the assessment area results in a high potential for protozoa contamination. There are no noteworthy contamination threats associated with other discrete contaminant sources. Finally, it should be noted that relatively high flow velocities make river drinking water supplies highly sensitive to existing and new sources of microbial contamination.

SUMMARY of SIGNIFICANT FINDINGS		
Potential Sources of Contamination	Potential Impacts to Water Source	Contaminants of Concern
None found using GIS	Medium-High	New sources of microbials could cause water quality problems due to the sensitivity of this waterbody.
Agricultural Land Cover - pasture	High	Protozoa

Table 1: System and Source Information

System Information			
System Name	ITHACA CITY		
Federal ID	NY5404416		
County Served	TOMPKINS		
Source Information			
TINWSF Number	2571553		
External System Number	47840		
Source Name	SIX MILE CREEK		
Water Body Area (acres)	-99		
	<table border="1"> <tr> <td>Zone 1</td> <td>Zone 2</td> </tr> </table>	Zone 1	Zone 2
Zone 1	Zone 2		
Watershed Area (sq miles)	43.43		
Watershed Area (acres)	27825.49		

*-99 means area could not be calculated in GIS

Table 2: Natural Sensitivity Ratings

Waterbody type: RIVER

Contaminant Types and Categories	Sensitivity Ratings
Organics =	Medium
Halogenated Solvents	
Petroleum Products	
Other Industrial Organics	
Other Chemicals =	Medium
Pesticides Herbicides	
Metals	
Nitrates	
Sediments Turbidity	
Disinfection Byproduct Precursors	
Phosphorus =	Low
Phosphorus	
Microbials =	High
Protozoa	
Enteric Bacteria	
Enteric Viruses	

Table 3: Land cover Percentages

Land Use Class	Zone 1	Zone 2
Water	0.188796	0
Low Intensity Residential	1.182785	0
High Intensity Residential	0.070105	0
High Intensity Commercial	0.192870	0
Pasture	19.59408	0
Row Crops	1.220588	0
Other Grasses	0.552352	0
Evergreen Forest	4.425408	0
Mixed Forest	36.70316	0
Deciduous Forest	35.45719	0
Woody Wetland	0.291235	0
Emergent Wetland	0	0
Barren; Quarries, Strip Mines, and Gravel Pits	0.121421	0
Barren; Bare Rock and Sand	0	0
Barren; Transitional_including clear cut areas	0	0

Table 4: Land Use Susceptibility Analysis Summary

Contaminant Categories	CP Rating	Dominant land cover causing rating Z1	Dominant land cover causing rating Z2	Land cover notes	Susceptibility Rating
Organics					
Halogenated Solvents	LOW				
Petroleum Products	LOW				
Other Industrial Organics	LOW				
Other Chemicals					
Pesticides Herbicides	LOW				
Metals	LOW				
Nitrates	LOW				
Sediments_Turbidit	LOW				
Cations/Anions, Salts, Sulfate	LOW				
DBP Precursors	LOW				
Phosphorus					
Phosphorus	LOW				
Microbials					
Protozoa	MEDIUM	Pasture			HIGH
Enteric Bacteria	LOW	High Intensity Residential			MEDIUM-HIGH
Enteric Viruses	LOW	High Intensity Residential			MEDIUM-HIGH

Table 5: Summerized AEM and CAFO Data*

* An absent table means these data are not available for this assessment

Zone	# of CAFOs	CAFO Density per 100 ACRES	Rating
0	0	0.00	zero

Table 6: Number of Permitted Discharge Facilities That Result in Particular Contaminant Prevalence and Susceptibility Ratings

* A blank table means none of these facilities were found for this assessment area.

Contaminant Categories	HIGH	MEDIUM	LOW	NEGLIGIBLE	VERY HIGH	HIGH	MEDIUM-HIGH	MEDIUM	LOW	NOTE
	CP Ratings				Susceptibility Ratings					
Halogenated Solvents				8					8	
Petroleum Products				8					8	
Other Industrial Organics				8					8	
Pesticides/Herbicides				8					8	
Metals				8					8	
Nitrates				8					8	
Sediments/Turbidity				8					8	
Cations/Anions/Salts/Sulfate				8					8	
DBP Precursors				8					8	
Phosphorus				8					8	
Protozoa				8						8
Enteric Bacteria				8						8
Enteric Viruses				8						8

Table 7: Permitted Discharges, General SPDES Counts, Densities and Density Ratings

	Counts		#/100 Square miles		Rating	
	Zone 1	Zone 2	Zone 1	Zone 2	Zone 1	Zone 2
Surface WW	0		0.00		Zero	
Ground WW	8		18.40		Elevated	
non WW	0		0.00		Zero	

Table 8: Cumulative Surface Sanitary Wastewater Analysis Results

* An absent table means none of these facilities are present or the SWAP methodology does not work for this assessment

Table 9: Contaminant Prevalence and Susceptibility Ratings for Other GIS PCSs

* A blank table means none of these facilities were found for this assessment area.

Potential Contaminant Sources	No. of Facilities	Halogenated Solvents	Petroleum Products	Other Indus Organics	Pesticides/Herbicides	Metals	Nitrates	Sediments/Turbidity	Cations/Anions/Salts/Sulfate	DBP Precursors	Phosphorus	Protozoa	Enteric Bacteria	Enteric Viruses	
		CONTAMINANT PREVALENCE RATING													
Mines	2	N	N	N	N	N	N	M	N	N	N	N	N	N	
oilgas	1	N	N	N	N	N	N	N	N	N	N	N	N	N	
SUSCEPTIBILITY RATING															
Mines	2							M							
oilgas	1														

Table 10: Other Discrete GIS PCS Counts, Densities and Density Ratings

	Counts		#/100 Sqr Miles		Rating	
	Zone 1	Zone 2	Zone 1	Zone 2	Zone 1	Zone 2
CBS	0		0.00		Zero	
HSEES	0		0.00		Zero	
IHWS	0		0.00		Zero	
landfills	0		0.00		Zero	
Mines	2		4.60		Sparse	
Oil Gas	1		2.30		Sparse	
RCRA	0		0.00		Zero	
TRI	0		0.00		Zero	
MOSF	0		0.00		Zero	
CERCLIS	0		0.00		Zero	

NYS DOH SWAP DATABASE REPORT

Appendix 1

NYS DOH SWAP Database

I. System Level Info

A. Protection

- 1. Watershed Rules and Regulations?* Yes *Details:*
- 2. Existing Protection Description* Watershed Rules & Regs., 45 acre reservoir on Six Mile Creek with 60' dam 24" raw water transmission line to treatment plant. Two rangers patrol along creek.
- 3. Jurisdiction of Source?* Much of length of creek is private land with city owning area around reservoir and parts of downstream creek.

B. Water Quality Concerns

- 1. Concerns of LHU* No
- 2. SWTR/DBP Issues* No
- 3. System Treatment Concerns* No
- 4. Significant Public Concern - Water Quality* No
- 5. Significant Public Concern - Contaminants* No

C. Other Available Information

- 1.* 1971 NYSDOH Water Supply Evaluation Report.

II. Source Information

A. Delineation

- 1. Delineation Description*
- 2. Zones*
- 3. Date* 4/2/2001
- 4. Intake to Shore* *Depth* *Units*

B. Potential Contamination

- 1. Significant Sum Survey Findings* The watershed is sparsely developed and has no significant industrial installations.
- 2. Water Quality Concerns* No
- 3. Existing Contaminant Inventory Date*
- 4. Surface Water Body Influence* No *Distance*

Description Six Mile Creek drains the SE section of Tompkins County. The watershed is sparsely developed and has no significant industrial installations. About 700 acres of the watershed is privately controlled. The entrance to the dam is posted as a public water supply watershed. The watershed is patrolled by rangers constantly during summer and semi-annual inspections are made.

- 5. Waterbody Quality* n/a
- 6. Source Structural or Locational Concerns* n/a

NY5404416

ITHACA CITY

TOMPKINS

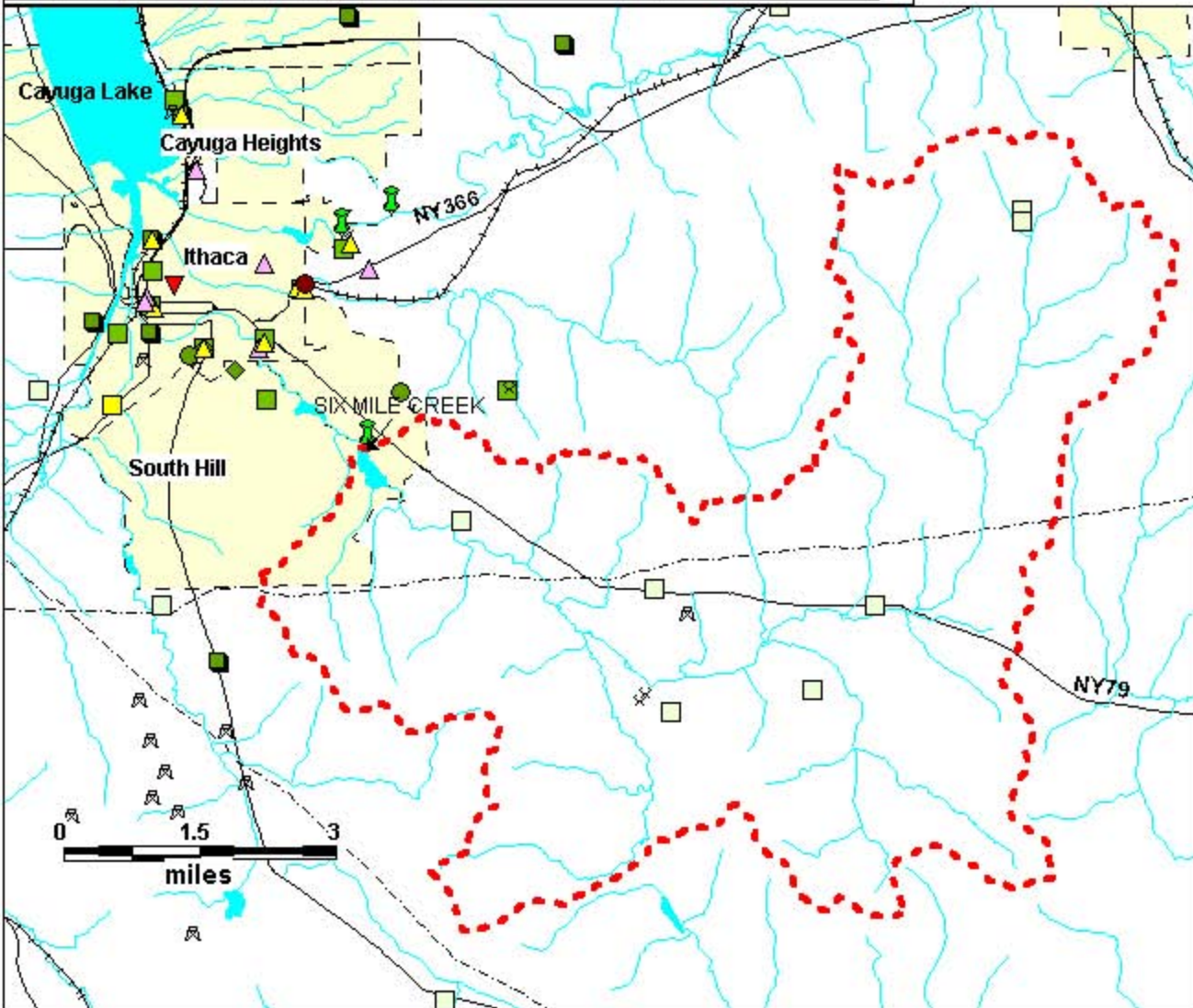
RIVER

SIX MILE CREEK

2571553

System_#	System_Name	County_Served
NY5404416	ITHACA CITY	TOMPKINS

Report_ID#	External_#	Source_Name	Waterbody_type
2,571,553	47,840	SIX MILE CREEK	RIVER



Railroads

Petroleum Pipelines

Major Roads

Surface Waters

Watersheds

Urban Areas

PWS intake



Permitted Discharge Potential Contaminant Sources

- Surface Water Sanitary Waste Discharge
- Non-Sanitary Waste Discharge
- Groundwater Sanitary Discharge

Other GIS Potential Contaminant Sources

- ▲ Chemical Bulk Storage
- ▲ CERCLIS Sites
- ▲ Hazardous Substance Spills
- ▼ Hazardous Waste Sites
- Landfills
- ✕ Mines
- Petroleum Bulk Storage
- ⊗ Oil and Gas Wells
- RCRA facilities
- ◆ TRI facilities



**STATE OF NEW YORK
DEPARTMENT OF HEALTH**

Layer	Contaminant Source Name	Layer Id
Mines	Caroline, Town of	70033
Mines	University Sand and Gravel, Inc.	70010
oilgas	HEAD DEFOREST 1	31115

Wastewater	Facility Name	SPDES	DEC_id	Design_MGD	Waterbody
GW	3 APARTMENT BLDGS	023 2611	7502400067	0.0024	GW-6 MILE
GW	ARROWBROOK FARM A	023 3064	7502400070	0.0018	GW-SIX MILE
GW	ETNA MILL APTS	015 5241	7502400071	0.0032	GW-FALL CREEK
GW	FOUNTAIN MANOR AP	021 3641	7502000034	0.0036	GROUNDWATER
GW	IACOVELLI APARTME	015 5900	7502400024	0.0018	
GW	MARION APARTMENTS	015 5934	7502000004	0.0018	GW-SIX MILE CK
GW	NAZARENE DISTRICT	015 6183	7502000001	0.013	GW-SIX MILE
GW	SUNRISE BARN APAR	024 4562	7502000050	0.0014	GW-SIX MILE CK