LAKE LANIER REGIONAL SOURCE WATER ASSESSMENT PLAN (SWAP): USING INFORMATION TECHNOLOGIES FOR QA/QC AND CREATING TOOLS FOR PLANNING

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Abstract. The Lake Lanier Regional Source Water Assessment Plan (SWAP) was developed with the overall goal of identifying potential risks to the integrity of surface drinking water sources in the Basin. Point and nonpoint potential contaminant sources were identified and assessed for thirteen existing and new municipal drinking water intakes. The majority of intakes received a low score for point source susceptibility and medium score for nonpoint source susceptibility. Methodologies were developed maximizing information technology capabilities. A systematic field survey was conducted to verify and accurately map contaminant source locations. An automated susceptibility analysis was created that can be easily updated by utility managers. Interactive watershed maps were also developed to track project progress and for use in long-range source water protection planning.

INTRODUCTION

Recent amendments to the Safe Drinking Water Act require Source Water Assessment Plans (SWAPs) be completed for all public drinking water systems. "Source water" is the term for untreated water from streams, rivers, lakes, or underground aquifers that is used to supply private wells and public drinking water systems. Source water assessment programs are aimed at protecting drinking water sources from contamination. The focus is on human health risk and identifying contamination threats to raw water sources; therefore, consideration for drinking water treatment processes is not considered.

Georgia's SWAP Program requires that source water assessments include:

- A delineation of the water supply watershed and source water assessment areas that drain to each water intake location;
- An inventory and ranking of potential pollution and contaminant sources (PCS) within designated assessment areas; and
- A determination of the overall susceptibility of the drinking water source to contamination, based on the number and ranking of PCS.

The ultimate goal of the program is the development and implementation of source water prevention and protection strategies to address potential threats identified through the source water assessment process.

The Lake Lanier Regional SWAP, conducted through the Georgia Mountains Regional Development Center (GMRDC), includes thirteen existing and new municipal surface water intakes in Basin. The study area includes the entire watershed area upstream of Bu-

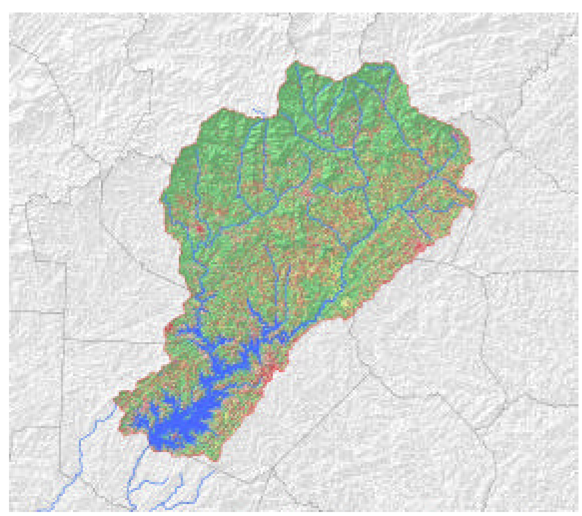

Figure 1. Lake Lanier Basin, Georgia.

ford Dam (fig 1). The Lanier watershed covers approximately 1,040 square miles and includes land in Forsyth, Habersham, Hall, Lumpkin, White, Dawson, Union, Towns, and Gwinnett counties. This area forms the upper portion of the Upper Chattahoochee Watershed (USGS Cataloging Unit: 03130001), and is the headwaters of the larger Chattahoochee River Basin.

METHODS

A database of potential contaminant source types and locations was created for each source water assessment area in the Lanier Basin. Existing data was compiled, field-verified and supplemented with additional information obtained through mailer surveys and other research. Inventory, mapping and database tools were developed for a complete, accurate, and dynamic data inventory. Quantitative information was developed that allowed for a more rigorous and measurable assessment and ranking that could easily be adjusted according to individual community needs.

Data Collection – Contaminant Inventory

Available data were collected for each water system and corresponding source water assessment areas to identify physical watershed features, land use, and potential contaminant sources (PCS), including municipal, industrial, and other business facility sites. Most environmental regulatory programs have information available for regulated sites such as wastewater treatment plants, superfund sites, hazardous waste sites, etc., including:

- Permitted discharges: National Pollution Discharge Elimination System (NPDES) program;
- Hazardous waste generators and treatment, storage, and disposal facilities designated by the Resource Conservation and Recovery Act (RCRA);
- State remediation sites designated by the Comprehensive Environmental Response Compensation and Liability Act (CERCLA);
- Toxic Release Inventory (TRI) sites; and
- Industrial and municipal landfills; for example.

These data are easily accessible from state and federal databases, and often exist in digital form from the Georgia GIS Clearinghouse. These data can be used not only to locate PCS but also to determine what potential contaminants may be in use or stored at a particular location. All pertinent data were compiled into a master SWAP database. Data with a spatial component were converted as necessary into a format compatible with ArcView.

Existing water quality information was also collected and summarized for each water system and limited *Cryptosporidium* and *Giardia* sampling was conducted above water intake locations.

Field Inventory

Existing data sources are useful in identifying PCS; however, some of the spatial data may be incorrect or incomplete. Many PCS that occur in the watershed cannot be identified through these information sources alone. In many cases, the existing spatial and non-spatial data may have source locations that are inaccurate, information that is obsolete, a particular facility or facilities that occur across multiple data sources, and/or incomplete information for all source locations. Experience has shown that the relative number of these types of PCS can be significant and their omission would lead to an incomplete and less than meaningful susceptibility analysis. These findings are consistent with other studies, such as the University of South Carolina's Earth Sciences and Resources Institute (2000), that concluded a windshield survey was needed to identify and locate over 50% of inventoried sites.

Therefore, a field inventory was conducted to verify PCS locations and to locate PCS not otherwise identified from existing data sources. The field inventory, or windshield survey, consisted of driving public roads in the inner and outer management zones (approximately 2,012 miles of roads were driven) and looking for potential contaminant sources. An efficient method of performing this survey was developed utilizing mobile GIS software (ArcPad) and Global Positioning Systems (GPS) technology. The mobile GIS system allowed for a systematic approach to performing the windshield survey and facilitated location of PCS. Locations of existing facilities were adjusted as necessary and facilities with multiple records were combined into one, when appropriate.

When new PCS were identified during the survey, and/or existing PCS required modification, the spatial information was collected in the field using a portable laptop computer and GPS datalogger. New PCS typically include both regulated and non-regulated (often nonpoint) PCS that do not appear in existing state or federal databases. Examples of non-regulated PCS include:

- Auto repair shops;
- Golf courses;

- Illegal dump sites; and
- Agricultural activities/facilities (confined animal feeding operations, waste lagoons, agricultural chemical suppliers, farm tanks, etc).

PCS attributes were recorded on a custom database form linked to the spatial data. The data entry form included a database of the existing data to allow review of all available information related to a particular site while performing the windshield survey. The form was used to ensure consistent data collection by prompting the user to record specific information related to each PCS. A unique identifier was used to link GPS points to attribute data, which included general information such as facility name and address information. Other attributes related to the potential for contamination was entered using drop down lists with domains (e.g., PCS types) to reduce data variability.

The portable database also helped to determining whether a particular facility constituted a PCS or not. For example, it may not be obvious that a certain industry uses or stores potential contaminants. However, by reviewing the RCRA, NPDES, or TRI data that may exist for the industry, for example, information can be obtained concerning on-site chemicals and any releases that may have occurred. Additional information useful to the susceptibility analysis was collected during the windshield survey, such as the presence or absence of secondary containment for tanks, the approximate volume of tanks, distance to surface water, etc.

Additional Information

The SWAP database was further populated with additional data and information obtained from mailer surveys and review of NPDES permit files. Mailer surveys were developed and sent to all PCS identified during the windshield survey that were found to be included in one or more regulatory programs (e.g., NPDES, UST, etc.). Gas stations, landfills, and drinking water treatment plants were excluded from the survey. The surveys were distributed to selected facilities explaining the program goals and requesting information for the susceptibility analysis, including:

- The confirmation of existing data,
- The nature (type and volume) of potential contaminants that may be stored, handled, used, and/or produced on-site,
- Records of accidental spills, and
- On-site secondary containment facilities and procedures, (e.g. emergency/spill response plans).

Susceptibility Analysis

Point and nonpoint sources (PS and NPS) were identified and ranked according to the potential for contaminant(s) to be released into the environment, as well as the risk the contaminant(s) poses to the surface water intake should it be released. Each point source PCS was assessed for its *release potential* based on

- Distance from surface water,
- Volume of release,
- Duration of release, and
- Ease of travel/transport.

Likewise, *risk potential* was d assessed according to:

- Distance from the nearest surface water body, and
- Contaminant toxicity.

These factors were used to develop qualitative measures, or susceptibility rankings (high, medium, low) for each PCS. Once each PCS was assigned its release and risk potential, it was plotted into a matrix for the final point source susceptibility analysis (fig2). The matrix is divided into three priority regions designated as high (upper right), medium (middle), and low (lower left). An overall source water susceptibility score (High, Medium, Low) was computed for each intake based on the percentage of PCS that fell into each matrix region. Because of the potential to unfairly weight some PCS and thus skew the susceptibility analysis, separate susceptibility matrices were developed for point and nonpoint sources.

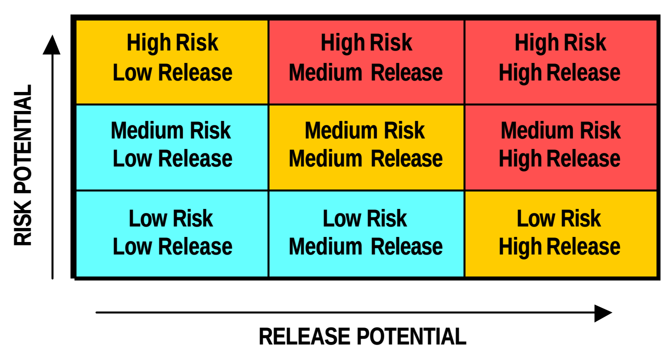

Figure 2. SWAP Susceptibility Matrix.

Nonpoint source susceptibility was determined for different land use types within each source water assessment area. The area of each land cover grouping was summed and "adjusted" by applying runoff coefficients. The percent of each land cover grouping was then determined. The "release potential" for each land cover group was determined based on the adjusted percentage of the land cover for the assessment area. A risk ranking was assigned to each land cover type based on the types of contaminants

Table 1. SWAP Susceptibility Results

Susceptibility	Point Source	Nonpoint Source
	# Intakes	
High	4	0
Medium	2	10
Low	7	3

expected to occur in runoff from those areas. Road-stream crossings, sewered and septic areas, and poultry areas were also assessed according to density and aerial extent within source water assessment zones. Roads within one (river) mile of the intake were ranked as high priority point sources.

Vulnerability and Regional Comparative Analysis

In addition to land use impacts, water supply watersheds have different degrees of vulnerability according to their size and topography. A larger watershed in gently rolling terrain, for example, is less vulnerable to contamination than one that is small and steep. Similarly, an intake on the lake is more buffered from runoff impacts due to mixing effects compared to an intake on a river. Each water supply watershed in the Lanier Regional SWAP was assigned an overall vulnerability based on high/medium/low rankings for watershed size and topography. A final analysis was done to show susceptibility and vulnerability results relative to other intakes in the Basin in an effort to help prioritize source water protection needs. Separate matrices were created for point and nonpoint sources.

RESULTS

Susceptibility results for potential point source and nonpoint source contaminants are summarized in Table 1. High priority point sources were determined mainly by the proximity of the PCS to water and the intake. Facilities such as marinas and wastewater treatment plants were consistently high priority point source sites. In general, service-type facilities (e.g., gas stations, auto repair, etc.) were the most common point source PCS type. High priority NPS included road crossings, runoff from urban areas, sewered and septic areas, and in some cases poultry farms. Secondary road crossings were the dominant nonpoint source PCS type. The majority of intakes received a "Low" point source susceptibility due to less variability in the point source PCS ratings. Four intakes received a high rating for point source PCS due to their smaller watershed size and close proximity of contaminant sources, particularly roads, to the intake. All but three intakes received a "Medium" nonpoint source susceptibility.

Figure 3 illustrates the integration of watershed vulnerability with point and nonpoint source susceptibility results. The resulting matrices give an overall susceptibility for each source category across the thirteen intakes. Final priority rankings for intakes located on Lake Lanier were lower due to the larger watershed size and the buffering effects of the lake. Similarly, priority rankings for intakes in steeper areas of the Basin were higher due to the effects of topography and drainage size. Watershed vulnerability had less effect on overall point source susceptibility rankings than it did on nonpoint source rankings.

SUMMARY AND CONCLUSION

Potential source water contaminant data for the Lake Lanier Basin was gathered and reported in a digital spatial format, compiled into a database, and linked to interactive maps for ease of interpretation by local jurisdictions and their respective communities. Methodolo-

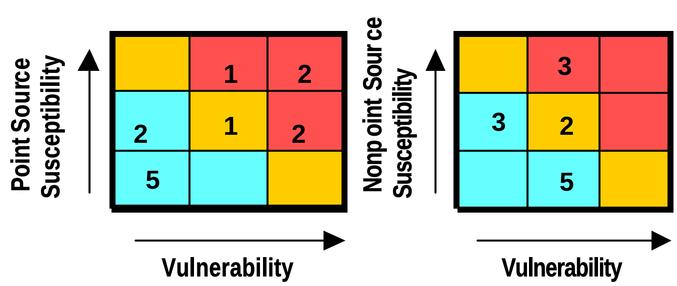

Figure 3. Regional Comparative Analysis for Point and Nonpoint Source Susceptibility Scores.
(Numbers are number of intakes classified for each matrix zone.)

gies were developed to streamline data collection and field inventory efforts.

One of the critical components to a source water assessment is the susceptibility analysis. This analysis can be highly subjective if the initial contaminant inventory data is incomplete or suspect. The mobile GIS and GPS tools developed for the project were valuable not only for a more complete and accurate assessment process, but also for easier long-term database management and maintenance. This approach maximizes computer technologies to affect greater efficiencies and allow a stronger focus on susceptibility analysis and management implications, laying the groundwork for effective pollution prevention and source water protection planning. Methods presented herein can also be used in any number of watershed assessment and planning efforts, including local comprehensive land use planning, TMDL planning and implementation, emergency response and spill prevention planning, and other watershed scale planning strategies.

The majority of intakes received a low point source and medium nonpoint source susceptibility. Factoring watershed vulnerability, the majority of intakes fell into the low priority zone for nonpoint source susceptibility and three scored in the high zone. High priority point sources included marinas and wastewater treatment plants, due to their proximity to the intake and potential for release of pathogens. High priority NPS included road crossings, runoff from urban areas, sewered and septic areas, and in some cases poultry farms.

Primary recommendations for source water protection include

- **Developing specific source water protection plans** for individual jurisdictions to include spill prevention and emergency response measures and best management practices,
- **Educating local officials, planners, and enforcement personnel** in an effort to educate them about the impacts of existing and future land use on source water quality and the need for sound land use planning and management. Jurisdictions are encouraged to develop local land use standards as part of their source water protection plan,
- **Community education and partnering** with local community groups for effective implementation of educational projects and programs aimed at source water awareness and protection, pollution prevention and clean-up, and
- **Coordination and communication with other jurisdictions,** particularly for larger water supply watersheds, such as Lake Lanier.

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