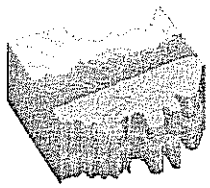
DRINKING WATER SOURCE ASSESSMENT
for Village of Camden
(PWS ID # 6800112)



Protecting Ohio's Drinking Water Sources

OhioEPA

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INTRODUCTION. The 1996 Amendments to the Safe Drinking Water Act require all states to assess the drinking water source for all public water systems. Ohio's Source Water Assessment and Protection Program is designed to help public water systems protect their sources of drinking water from becoming contaminated. This assessment:

- identifies the drinking water source protection area, based on the area that supplies water to the well(s);
- inventories the potential contaminant sources in the area;
- evaluates the susceptibility of the drinking water source to contamination; and
- recommends protective strategies.

The purpose of the assessment is to provide information that Village of Camden can use to help protect its source of drinking water from contamination.

SYSTEM DESCRIPTION & GEOLOGY. Village of Camden is a community public water system serving 2210 people in Somers Township, Preble County. This system operates three wells that pump approximately 254,150 gallons of water per day from a sand and gravel aquifer (water-rich zone). The aquifer is covered by 5-10 feet of low-permeability material, which provides minimal protection from contamination. Depth to water in this aquifer is 10 to 15 feet below the ground surface.

Soils in the area are silty loams which are moderately well-drained, meaning that much of the rainfall and snowmelt will infiltrate into the soil, instead of running off or ponding. The topography is generally level with an average relief of 10 feet. Ground water in this area is replenished by the gradual flow of water underground from higher to lower elevations and by approximately 7 inches per year of precipitation that infiltrates through the soil. At the Village of Camden wellfield, ground water flows generally toward the southwest.

PROTECTION AREA. The drinking water source protection area for Village of Camden's well is illustrated in Figure 1. This figure shows two areas, one inside the other. The "inner protection zone" is the area that provides ground water to Village of Camden's well within one year of pumping. A chemical spill in this zone poses a greater threat to the drinking water, so this area warrants more stringent protection. The "outer protection zone" is the additional area that contributes water when the well is pumped for five years. Together, they comprise the drinking water source protection area.

Method Selection

An analytic element model computer program called GFLOW was used to determine the areal extent of the protection area. Protection areas based on computer modeling can be significantly more credible than those produced by simpler methods, especially in areas with complex geology. The time and effort required to develop a computer model are warranted when the wellfield is located in a complex hydro-geologic setting, and the hydrogeologic data needed to run the program are available for the area. Both criteria were met for Village of Camden's source water assessment.

Model Set Up
The GFLOW model for Village of Camden's wellfield was designed to simulate the characteristics of a sand and gravel alluvial and buried valley aquifer that lies within an end moraine. Figure 3 shows that the more permeable buried valley aquifer was modeled as an area of different flow properties (called an "inhomogeneity") within the less permeable alluvial deposits. Figure 3 also shows that end moraine deposits were modeled as "no-flow boundaries", meaning these deposits do not contribute water to the Village of Camden's wellfield. Since the end moraine in this area yields very little water, the use of no flow boundaries is appropriate. Seven Mile Creek and Beasley Run were modeled as lines along which ground water enters or leaves the aquifer (called "line sinks").

Model Values
Information needed to run the GFLOW model includes, at a minimum, **pumping rate** of the well(s), **hydraulic conductivity** of the aquifer (that is, the ease with which water moves through it), **aquifer thick-ness**, and **aquifer porosity**. For this model, the pumping rate of 254,150 gallons per day was taken from Ohio EPA's files (see table 1) An aquifer thickness of 30 feet was used, based on well logs and glacial aquifer maps. Site specific information on the hydraulic conductivity of the buried valley sand and gravel was not available, and measured porosity values were unavailable for any of the units. In these cases, the values used in the model were based on values typically found in these kinds of rock and sediments. They were: 25 % porosity and 300 ft/day conductivity for the buried valley aquifer and 20% porosity and 100 ft/day conductivity for the alluvial deposits. Refer to table 2 for a detailed list of model input values.

The protection area was determined based on the best information available at the time of the assessment. If you would like to have more information about how this protection area was derived, or if you would like to collect additional information and revise your protection area, please call Ohio EPA staff listed at the end of this report. Also, a more detailed discussion of the technical aspects of modeling drinking water source protection areas, can be found in the Delineation Guidelines and Process Manual (Ohio EPA, 2000) on Ohio EPA's Source Water Assessment and Protection Web page (www.epa.state.oh.us/ddagw/pdu/swap.html).

INVENTORY. On February 13 2002, an inventory of potential contaminant sources located within the drinking water source protection area was conducted by Ohio EPA with the assistance of Village of Camden personnel. Twenty eight potential sources of contamination were identified within the protection area (see Figure 2). Table 4 provides additional information about these types of potential contaminant sources.

A facility or activity is listed as a potential contaminant source if it has the **potential** to release a contaminant, based on the kinds and amounts of chemicals typically associated with that type of facility or activity. It is beyond the scope of this assessment to determine whether any specific potential source is **actually** releasing (or has released) a contaminant to ground water. Also, the inventory is limited to what staff were able to observe on the day of the site visit. Therefore, Village of Camden staff should be alert to the possible presence of potential sources of contamination that are not on this list.

GROUND WATER QUALITY.
At this time, there is evidence indicating the quality of water provided by Village of Camden has been impacted. Samples collected between 1987 and 1990 contained nitrate above the concentration of concern of 2 mg/L on at least 11 occasions, with concentrations ranging from 2.17 to 5.08 mg/L. Atrazine was also detected on 12 occasions between 1997 and 1998 (see table 3). This indicates a manmade influence but these concentrations are below the federal and state drinking water standards of 10 mg/L for nitrate and .003 mg/l for atrazine.

Please note that this water quality evaluation has some limitations:

1) The data evaluated is for treated water samples only, as Ohio EPA's quality requirements are for the water being provided to the public, not the water before treatment.

2) Sampling results for coliform bacteria and naturally-occurring inorganics were not evaluated for this assessment, because they are not a reliable indicator of aquifer

contamination.

Current information on the quality of the treated water supplied by Village of Camden's Public Water System is available in the Consumer Confidence Report for the system, which is distributed annually. It reports on detected contaminants and any associated health risks from data collected during the past five years. Consumer Confidence Reports are available from Village of Camden.

SUSCEPTIBILITY ANALYSIS. This assessment indicates that Village of Camden's source of drinking water has a high susceptibility to contamination because:

- the sand and gravel aquifer has a depth to water of 10 feet below the surface;
- the sand and gravel aquifer material is continuous to the surfaces and the soil is very sandy;
- water quality results indicate the presence of semi volatile organic compounds implying a pathway exists from the ground surface to the aquifer; and
- potential significant contaminant sources exist.

Consequently water quality results indicate that the Village of Camden's of drinking water shows the presence of volatile organic compounds. Therefore the likelihood for the Village of Camden's source of drinking water to be contaminated from other sources is high and it is critical that potential contaminant sources are handled carefully with the implementation of appropriate protective strategies.

PROTECTIVE STRATEGIES. Protective strategies are activities that help protect a drinking water source from becoming contaminated. Implementing these activities benefits the community by helping to:

1. Protect the community's investment in its water supply.

2. Protect the health of the community residents by preventing contamination of its drinking water source.

3. Support the continued economic growth of a community by meeting its water supply needs.

4. Preserve the ground water resource for future generations.

5. Reduce regulatory monitoring costs.

Ohio EPA encourages Village of Camden to develop and implement an effective Drinking Water Source Protection Plan. The plan can be developed from the information provided in this Drinking Water Source Assessment Report. The potential contaminant source inventory provides a list of facilities or activities to focus on. Table 5 lists protective strategies that are appropriate for the kinds of facilities/activities listed in the inventory. Finally, a document titled "*Implementing Drinking Water Source Protection: Guidance for Public Water Systems Serving Municipalities and other Large Populations*" is enclosed. This document offers comprehensive guidance for developing and implementing a municipal Drinking Water Source Protection Plan. Ongoing implementation of the plan will help protect Village of Camden's valuable drinking water resources for current and future generations.

For further technical assistance on drinking water source protection, please contact the Ohio EPA Southwest District Office at (1-800-686-7330) or visit the Ohio EPA Source Water Assessment and Protection Web page at: http://www.epa.state.oh.us/ddagw/pdu/swap.html.

BIBLIOGRAPHY

Ohio EPA public drinking water files.

Ohio Department of Natural Resources,1995 *Ground Water Pollution Potential of Preble County, Ohio*,

Ohio Department of Natural Resources, 1986, *The Water Resources of Preble County, Ohio*

Ohio Department of Natural Resources, 2000, Glacial Aquifer Map (digital).

Ohio EPA, 2002, *Drinking Water Source Protection Area Delineation Guidelines & Process Manual*, Draft (February, 2002).

Table 1. Data for Public Water System Wells

Well #	Total Depth (feet)	Casing Length (feet)	Screen Length (feet)	Pump Capacity (gallons per minute)	Well Status
1	46	33	10	450	In Use
2	41	28	10	450	In Use
3	44	33	10	?	In Use

Table 2. Data Used in Construction of Ground Water Flow Model

Type of Information	Value Used	Source of information
Pumping rate	254,150 gallons per day	Ohio EPA public drinking water files
Aquifer porosity (buried valley)	25%	Estimated, based on typical porosity of sand and gravel aquifer
Aquifer porosity (alluvial)	20%	Estimated, based on a silty sand & gravel
Aquifer thickness	30 feet	Well logs for area, filed at Ohio Department of Natural Resources, Division of Water
Hydraulic conductivity of buried valley aquifer	300 feet per day	Estimated, based on typical values for buried valley aquifers
Hydraulic conductivity of alluvial deposits	200 feet per day	Estimated, based on typical values for alluvial aquifers
Precipitation recharge	7 inches per year	From Ohio Department of Natural Resources, 1995, *Ground Water Pollution Potential of Preble County, Ohio*

Table 3. Summary of contaminants that have impacted Village of Camden's drinking water source.

Contaminant Name	# Samples with detections	Detectable Concentration Range (µg/L)	Maximum Contaminant Level (MCL) (mg/L)
Nitrate	12	1.47-5.08	10,~~000~~
Atrazine	14	0.10 -0.23	0.003

3 ug/l

Table 4: Potential Contaminant Sources located in the Village of Camden's Drinking Water Source Protection Area

Potential Contaminant Source	Number of Sources	Environmental Concerns
AGRICULTURAL SOURCES		
Crops: Corn, Soybean, Wheat	2	Potential contaminant sources that may be associated with pastures include sludge application, fertilizer, and pesticide use. Cropland may be associated with nitrates, ammonia, pesticides, and pathogens in drinking water sources.
Silage Storage (Bulk)	1	Runoff or infiltration of liquids from bulk silage storage areas may be a source of excess nutrients in source water.
MUNICIPAL SOURCES		
Drinking Water Treatment Plants	1	Among the potential contaminant sources related to these facilities are: underground storage tanks; aboveground storage tanks; and storage of chemicals used in water treatment and testing.
Garages	2	Among the potential contaminant sources related to these facilities are: underground storage tanks; automotive fluid storage; equipment storage areas; parking lots; vehicle storage areas; vehicle maintenance areas; and vehicle washing areas. These types of facilities may be associated with the potential for leaks and spills of oil, gasoline, other petroleum products, and automotive fluids. Waste oil and machining wastes may contain metals that could contaminate drinking water sources.
Storm Water Basins	1	Storm Water Basins may be a source of pesticides, microorganisms, nutrients, metals, petroleum products, and organic chemicals in source water.
Car Washes	1	Runoff from these facilities may be a source of metals, petroleum products such as motor oil, and organic compounds in source water.
Cemeteries	1	Cemeteries have been associated with arsenic and formaldehyde contamination in ground water.
Other Commercial Sources		Environmental concerns are dependant on the materials used and other site specific conditions.
INDUSTRIAL SOURCES		
Machine and Metalworking Shops	1	Among the potential contaminant sources related to these facilities are: waste handling and disposal practices; aboveground storage tanks; underground storage tanks; other liquid storage; bulk material storage; and equipment storage and maintenance areas. These types of facilities may be associated with the potential for leaks and spills of oil and other chemical. Waste streams may contain metals that could contaminate drinking water sources.
Plastics / Synthetics Producers	1	Among the potential contaminant sources related to these facilities are chemical storage in underground storage tanks, above ground storage tanks, and other storage areas. The chemicals of concern at these facilities are dependant on the materials processed and the processes used at the facility, but may include solvents and organic chemicals.

Potential Contaminant Source	Number of Sources	Environmental Concerns
WASTE DISPOSAL SOURCES		
Unknown Status Landfills	1	Runoff or leachate from waste disposal sites may be a source of metals, pesticides, or organic compounds in source water, dependant on the materials disposed and other site specific conditions.
WIDESPREAD SOURCES		
Aboveground Storage Tanks	7	Above ground storage tanks present a potential for leaks and spills that could impact surface or ground water.
Septic Systems	2	If poorly maintained, may be a source of household chemicals, excess nutrients, viruses and bacteria in drinking water sources.
Wells: (industrial)	1	Improperly sealed unused water wells create a direct pathway for potential contaminants to reach the aquifer.
Highway / Transportation Route/Railroad	2	Accidents on transportation routes pose the threat of leaks and spills of fuels and chemicals. Weed killers used to control vegetation can elevate levels of pesticides in drinking water sources. Runoff may contain oil, metals, and deicers.
Pipelines	1	Spills and leaks from pipelines the potential to impact drinking water sources, even at small quantities. Condensate in natural gas pipelines may contain PCBs and other chemicals.

Table 5. Protective Strategies for Consideration by Village of Camden

Potential Contaminant Source	Protective Strategies To Consider
General	▸ Purchase additional property or development rights ▸ Provide educational material to members of the community on topics regarding the drinking water source protection area. ▸ Include drinking water source protection into the local school curriculum. ▸ Provide education (material/meetings) to local businesses and industries on topics relating to drinking water source protection. ▸ Encourage 'ground water friendly' development. ▸ Develop/enact/enforce a local ordinance which may include any of the following: changing zoning; requiring registration of existing facilities; banning certain new types of activities; dictating chemical handling procedures; maintaining/filing a chemical inventory; facility spill/contingency planning; engineering controls for existing/new facilities; paralleling existing federal or state requirements.
Agricultural Sources	▸ Assess the use of best management practices and recommend additional practices. ▸ Encourage road safety with agricultural chemicals. ▸ Provide education (material/meetings) to local farmers and agribusinesses on appropriate topics. ▸ Plan/design/implement methods to control impacts to surface water.
Residential Sources	▸ Inventory/remove underground home heating oil tanks in the protection area. ▸ Identify areas used for illegal dumping. ▸ Provide education (material/meetings) to home owners on: drinking water protection; use/maintenance of septic systems; illegal dumping; proper well abandonment (both the reason and the process). ▸ Develop a centralized wastewater collection/treatment system. ▸ Encourage/require (and provide incentives) for sealing unused wells. ▸ Ensure enforcement of existing requirements for closing unused wells. ▸ Ensure the proper construction of new wells.
Municipal Sources	▸ Monitor compliance with existing regulations through inspections and/or contact with regulatory agencies (such as the local fire department, State Fire Marshal, or the Ohio EPA). ▸ Encourage/arrange hazardous materials training or waste and disposal assessments for employees. ▸ Develop an early release notification system for spills and emergency planning; educate emergency responders to be aware of drinking water protection areas; or coordinate facility spill/contingency planning. ▸ Encourage compliance with materials handling procedures/requirements. ▸ Install of engineering controls at municipal facilities ▸ Implement pollution prevention strategies. ▸ Work with the street department and Ohio DOT to minimize use of road salt. ▸ Evaluate and close fire cisterns or other city owned wells. ▸ Conduct routine sewer inspections, maintenance & upgrades.

Commercial Sources	▸ Monitor compliance with existing regulations through inspections and/or contact with regulatory agencies. ▸ Use routine inspections as an educational opportunity. ▸ Encourage compliance with materials handling procedures/requirements. ▸ Encourage/arrange hazardous materials training or waste and disposal assessments for local businesses (and their employees). ▸ Request installation of engineering controls for existing facilities. ▸ Encourage facility spill/contingency planning in conjunction with the fire department. ▸ Encourage local businesses to implement pollution prevention strategies.
Industrial Sources	▸ Monitor compliance with existing regulations through inspections and/or contact with regulatory agencies. ▸ Use routine inspections as an educational opportunity. ▸ Encourage compliance with materials handling procedures/requirements. ▸ Encourage/arrange hazardous materials training or waste and disposal assessments for local industries (and their employees). ▸ Encourage facility spill/contingency planning in conjunction with the fire department. ▸ Request installation of engineering controls for existing facilities. ▸ Encourage local industries to implement pollution prevention strategies. ▸ Encourage compliance with materials handling procedures/requirements. ▸ Encourage/arrange waste and disposal assessments for local businesses.
Spills	▸ Develop an early release notification system for spills and an emergency response plan. ▸ Include drinking water protection in response planning and training. ▸ Post signs indicating the extent of the protection area.
Transportation	▸ Create hazardous materials routes around the protection area and require/encourage transporters to use them. ▸ Work with local transporters on protection area awareness. ▸ Encourage road safety with chemicals. ▸ Post signs indicating the extent of the protection area.

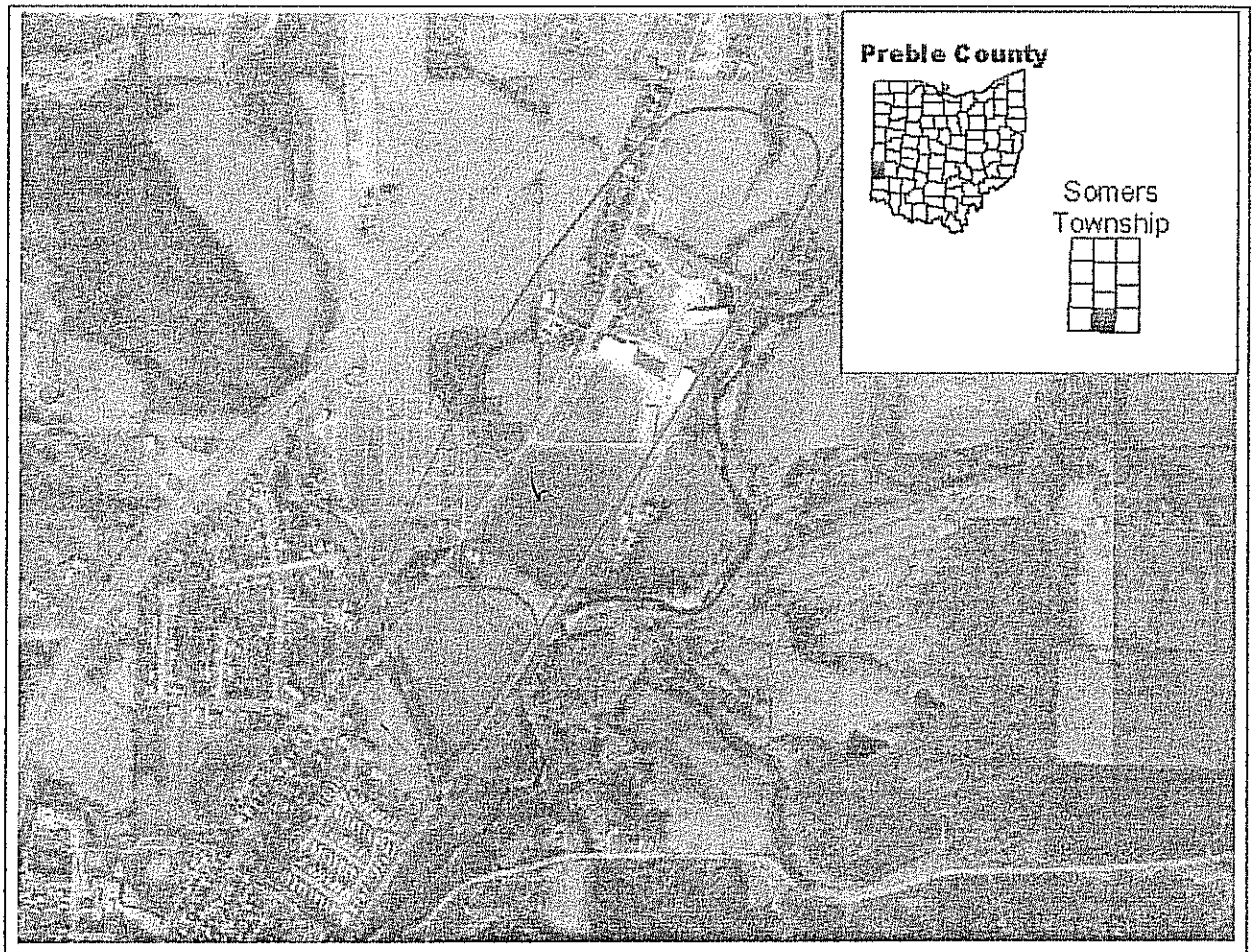

Figure 1. Drinking Water Source Protection Area
Village of Camden Public Water System Identification # 6800112

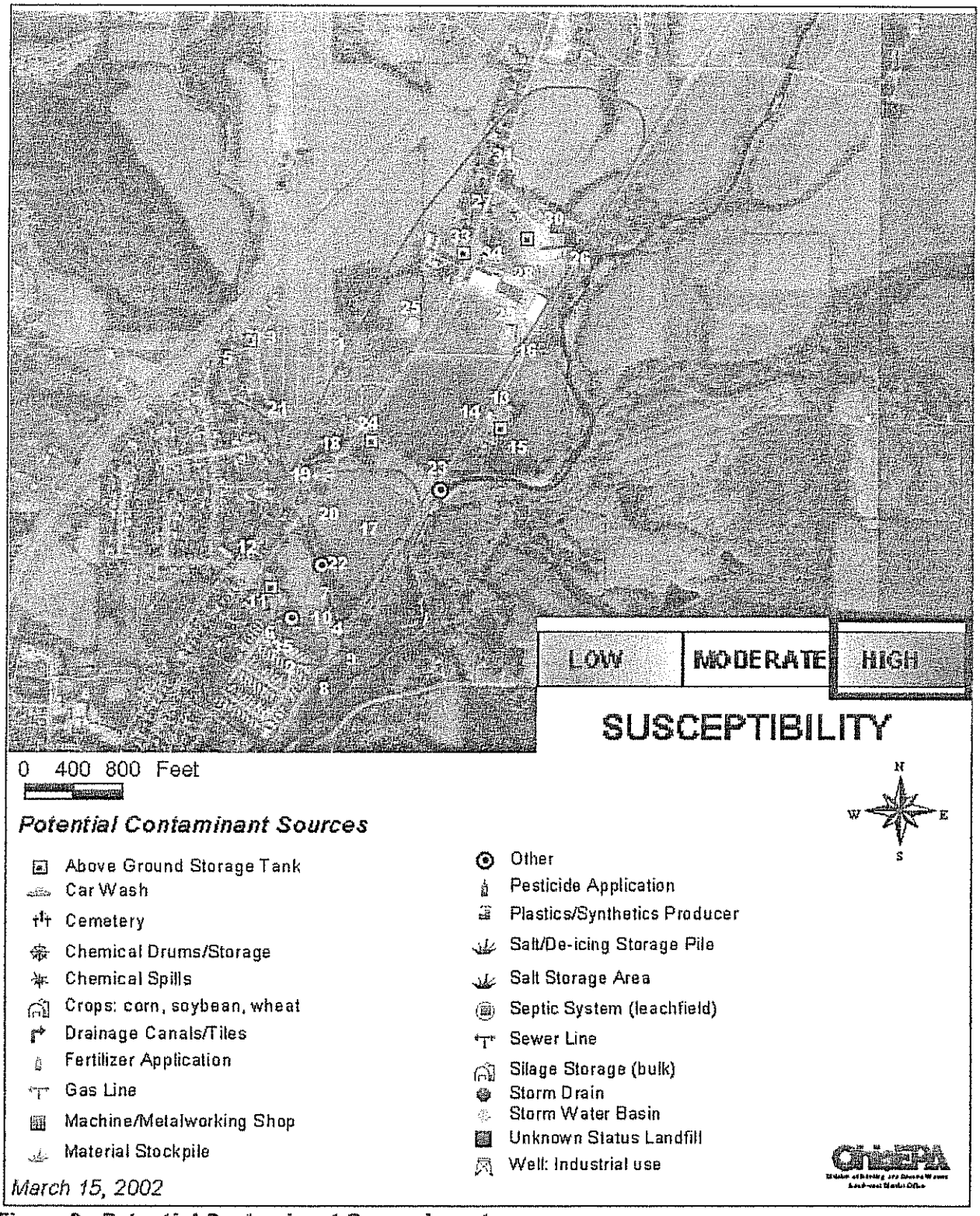

Figure 2. Potential Contaminant Source Inventory
Village of Camden Public Water System Identification # 6800112

Figure 3. Model Development