Part Seven: Groundwater Monitoring & Assessment

It is the policy of the state of Vermont to protect its groundwater resources (Chapter 48: Groundwater Protection). To this end, the Secretary of the Vermont Agency of Natural Resources is responsible for the development of a comprehensive groundwater management program and has established a Groundwater Coordinating Committee with representation from the private sector as well as other departments and agencies. The Committee's role is to advise the Secretary regarding the development of the groundwater program and its corresponding implementation. Also, the Secretary shall, after review by the Groundwater Coordinating Committee, adopt rules for the protection of public water source protection areas (Chapter 56: Public Water Supply). The administrative arm of the Committee is the Water Supply Division (WSD) of DEC.

The purpose of the groundwater program is to protect the quality of groundwater through a variety of mechanisms. Such mechanisms include the development of a strategy for the management and protection of the state's groundwater. This strategy is to be integrated with other regulatory programs administered by the Secretary. Continuing studies and investigation of groundwater, identifying and mapping groundwater, and classifying groundwater per technical criteria and standards, are also components of the program. Cooperation with the federal government in the development of groundwater protection programs along with cooperating with other government agencies in collecting and compiling data on the quantity and quality of groundwater and location of aquifers are yet additional aspects of the groundwater program. Finally, the strategy also includes developing public information and education materials along with providing technical assistance to municipalities for the purpose of protecting the groundwater resources.

Groundwater Strategy and Management

During 2003, the WSD and the Groundwater Coordinating Committee (GWCC) focused on revising the Groundwater Rule and Strategy (GWR&S). The GWR&S is required under 10 VSA §1392(d) of the Groundwater Protection statute. This same statute establishes the GWCC in 10 VSA §1392(c). The purpose of the rule and strategy as well as the committee is, in part, to develop and implement a groundwater program. Improvements to the existing groundwater program were thought attainable by revising the GWR&S. Because groundwater quality standards are continuously changing the rule was updated to include these changes. Revisions to the GWR&S include updates to water quality standards that establish groundwater remediation requirements. Protection of groundwater is sought through compliance with the groundwater quality standards. Compliance with these standards can require remediation of groundwater contamination.

Related to the strategy and management of groundwater and during 2002, the state's on-site sewage statute was comprehensively reformed to provide universal jurisdiction over all on-site sewage (i.e. septic) systems. Existing sewage ordinances and bylaws regulating private water supplies and wastewater systems are superceded by the uniform statewide technical standards beginning July 1, 2007. There were several other provisions contained in the legislation, one of which required the Agency of Natural Resources to develop a model groundwater protection ordinance that municipalities may use as part of their municipal planning efforts. The legislation affecting sewage reform is considered a major event in the protection and improvement of Vermont's groundwater quality.

Cooperation and Coordination

Under the provisions of 10 VSA, §1392(c), the GWCC has the responsibility of advising the Secretary on groundwater issues. The Committee consists of representatives of all state agencies whose

programs impact groundwater, plus members of outside organizations interested in groundwater issues. In 2003, the Committee met on a monthly basis and has provided significant coordination with the Waste Management Division (WMD) of DEC regarding the classification of groundwater. In particular, several groundwater areas identified by the WMD as contaminated were subsequently classified as Class IV groundwater areas. This designation defines the groundwater area as non-potable.

State and federal regulations govern drinking water, wastewater, and waste disposal as related to groundwater. The GWCC provides input to these regulations and has focused on a number of recent regulations. Included in this review is the *Groundwater Rule and Strategy*. This rule has been updated to include198 primary groundwater quality standards and14 secondary groundwater quality standards. These standards are listed with Enforcement Standards and Preventative Action Levels in the 2003 revised rule. Other regulations recently revised, with input from the GWCC, include the Environmental Protection Rules, Chapter 1, *Wastewater System and Potable Water Supply Rules*: Chapter 1 and the *Water Supply Rule*: Chapter 21. Updates to Appendix A, Parts 11 and 12, *Small Scale Water Systems* and *Construction & Isolation Standards for Wells*, of Chapter 21 are also being considered.

It is expected that the federal Groundwater Rule is to be promulgated by EPA in the fall 2004. DEC anticipates this rule will require that sanitary surveys be conducted every three years for community water systems and every five years for the remaining systems. The Rule will likely increase state efforts to identify sources of fecal contamination, require source water microbial sampling for non-disinfecting systems, and require the state to conduct hydrogeological sensitivity assessments for non-disinfecting public water systems that are vulnerable to contamination.

Proposed state legislation in 2003 was discussed among GWCC members. The proposed legislation included requiring testing of private water supplies at the time of property sale is being considered and a separate legislation requiring the permitting of certain groundwater withdrawals.

Members of WSD and the Vermont Geological Survey (VGS) provided a report outlining a proposed strategy for mapping Vermont's aquifers. The report, requested by the Legislature, contains information on the current status of groundwater reclassification and groundwater mapping in Vermont along with proposed strategies for mapping the state's aquifers by 2007. The report is provided as Appendix E.

The VGS coordinated with the WSD and the Agency of Agriculture, Food, and Markets regarding the nitrate contamination of groundwater near a farm in East Montpelier. Elevated nitrate has been found in several private residential wells near some of the farm's fields. In April 2003, VGS and WSD submitted a nonpoint source pollution control grant proposal and obtained $30,000 in Clean Water Act Section 319 funding for VGS to continue its work. Plans include using a borehole camera down 10-12 residential wells to look at the well construction and identify fractures, bedding, and water-bearing zones. A subset of wells will be sampled for major and trace element geochemistry, nitrogen and oxygen isotopes, and chlorofluorocarbon dates. A tracer study using fluorescent dyes is also under consideration.

Throughout 2003, experts from DEC and others addressed a variety of GWCC concerns. These concerns included the occurrence of naturally occurring arsenic and radionuclides. The wastewater disposal issue regarding radionulcides at public drinking water system is particularly problematic. MTBE is also of major concern regarding groundwater. In Vermont, about 75,000 private wells near

hazardous waste sites have been sampled for MTBE. More than 250 wells have detections across the state. The GWCC agreed that this topic warrants further investigation. In some cases, depending on the extent of contamination and the hydrogeological setting, a Class IV designation could be appropriate.

The GWCC has examined its own roles and responsibilities and determined that to be an effective committee it must have a stronger relationship with the Secretary of the Agency of Natural Resources. To strengthen its role in protecting groundwater, Vermont must better coordinate groundwater concerns and design an educational strategy.

Groundwater Investigations

Investigations between 2001-2003 were pursued by WSD's Water Resource Management staff. The staff identified approximately 80 public community water systems with simple 3000 foot radius circles for Source Protection Areas (SPAs). WSD staff identified existing data for water systems in an effort to hydrogeologically delineate a corresponding SPA. Data examined often included well completion reports, pump tests or aquifer analysis data, bedrock and surficial geology information, along with orthophoto and topographic maps. In addition, a site visit was conducted at the corresponding water system. With this data in mind, appropriate hydrogeologic calculations and principles were used to provide a hydrogeologically based SPAs for the water systems. A rationale explaining the SPA was also provided. Of the 80 SPAs identified, 9 reports have been completed and another 10 are being drafted. The result of this work has been to optimize data provided by WSD's permitting programs.

The WSD's 30 year old water level monitoring program was discontinued in 1995 due to lack of resources. The program provided water level trends for about twenty wells throughout the State. The WSD has entered into a contract with the US Geological Survey to continue monitoring 12 of the 20 monitoring wells to continue this program.

Information and Public Education

Each of the above SPA delineations includes a public notice. The town, residents or property owners in the SPA, and officials of the water system were contacted. An opportunity for a hearing regarding the SPA was also provided. This process is also provided in the reclassification of groundwater. The outcome of both processes includes the identification of the groundwater resources along with an excellent rapport developed with concerned citizens at the town level. Groundwater planning at the local level can be better afforded through such efforts. It is hoped that such studies will go a long way with respect to educating the public and protecting the resource.

Staff of the WSD met with town officials of Brandon, Vermont regarding their SPA. Brandon officials are considering enhancing the protective measure of the SPA by reclassifying their aquifer as Class II groundwater. They are also considering whether their aquifer would benefit from a Federal Sole Source Aquifer designation. The WSD and EPA Region I have discussed the requirements of this designation and plan to work with the town to explore this designation.

EPA Region I, the Vermont Department of Health and the WSD have collaborated on groundwater support documents, such as *Guide to Water Quality Testing in Private Wells* and *Private Well Brochure for New England Real Estate Agents.* In addition, a groundwater protection handbook for local officials, the *Ounce of Prevention*, is being updated and will include a groundwater model ordinance. The Vermont Department of Health (DOH) continues to provide groundwater related fact sheet to other departments and agencies as well as the public. Websites specific to groundwater in Vermont include those maintained by WSD, VGS, WMD, and DOH. These sites contain information

regarding regulations, groundwater, geology, and provides access to the well completion report data base.

The WSD annually sponsors Drinking Water Day at the Statehouse. The event provides a number of exhibits that explains the importance of drinking water and its protection. Attendance often includes students, the general public, interested parties, and members of the legislature.

The remainder of this chapter is devoted to a summary discussion of significant aspects concerning the status of groundwater in Vermont.

State of Groundwater Quality

The quality of Vermont's groundwater varies due to both natural and human influences. No comprehensive studies have been completed on the quality of the resource. The WSD requires water quality monitoring at public community and non-transient non-community water systems. A map showing the approximate location of the public community and non-transient waters systems[1] in Vermont is provided at the end of this chapter. Below are results of the monitoring as it pertains to water systems on increased monitoring:

> In 2003, 113 groundwater supplied public water systems received boil-water notices mostly due to bacterial contamination. Boil-water requirements were also due to leaks in the distribution system, water system infrastructure deficiencies, lack of water, or other reasons. Of these 113 systems, 28 were Transient Non-community water systems, 28 were Non-transient Non-community water systems, and 59 were Public Community water systems (WSD, 2003).
>
> 5 public water systems are on increased monitoring due to arsenic levels equal to or above the Maximum Contaminant Level (MCL) concentration of 0.010 ppm (WSD, 2003). A map of arsenic detections appears at the end of this chapter.
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> 9 public water systems are on increased monitoring because either the gross alpha particle radiation was above 10 pCi/l (the gross alpha MCL is 15 pCi/L) or was above the MCL of 5pCi/l for radium (WSD, 2003). A map of gross alpha values is provided at the end of this chapter.
>
> 9 public water systems have nitrate concentrations equal to or above the 5 mg/l limit which triggers increased monitoring. The MCL for nitrate is 10 mg/l (WSD, 2003).
>
> 28 public water systems are required to perform increased monitoring because these systems have had VOC detections over the 5 ug/l limit (WSD, 2003).

Vermont's Agency of Agriculture, Food, and Markets oversees agricultural activities and promotes best management practices with respect to groundwater protection. As part of this effort the Agency found:

> There are 1,294 private agricultural monitoring wells. All of the wells do not necessarily serve farms but all are subject to agricultural land use. Of these 1,294 monitoring wells (863 are farm wells and 431 are neighboring wells), 78 wells (6%) exceed the MCL for nitrate-N of 10 mg/l (Vermont Agency of Agriculture, 2003).

[1] A **Public Community System** means a water system which serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents. A **Non-transient System** means a system that regularly serves at least 25 of the same persons daily for more than 6 months per year (e.g. schools, factories, office buildings).

> Of the 1,294 agricultural monitoring wells, 55 wells (4.2%) tested positive for herbicides but only one well exceeded the MCL or Health Advisory. (Vermont Agency of Agriculture, 2003).

The Waste Management Division (WMD) of DEC regulates and manages a wide variety of hazardous waste along with the groundwater clean-up that occurs regarding this waste. The WMD reports that:

> There are approximately 1,400 petroleum or hazardous waste sites in Vermont which have degraded or have the potential to degrade groundwater to the point where it is non-potable. There are approximately 1,600 sites where the WMD has addressed the existing potential release of hazardous substances and completed site management (WMD, 2003). A map showing the approximate location of known hazardous waste sites in Vermont appears at the end of this chapter.

> There are 2,476 underground storage tanks (UST) in Vermont that could each individually pose a threat to groundwater quality in the event of a leak (WMD, 2003). A map showing the approximate location of known USTs in Vermont is provided at the end of this chapter.

In 2003, the WSD provided the VGS with data regarding the occurrence of radionuclides and arsenic at public water systems. VGS mapped the location of this information and determined the geologic characteristics of corresponding problem areas. As part of this investigation it was determined that:

> Approximately 90% of the state has been mapped for elevated radioactivity, however, areas of elevated radioactivity may or may not correlate to contamination in groundwater (VGS, 2003).

The USGS for New England examined data on arsenic levels for 1,600 public and private water sources. The study focused primarily on the eastern part of the region, which contains the highest population density and where large amounts of groundwater are used for the water supply. Although there are some water supplies with high arsenic levels in western New England, the problem is not as extensive as it is in the eastern part of the region (USGS, 2003). As mentioned, only five water systems in Vermont require increased monitoring due to arsenic.

State of Groundwater Assessment and Use

Public groundwater sources are expected to supply sufficient water quantities. However, other than those regulated as public water sources, groundwater withdrawals are not regulated. Likewise, the significance of groundwater to the ecosystem is not routinely evaluated. Groundwater assessments are driven by the rules mentioned above and by several interested parties such as the USGS. Information from these assessments provides the basis for characterizing groundwater in the State. The following provides some facts regarding groundwater:

> About 50 million gallons of groundwater is withdrawn on a daily basis in Vermont. Withdrawals from public and private groundwater sources account for 33 million gallons per day. Agricultural withdrawal accounts for 2 million gallons daily, another 12 million is used for commercial and industrial purposes, and the remaining groundwater withdrawals are used for mining and the generation of thermoelectric power. (USGS, 1997)

> Groundwater is currently used for drinking water by approximately 70% of Vermont's population. About 46% of the population are self supplied while about 24% are served by public water systems using groundwater (USGS, 1997). In 2003, there were 22 new or modified groundwater sources that required a source permit from WSD.

> Of the 2,078 active farms within Vermont, 85-90% rely on groundwater for agriculture use (Vermont Agency of Agriculture, 2003).

It is estimated that 320,000 of Vermonters get their drinking water from about 93,500 private wells. This number does not include dug wells or springs. Approximately 2,000 new private wells were drilled and reported to the WSD in 2003.

It is estimated that 80% of the private wells are completed in bedrock and 20% in gravel aquifers. The mean well depth is about 200 feet and the mean yield is about 6 gallons per minute (WSD, 2003).

Groundwater levels in Vermont are measured at 12 monitoring wells located throughout the state. For the year 2003, groundwater levels were normal from 1/03 to 6/03 and above normal from 7/03 to 12/03 (USGS, 2003).

Six public water supplies currently lack sufficient water quantity to meet their water demands. Water shortages have occurred at Jericho Heights (Jericho), Oglewood (Milton), Magic Village (Londonderry), Deep Rock Water FD#8 (Barre Town), Eatons Mobile Home Park (Royalton), and Windy Hill Acres located in Springfield (WSD, 2003).

87% of the public community water systems in the State have their corresponding Source Protection Areas or aquifer recharge areas mapped. The remaining public community water systems are using 3,000 foot radius circles as their Source Protection Areas (WSD, 2003).

Existing aquifer maps include the *Groundwater Favorability Maps* (1966 to 1968) which cover the entire state, the *Geology for Environmental Planning* series (1975) that covers 66% of Vermont and was primarily based on data from the *Surficial Geologic Map of Vermont* (1970) and the *Centennial Geologic Map of Vermont* (1961). In the 1980s, ANR provided aquifer maps to 20 towns for planning purposes while just 2 years ago VGS produced an aquifer map in Arlington. These maps included a depth to groundwater map, a thickness of overburden map, and an aquifer yield maps. (Report on the Status of Groundwater and Aquifer Mapping in the State of Vermont, 2003).

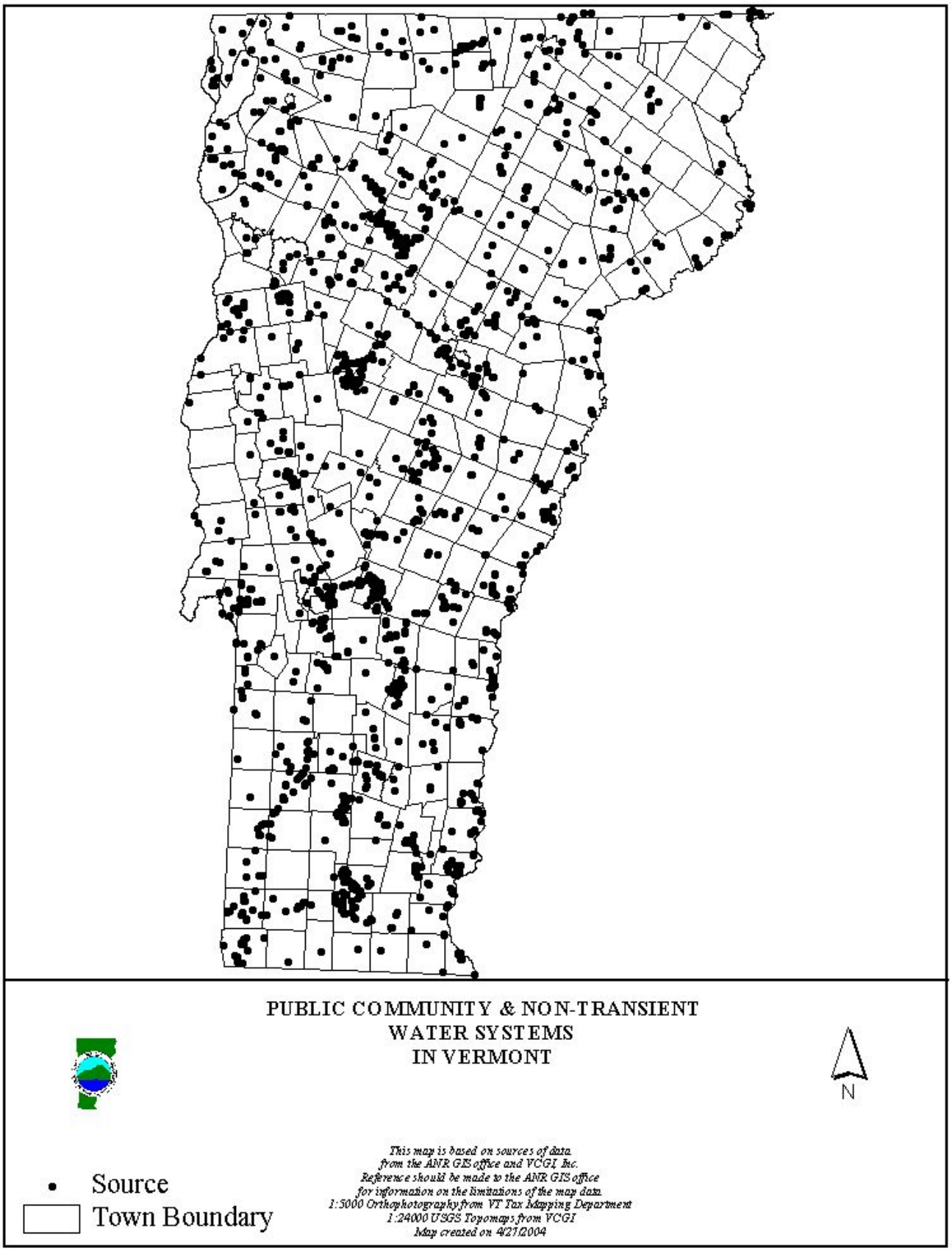
Vermont's groundwater classification systems defines Class I groundwater as suitable for a public water supply with character that is uniformly excellent and is not exposed to any activities that pose a risk to its use. Currently, there are no Class I groundwater areas classified in Vermont.

Vermont's groundwater classification system defines Class II groundwater as suitable for public water supply with character that is uniformly excellent but exposed to activities that may pose a risk to its use. There are no Class II groundwater areas in Vermont although one area is currently being proposed as a Class II groundwater area (Brandon, Vermont).

Vermont's groundwater classification system defines Class IV groundwater as not suitable as a source of potable water but suitable for some agricultural, industrial, and commercial uses. There are 8 areas classified as Class IV groundwater areas in Vermont, including the Burgess Brothers Landfill (Bennington), Parker Landfill (Lyndon), Transitor Electronics (Bennington), UniFirst Sites (Williamstown, Brookfield, and Randolph), Pine Street Barge Canal (Burlington), Maska Inc. (Bradford), Windham Solid Waste District Unlined Landfill (Brattleboro), and the Bennington Landfill located in Bennington.

With the exception of the 8 Class IV groundwater areas, Vermont's remaining groundwater is classified as Class III. Class III groundwater is defined as suitable as a source of water for individual water supply, irrigation, agricultural use, and general industrial and commercial use.

Groundwater is a critical resource for the State of Vermont and continues to be vulnerable to numerous man-made and natural risks. It supplies a significant portion of the drinking water to Vermont's population. While drinking water is a top priority environmental concern in the State, the clear connection between drinking water and groundwater is lacking. Groundwater efforts, however, are most limited regarding its interaction with surface water. Specifically, the contribution groundwater makes to wetlands, streams, rivers, ponds and lakes receives little attention. Its importance to sustaining the drinking water needs of the State along with Vermont's flora and fauna appears to be taken for granted. The lack of attention given to groundwater when compared to the attention given to surface waters may be due, in part, to the lack of public education regarding groundwater and the associated costs required to comprehensively evaluate this resource.


PUBLIC COMMUNITY & NON-TRANSIENT
WATER SYSTEMS
IN VERMONT
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This map is based on sources of data
from the ANR GIS office and VCGI, Inc.
Reference should be made to the ANR GIS office
for information on the limitations of the map data.
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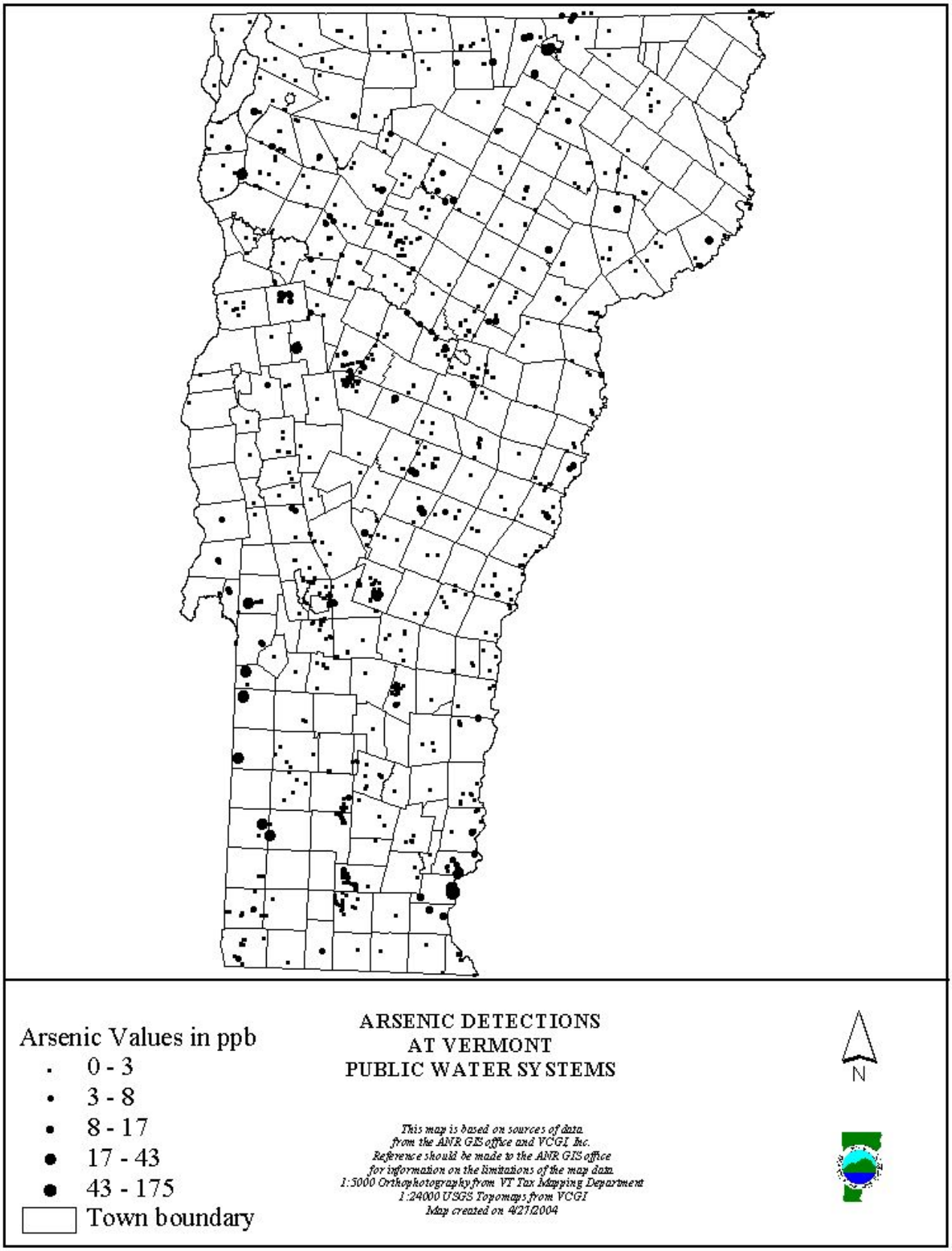
1:24000 USGS Topomaps from VCGI
Map created on 4/27/2004
Source
Town Boundary


Arsenic Values in ppb
0 - 3
3 - 8
8 - 17
17 - 43
43 - 175
Town boundary
ARSENIC DETECTIONS
AT VERMONT
PUBLIC WATER SYSTEMS
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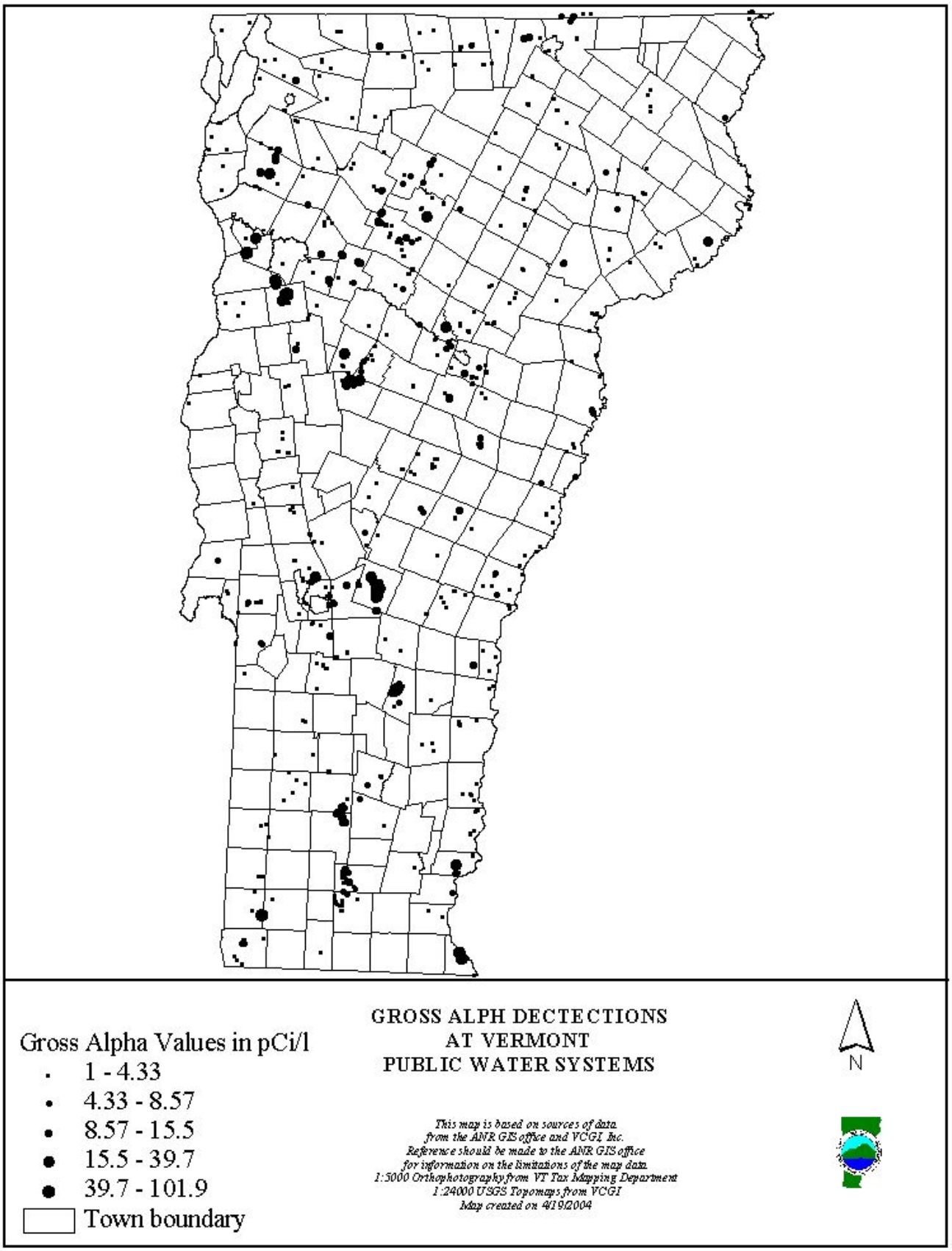
Gross Alpha Values in pCi/l
1 - 4.33
4.33 - 8.57
8.57 - 15.5
15.5 - 39.7
39.7 - 101.9
Town boundary
GROSS ALPH DECTECTIONS
AT VERMONT
PUBLIC WATER SYSTEMS
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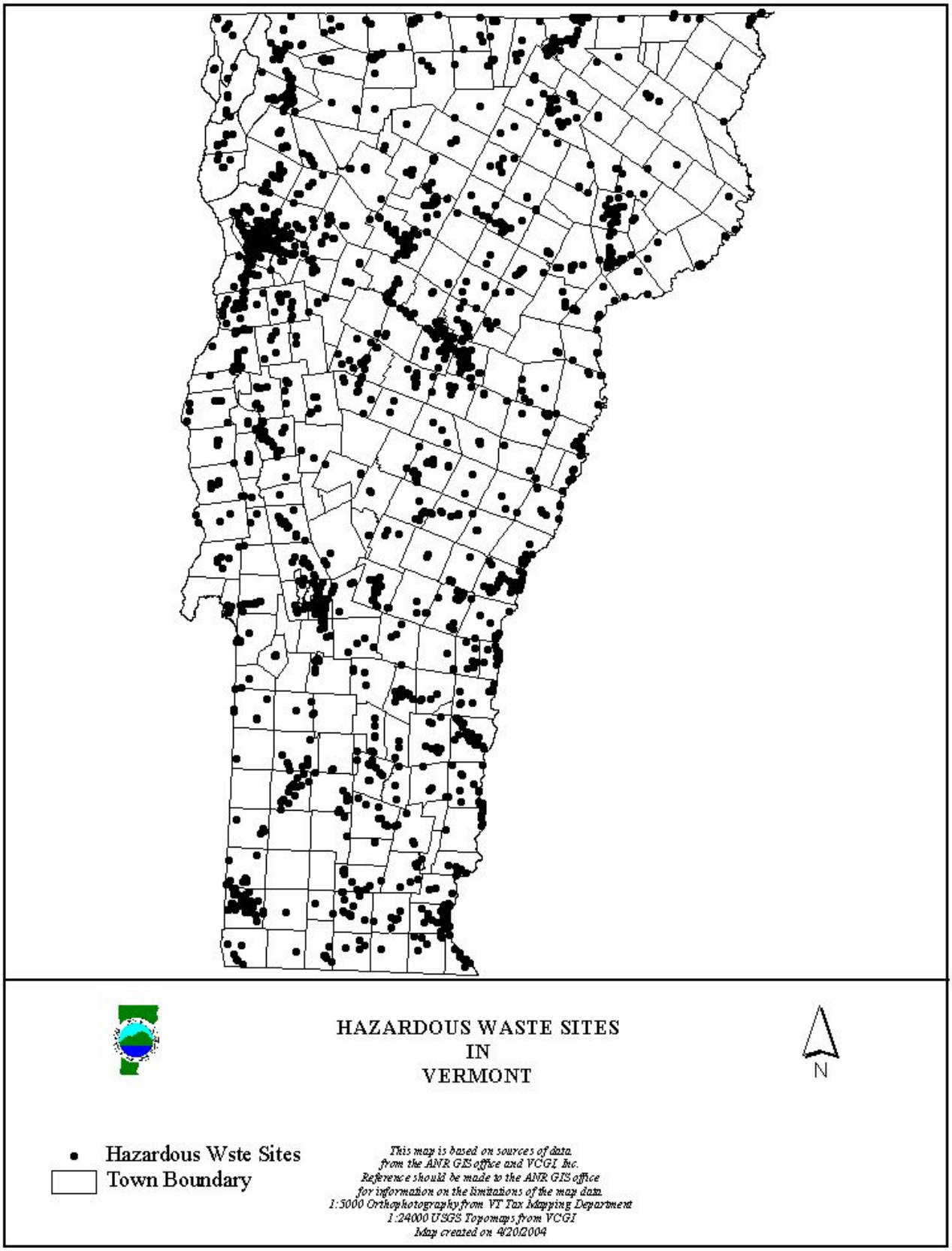
HAZARDOUS WASTE SITES
IN
VERMONT
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Hazardous Wste Sites
Town Boundary
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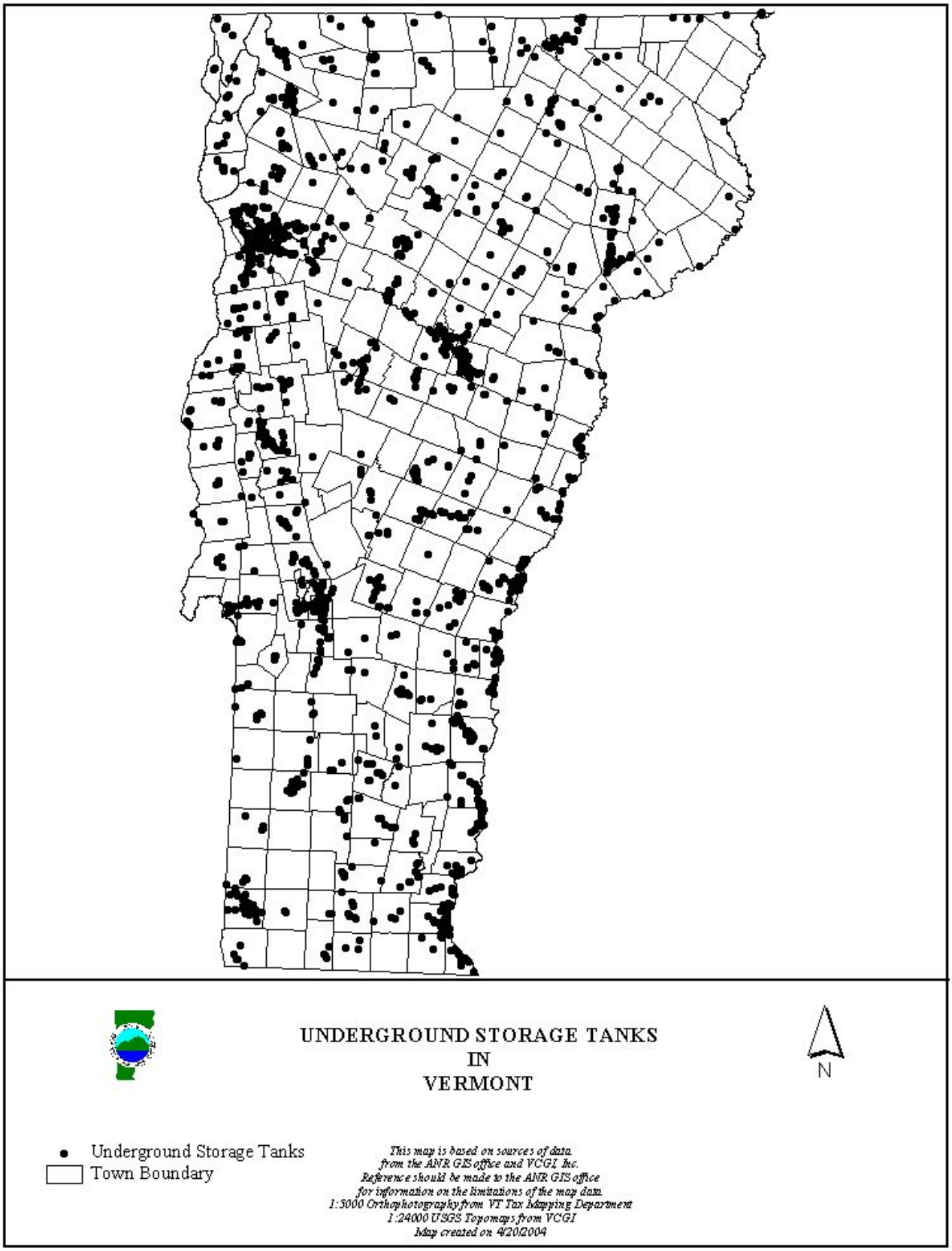
UNDERGROUND STORAGE TANKS
IN
VERMONT
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Underground Storage Tanks
Town Boundary
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