

**NEW JERSEY**  
**HIGHLANDS**  
**WELLHEAD PROTECTION PROJECT**



***GRANTOR:***  
NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

***GRANTEE AND LEAD MUNICIPALITY:***  
READINGTON TOWNSHIP  
Hunterdon County, New Jersey

***CONSULTANT:***  
T&M ASSOCIATES  
Middletown, New Jersey

***PROJECT COORDINATOR:***  
SOUTH BRANCH WATERSHED ASSOCIATION, INC. (SBWA)  
Flemington, New Jersey

**FINAL REPORT<sup>®</sup>**

*This page left intentionally blank*

## FOREWARD

Frequently, water shortages or contamination events in the local or regional drinking water supply make headlines in the NY Times, Newsweek and Time magazines, disaster books and TV specials.

And then.....it rains, or something else focuses the public's attention on some other news sound bite. After all, if front page color photos of international genocidal atrocities will not hold the public's attention, or move people to make a call or write a letter, then there is little hope that the public will raise their voices concerning drinking water aquifer management until their lawns die and their wells run dry. Therein lies the dilemma; there is no public constituency urging elected officials to adopt a protective program to prevent future problems.

With this in mind, it was the primary objective of the Highlands Wellhead Protection Project to develop a set of straightforward, easily implemented, low-cost or no-cost, local, governmental ordinances which will protect existing wells and drinking water aquifers from contamination and over-use. Most of the chemicals which contaminate aquifers are stored outdoors in small to medium quantities by many businesses. Most of these small to medium businesses are those upon which we depend to operate and maintain the normal economy of any community, and for which there are no regulations on the storage or handling of chemicals. This project has developed draft Model Municipal and Board of Health Ordinances which implement the use of locally enforced Best Management Practices to manage the storage of these multiple sources of potential pollutants.

A second and extremely important finding of this Project is that the continuous rapid growth and development in suburban New Jersey has very little basis in supportable science as it relates to the long term "Dependable Yield" for the local drinking water aquifer(s). The standard should not be, "How much water can an individual well pump per minute for 8 hours and then recover on that one day?" The standard should be, "How much rain water enters this aquifer annually and how much can we safely withdraw annually while still keeping the ground and surface water systems in ecological balance?"

Based on this finding, the report and ordinances address the question, "Does our local zoning take this extraordinarily important, limiting factor into account?" A recent book called Tapped Out, by former Senator Paul Simon, now a fellow at the Public Policy Institute at the University of Southern Illinois, makes the case that population-induced water shortages are already here.

If you are a local official interested in these issues, the model ordinances included in this report for Planning Boards and local Boards of Health will be excellent tools to initiate constructive action. The challenge for present-day, informed political leaders is to take constructive action in the face of little or no immediate public interest.

Of course, present-day officials who deal with land use planning, public health, and public

water supply problems can simply avoid these prickly issues and do nothing. However, the eventual backlash for the community will be the harsh reality of annual shortages of public drinking water, irrigation supplies, tapped-out individual wells, and increasing levels of contaminants in the remaining useable groundwater. The subtle but significant side-effects will be longer and longer periods of low-flow in rivers, lower levels in lakes and wetlands, and salt-lines moving further upstream in tidal waterways.

Wise ground water supply management demands action by local planning and health officials who are entrusted with the protection and utilization of these finite aquifer resources. The Highlands Wellhead Protection Project provides the basis for developing educational and regulatory programs for the long-term management of the precious water resources upon which a healthy economy is dependent.

Users of this report will find the background research in the first sixty pages of text. The balance of the report is composed of ready-to-use ordinances, forms and graphics aimed at wellhead and aquifer protection.

***Ironically, as this report goes to press, the New York/New Jersey/Pennsylvania region is experiencing its most severe 12 months of drought in 100 years.***

**TABLE OF CONTENTS**

	<i>PAGE</i>
<b>FOREWARD</b> _____	<b>i</b>
<b>TABLE OF CONTENTS</b> _____	<b>iii</b>
<b>EXHIBITS TABLE OF CONTENTS</b> _____	<b>iv</b>
<b>MATERIALS AVAILABLE</b> _____	<b>vii</b>
<b>ACKNOWLEDGEMENTS</b> _____	<b>viii</b>
<b>ABSTRACT</b> _____	<b>x</b>
<b>CONDENSED REPORT "THE TOOL KIT"</b> _____	<b>xii</b>
<b>INTRODUCTION</b> _____	<b>1</b>
<b>PROJECT STUDY AREA MAP</b> _____	<b>3</b>
<b>CHAPTER I DEVELOPING A MUNICIPAL ORDINANCE</b> _____	<b>5</b>
<b>CHAPTER II DEVELOPING A MODEL STATE ENABLING LAND USE LEGISLATION</b> _____	<b>13</b>
<b>CHAPTER III DEVELOPING A COUNTY OR LOCAL HEALTH DEPARTMENT REGULATIONS AND LOCAL CONSTRUCTION CODE REGULATIONS</b> _____	<b>17</b>
<b>CHAPTER IV DEVELOPING A HANDBOOK OF BEST MANAGEMENT PRACTICES (BMP's)</b> _____	<b>33</b>
<b>CHAPTER V EDUCATION PROGRAM</b> _____	<b>39</b>
<b>CHAPTER VI WELLHEAD MAPPING/GPS/GIS</b> _____	<b>47</b>
<b>CHAPTER VII BIBLIOGRAPHY</b> _____	<b>55</b>
<b>EXHIBITS</b> _____	<b>61</b>

**EXHIBITS  
TABLE OF CONTENTS**

<b>CHAPTER</b>		<b>PAGE</b>
<b>I-A</b>	<b>MUNICIPAL LAND USE LAW AND WELLHEAD PROTECTION</b>	
	<i>Table of Contents</i>	<i>i</i>
	<i>Municipal Land Use Law and Wellhead Protection</i>	<i>1</i>
<b>I-B</b>	<b>MODEL DRAFT MUNICIPAL ORDINANCE</b>	
	<i>Abstract</i>	<i>i</i>
	<i>Overview</i>	<i>ii</i>
	<i>Draft Model Municipal Ordinance</i>	<i>1</i>
	<i>Appendix I-B.1: Application Checklist</i>	<i>23</i>
	<i>Appendix I-B.2: New Jersey Safe Drinking Water Act</i>	<i>25</i>
	<i>Appendix I-B.3: Form for Annually Updated List of Wells</i>	<i>27</i>
	<i>Appendix I-B.4: Application Review Form/Site Inspection List</i>	<i>28</i>
	<i>Appendix I-B.5: A Method for Evaluating Ground-water Recharge Areas</i>	<i>34</i>
	<i>Appendix I-B.6: Signage/Posting Locations BMPs</i>	<i>38</i>
<b>I-C</b>	<b>THE NEW JERSEY STATE DEVELOPMENT and REDEVELOPMENT PLAN (GROUNDWATER POLICY EXCERPT)</b>	<b>1</b>
<b>II-A</b>	<b>DRAFT MODEL MUNICIPAL LAND USE LAW AMENDMENT</b>	
	<i>Abstract</i>	<i>i</i>
	<i>Background</i>	<i>i</i>
	<i>Draft Model Municipal Land Use Law Amendment</i>	<i>1</i>
<b>III-A</b>	<b>MODEL DRAFT BOARD OF HEALTH ORDINANCE</b>	
	<i>Abstract</i>	<i>i</i>
	<i>Overview</i>	<i>ii</i>
	<i>Ordinance</i>	<i>1</i>
	<i>Appendix III-A.1: Annual Notice Wellhead Management Certificate</i>	<i>29</i>
	<i>Appendix III-A.2: BMP Handbook and Signage</i>	<i>31</i>
	<i>Appendix III-A.3: Pre-Application Checklist</i>	<i>42</i>
	<i>Appendix III-A.4: Local Well Record Amendment Form</i>	<i>44</i>
	<i>Appendix III-A.5: PCW, PNCW and OPCW Well Listing for (Year)</i>	<i>45</i>
	<i>Appendix III-A.6: BMP - Pre -Application Review Form/Checklist</i>	<i>46</i>
	<i>Appendix III-A.7: NJ Safe Drinking Water SIC Code List</i>	<i>53</i>
	<i>Appendix III-A.8: Method for Evaluating Recharge Areas</i>	<i>55</i>
<b>IV-A</b>	<b>SOUTHBRANCH WATERSHED ASSOCIATION RESEARCH LIBRARY OF BEST MANAGEMENT PRACTICES</b>	<b>1</b>

**EXHIBITS  
TABLE OF CONTENTS**

<b>CHAPTER</b>		<b>PAGE</b>
<b>IV-B</b>	<b>BEST MANAGEMENT PRACTICES HANDBOOK FOR WELL OWNERS</b>	<b>1</b>
<b>IV-C</b>	<b>BEST MANAGEMENT PRACTICES HANDBOOK FOR LOCAL HEALTH AND PLANNING BOARDS</b>	
	<i>Overview</i>	<i>i</i>
	<i>Handbook</i>	<i>1</i>
	<i>Section I: BMPs for Potable Wells</i>	<i>2</i>
	<i>Section II: BMP Application Review Form/Site Inspection List</i>	<i>8</i>
	<i>Section III: Signage and Postage</i>	<i>14</i>
<b>V-A</b>	<b>THE WELLHEAD PROJECT POLL</b>	<b>1</b>
<b>V-B</b>	<b>PUBLIC MEETING PRESENTATIONS</b>	
	<i>Abstract</i>	<i>i</i>
	<i>Index of Overhead Transparencies</i>	<i>2</i>
<b>V-C</b>	<b>ELEMENTARY SCHOOL SCIENCE LESSON (Grade 4)</b>	<b>1</b>
	<i>Appendix V-C.1: Wellhead Protection Area Best Management Practices Handbook for Students</i>	<i>6</i>
<b>V-D</b>	<b>WELLHEAD HAZARD INVENTORY REPORT</b>	
	<i>Introduction</i>	<i>1</i>
	<i>Survey Letter to Wellowners</i>	<i>3</i>
	<i>Background Information on Potential Pollution Sources</i>	<i>4</i>
	<i>Wellhead Hazard Inventory</i>	<i>5</i>
	<i>Wellhead Pollution Source Inventory Log</i>	<i>7</i>
<b>V-E</b>	<b>PNCW PHONE SURVEY FORM FOR WELL CONSTRUCTION DATA</b>	
	<i>PNCW Owners Phone Survey – 1997</i>	<i>1</i>
	<i>STDS Subsurface Disposal Systems, Chapter 9A</i>	<i>2</i>
<b>V-F</b>	<b>ANNUAL LISTING OF PNCW/PCW OWNERSHIP AND LOCATION</b>	<b>1</b>
<b>VI-A</b>	<b>TYPICAL THEORETICAL WELLHEAD PROTECTION MAP</b>	<b>1</b>

**EXHIBITS  
TABLE OF CONTENTS**

<b><i>CHAPTER</i></b>		<b><i>PAGE</i></b>
<b>VI-B</b>	<b>CLOSE-UP OF EXHIBIT VI-A _____</b>	<b>1</b>
<b>VI-C</b>	<b>PUBLIC COMMUNITY AND PUBLIC NON-COMMUNITY WELLHEAD PROTECTION DATA FORM FOR BOARD OF HEALTH AND PLANNING BOARDS _____</b>	<b>1</b>
<b>VI-D</b>	<b>PUBLIC NON-COMMUNITY WELLS OF THE STUDY AREA _____</b>	<b>1</b>

## **MATERIALS AVAILABLE**

The following materials are available from:

**South Branch Watershed Association  
41 Lilac Drive  
Echo Hill Environmental Education Area  
Flemington, New Jersey 08822  
Telephone: (908) 782-0422.**

1. “Highlands Wellhead Protection Project” Video
2. Zip drive file of all 29 municipal PNCW GIS Maps
3. Municipal Wellhead Hazard Surveys
4. Zip drive file of eight Best Management Practices Posterettes
5. “The Local Wellhead and Aquifer Protection Tool Kit”
  - Model Draft Municipal Ordinance for Wellhead and Drinking Water Aquifer Protection
  - Model Draft Board of Health Ordinance for Wellhead and Drinking Water Aquifer Protection
  - Best Management Practices Handbook for Wellhead and Drinking Water Aquifer Protection
  - Public Meetings - Discussion Guides (Overhead Transparencies)
6. SBWA “Groundwater Resources Library”

## **ACKNOWLEDGMENTS**

**GRANTOR:** New Jersey Department of Environmental Protection, Office of Environmental Planning

**GRANTEE:** Readington Township, Hunterdon County

**PROJECT COORDINATOR:** South Branch Watershed Association: Marie Kneser

**PROJECT CONSULTANT:** T&M Associates: Sean M. Reilly

### **GRANTEE CO-PARTICIPANTS:**

Alexandria Township: Linda Kuhn  
Bethlehem Township: Roberta Morgenstern  
Delaware Township: Eric Fox  
East Amwell Township: Joan McGee, Lawrence Zambrowski  
Kingwood Township: Bill Rawlyk  
Lebanon Township: Josh Rich  
Mt. Olive Township: Kathy Murphy, Charlene Kelley  
Raritan Township: Pat Stover, Bob Kren  
Readington Township: Ron Krauth, Mike Roberti  
Roxbury Township: Tom Vickery  
Tewksbury Township: Jim Bowns, Dana Ulrich  
Town of Clinton: Don Goehe  
Union Township: Larry Carlbom, Dick Hess  
Washington Township: Paul Krylowski  
West Amwell Township: Marshall Werner

### **SUPPORTING AGENCIES:**

Hunterdon County Health Department: John Beckley, Director  
Hunterdon County Planning Department: John Kellogg, Director  
Morris County Planning Department: Ray Zabihach, Director

### **TECHNICAL ADVISORY COMMITTEE:**

Association of New Jersey Environmental Commissions: Candace Ashman  
Elizabethtown Water Company: Anthony Matarazzo  
Environmental Education Fund: Marie Curtis  
New Jersey Builders Association: Nancy Wittenburg  
New Jersey Business and Industry Association: Jim Sinclair  
New Jersey Department of Agriculture: Ferdows Ali  
New Jersey Fuel Merchants Association: Fred Sacco  
New Jersey Society of Municipal Engineers: Robert Lorentz  
Passaic River Coalition: Anne Kruger

Rutgers, Department of Geography: Robert Hordon  
Upper Raritan Watershed Association: Dave Peifer  
USDA Natural Resource Conservation Service: Tom Drewes  
Penelope Althoff, Interested Public  
Jessica Sanchez, Interested Public

**THE FOLLOWING HAVE MADE SPECIAL CONTRIBUTIONS TO THIS  
PROJECT:**

Barbara Grandin, Bruce Harrison, Robert Hordon, Ronald Krauth, Rick Lathrop, Patty Leidner, Ella Phillipone, Doug Schleifer, Caroline Swartz-Armstrong, and Mary Jane Trimmer for a variety of technical and support services.

**Interns:** Greg Boulbol, Pat Claxon, Tracey Lawson, Kim Nye, and Tracey Wrubel.

**NJDEP Representatives:** Tom McKee, Brenda Jogan, Robert Canace, and Bruce Goldberg

**Typing and Editing:**

Thanks to Winnie Fatton of SBWA, Laura McCabe and Shirley Howard, T&M Associates, and Linda Familant  
Thomas A. Thomas, P.P., A.I.C.P., final editing of report and model ordinances

**Mapping and Graphics:** T. Andrew Thomas, P.P., A.I.C.P., T&M Associates, Suzy Hess, Hunterdon County Planning Board

**Video:** Hunterdon Central High School, Channel 14, Mr. Dave Kelber

**G.I.S. Map Plotting:** Vertices, Highland Park, New Jersey

**Report Author:** Sean M. Reilly, Sr., T&M Associates, MaryPaul Laboratories

<b><u>Contacts:</u></b>	T&M Associates	South Branch Watershed Association
	11 Tindall Road	41 Lilac Drive
	Middletown, NJ 07748	Flemington, New Jersey 08822

Marypaul Laboratories  
P. O. Box 952  
Sparta, NJ 07871

## ABSTRACT

**The Highlands Wellhead Protection Project's overall objective was to develop working model tools necessary for local governments to protect wellhead recharge areas of drinking water wells, in communities underlain by hard fractured rock geology.**

The Project's specific tasks were to research, develop and draft:

- 1) Working model local wellhead protection ordinances for Planning Boards and Boards of Health.
- 2) Working model state legislation to amend the Municipal Land Use Law to encourage wellhead protection.
- 3) Compile a Best Management Practices handbook for Wellhead Protection.
- 4) Prepare local wellhead maps which identify Public Non-Community Wells (PNCW's) and their estimated wellhead protection areas.
- 5) Initiate an education program with the fifteen actively participating communities.

The study area included twenty six (26) municipalities in Hunterdon County and three (3) in Morris County. This geographic area is divided between the Highlands and the Piedmont geologic provinces. All the communities are underlain by hard crystalline or sedimentary rock, and two are also partially underlain by Buried Valley aquifers. The area is predominantly a suburban/rural area with a collection of a dozen or so densely populated boroughs or villages concentrated along the principal transportation corridors in the region. Most of the communities rely entirely on local groundwater for their water supply. A few communities, mostly the boroughs, have limited public water supply service areas. A few of these public water supplies are serviced by surface water or wells located outside the municipal geographic boundaries.

The Project found, as a general rule, that there is a low level of local interest or concern in the need for a wellhead protection regulatory program unless there is some current well contamination or well water supply issue capturing local officials' attention. Furthermore, since there is no required registry or listing maintained by local, county or state agencies of contaminated individual wells, Public Community Wells or Public Non Community Wells, or contaminated aquifers, it is very difficult to obtain a specific picture of a municipality's current well problems or any trends. Public Non-Community Wells generally serve free-standing facilities i.e., private schools, offices, and businesses, and therefore, when one is contaminated, it creates an individual isolated hardship, but does not become a community-wide concern unless it serves a school or other public facility. As a result, there is little or no public movement to establish a process to prevent these occurrences.

The overall finding, after two years of study, research, education, and public presentations, is that the general public and elected and appointed officials in suburban and rural communities know very little about the nature of their aquifers and the realistic availability and reliability of the current and future water supply. Furthermore, since there are presently very few cases of public or private well contamination or wellfield depletion, most local governments have

generally taken very few concrete steps to study, document or protect the aquifers and wells from general contamination by hazardous contaminants or from use in excess of the natural rainfall recharge cycle, i.e., Dependable Yield.

The Project's overall conclusion is that a long term educational program is needed in all groundwater dependent communities. Community residents need to understand that the community drinks the naturally clean untreated water out of the fractured rocks, sand, and gravel beneath its streets, lawns, septic tanks, parking lots, business districts, and school yards, as if inserting a straw and sipping it out over a period of time.

This type of simple common-sense understanding may more clearly bring into focus the need for community-wide participation in wellhead and aquifer protection from the local car repair garage, the small freestanding manufacturing facility, the local Department of Public Works garage, and the local elementary school, to the individual homeowner.

In response to these findings, the Project has developed a series of specific recommendations, local ordinances, an amendment to state legislation, local maps depicting Public Non-Community Wells (PNCW's), and a set of easy to understand and implement wellhead protection Best Management Practices (BMP's) for use by every well owner.

**CONDENSED REPORT  
“THE TOOL KIT”**

The primary thrust of this Wellhead Protection Project was to develop action-oriented tools for use by local governments to protect Public Non-Community Wellhead Areas and the Drinking Water Aquifers which are the source of local supplies. To provide an educational program on wellhead protection, the Project developed a condensed version entitled “The Local Wellhead and Drinking Water Aquifer Protection Tool Kit.”<sup>+</sup>

The Tool Kit contains the distinct products which were developed to assist local governments in wellhead and drinking water aquifer protection. It includes:

- Model Draft Municipal Planning Ordinance
- Model Draft Board of Health Ordinance
- Best Management Practices Handbook
- Public Meeting Discussion Guides (Overhead Transparencies)
- A video of a typical public meeting presentation

---

<sup>+</sup> Available for a fee from SBWA.

*The video of a standard local public meeting presentation using these overheads is available on loan from the South Branch Watershed Association, Inc. (SWBA).*

## **INTRODUCTION**

Based on evidence which showed a trend of increasing contamination of the nation's water supplies, the US Congress, under the terms of the Federal Safe Drinking Water Act, directed the US Environmental Protection Agency (USEPA) to develop programs to protect the nation's water supply. The USEPA then directed the states to develop programs to protect the areas around wells utilized for public water supplies.

The New Jersey Department of Environmental Protection (NJDEP), based on this federal requirement and the New Jersey Safe Drinking Water Act, has begun to locate, map, and improve their regulatory programs in the wellhead recharge areas surrounding the 2,500 +/- Public Water Supply Wells (PCW's) in the State.

Furthermore, NJDEP has provided grants to a variety of public and non-profit organizations throughout the State in an effort to generate innovative management strategies to protect the approximately 5,000 Public Non-Community Wells (PNCW's) which serve the public, but are not public water supplies, i.e., schools, offices, restaurants, institutions, etc.

The "Highlands Wellhead Protection Project" is one of the demonstration grants funded by NJDEP as an outgrowth of the mandate in the Federal "Safe Drinking Water Act" to protect public drinking water supplies. The project was funded under the State's Wellhead Protection Program developed by NJDEP's Office of Environmental Planning. The grant amount was \$100,000, with a required 20 percent local matching contribution of cash or in-kind services. The purpose of the Project was to develop tools to assist local governments in protecting wellhead recharge areas in hard rock aquifers.

Readington Township, with the assistance of the South Branch Watershed Association and T&M Associates, applied for the study grant on behalf of a consortium of environmental commissions from 15 townships. The commissions agreed to provide a portion of the required 20 percent matching funds or in-kind services.

Additional in-kind services were provided by the Hunterdon County Health Department and Planning Board, the Morris County Planning Board, the South Branch Watershed Association, Rutgers University through a USEPA-funded study, T&M Associates, and Hunterdon Central High School's – HCTV Channel 14.

Readington Township retained the services of T&M Associates, civil and environmental engineers and planners, as the prime contractor, and the South Branch Watershed Association as the project coordinator.

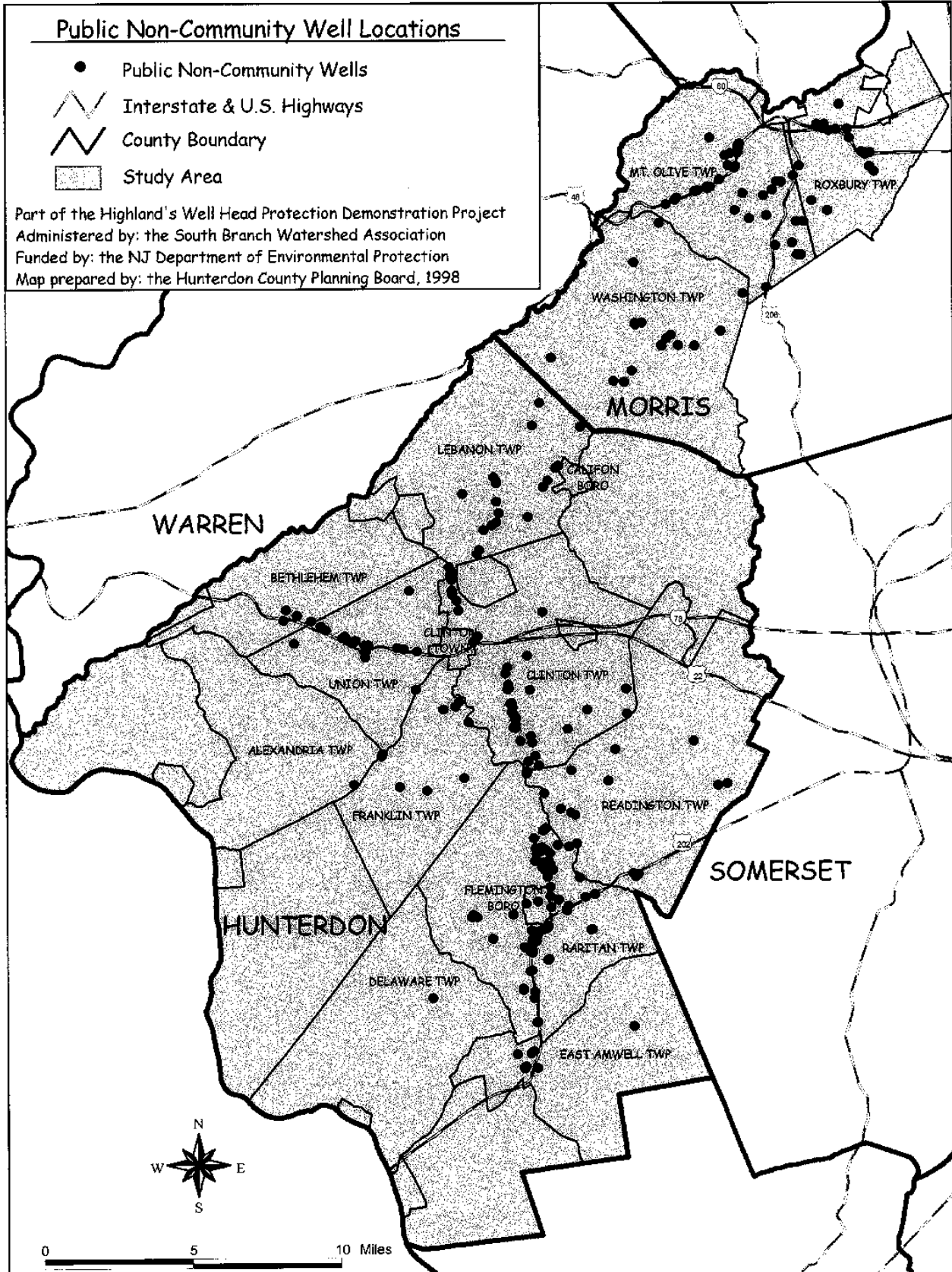
The project was initiated in July of 1995. The research was completed in March of 1998. This report represents the culmination of the efforts of the two-year study known as the "Highlands Wellhead Protection Project." The Highlands Wellhead Protection Project had seven major tasks deliverables. Each task and deliverable is summarized in one of the seven

Chapters of this Report as follows:

- Chapter I      Developing a Model Municipal Wellhead Protection Ordinances
- Chapter II     Developing a Model Wellhead Protection Enabling Legislation for Planning Boards
- Chapter III    Developing a Model Board of Health or Construction Official Ordinances for Wellhead Protection
- Chapter IV    Developing a Best Management Practices (BMP) Handbook
- Chapter V     Developing a multi-faceted Wellhead Protection Education Program
- Chapter VI    Mapping of all the known Public Non-Community Wells (PNCW's) and Overlay Draft Wellhead Protection Areas
- Chapter VII   Bibliography
- Appendix     The Appendix contains all the work-product exhibits
- Deliverables   Each of the twenty-nine municipalities received three (3) copies of their PNCW Draft Wellhead Protection Planning Area Maps.

Each of the fifteen participating Environmental Commission Communities received a Wellhead Potential Pollutant Hazard Report on its public non-community wells.

Hunterdon County -- 26 Municipalities; Morris County -- 3 Municipalities



NOTE: This map does not depict the most current PNC well list.

*This page left intentionally blank*

## CHAPTER I

### TASK I: “DEVELOP A MUNICIPAL ORDINANCE”

#### 1. OVERVIEW

The overall objective of Task I was the development of an ordinance to be used by the local Planning Boards to protect Public Non-Community Well (PNCW) wellhead areas.

Definitions: Public Non-Community Wells are categorized as “non-transient” or “transient”.

A “non-transient” Public Non-Community Well is one that regularly serves at least 25 of the same persons more than six months a year, but is not a public community water supply serving residences. These facilities would typically be schools, places of work, and other freestanding public and private facilities which are not part of a public water supply system.

A “transient” Public Non-Community Well is one which serves at least twenty-five different (transient) individuals daily for 60 or more days each year.

The Project staff quickly determined from polling, public discussions, review of the relevant literature, meeting with agency officials and mapping of PNCW’s that limiting the scope of the study to only +/- 430 public non-community wells in the 29 municipalities of this region which also contains +/- 40,000 individual domestic wells, was an inadequate management strategy.

If the project only focused on the small number of Public Non-Community Well wellhead areas in each community, the balance of the community’s individual wellhead areas and the remainder of the untapped aquifer areas would remain vulnerable to happenstance pollution. On average, there are only 15 PNCW’s per municipality.

Furthermore, PNCW’s serve only a limited percentage of the population of each community and virtually none of its residential population. They do, however, daily serve most of the children of each community in public and private schools.

Based on these initial findings, a decision was made to consider the development of comprehensive drinking water protection ordinances which not only focus particular attention to PNCW’s and PCWs, but also protect the drinking water aquifer in its entirety, especially wherever land use involves the use of hazardous substances, is located in a groundwater dependent community.

The balance of Chapter One sets forth our general findings, conclusions and recommendations. Exhibit I-B presents the model ordinance which was developed from this research.

**I - A. Deliverable A: RESEARCH – “DOES THE NEW JERSEY MUNICIPAL LAND USE LAW PERMIT WELLHEAD OR AQUIFER PROTECTION AT THE LOCAL LEVEL?”**

The Municipal Land Use Law NJSA 40:55D-1 et seq., permits the use of zoning and development controls to protect human health, safety, and welfare and to manage natural resources (See Exhibit I).

The adoption of a local ordinance, pursuant to the Municipal Land Use Law (MLUL), to protect the drinking water supply of a community is a valid use of the municipal police power. Several municipalities throughout the study region have used the land use law to increase lot sizes based on the estimated safe water supply yield of the aquifers serving the zone. Other municipalities have increased lot sizes in order to provide for adequate dilution of septic effluent for the purpose of maintaining high ground and surface water quality.

**I - B. Deliverable B: “CONDUCT A CASE LAW SEARCH”**

A “Westlaw” search did not reveal any cases in New Jersey specifically on point of the local planning boards using their authority to protect aquifers, groundwater, wellhead recharge areas or safe sustained yield. This appears to be an untested area.

**I - C. Deliverable C: “DEVELOP A MODEL ORDINANCE”**

Prior to drafting an ordinance, a determination had to be made of the water supply utilization and risk characteristics of the Highlands region.

The following facts provide a profile of the Highlands geographic region with respect to its groundwater-water supply and utilization and its development characteristics.

- The Highlands region, like most of the rural area of New Jersey, depends totally on local groundwater aquifers for its drinking, commercial and industrial needs.
- There are approximately 430 Public Non-Community Wells (PNCW’s) in the Highlands study region at this time. Most of these wells serve small businesses, schools and restaurants. The largest water users in this category are the public schools and a few large employers.
- The typical depth of the PNCW wells ranges between 150 feet and 300 feet .
- There are several dozen Public Community Wells (PCW) serving the dozen or so villages, town centers and boroughs.
- In general, there are very few wells reported to be contaminated with hazardous chemicals in the hard rock aquifers of the study region. Wells which have been

contaminated and reported, generally have a close proximity to a gasoline station, industrial facility, or automotive repair facility and are the result of accidents, corrosion, or improper waste management practices.

In one glaring case, it appears DOT's historic road salting of Route 31 over a limestone aquifer, has contaminated the aquifer into which a municipality has drilled two 600 foot wells in search of fresh water for its new municipal building. Both wells are contaminated and undrinkable. They now drink bottled water.

- Since most of the hard rock communities do not have central or public water supply systems or dedicated aquifer areas or discrete wellfields, the entire community serves as the drinking water aquifer.
- Almost all of the communities in the Highlands are included in a USEPA designation as a "Sole Source Aquifer" protection area, under the federal "Safe Drinking Water Act," due to their dependence on limited aquifers.
- A few of the Highlands communities have Buried Valley aquifers. These deep sand and gravel aquifers are undergoing extreme development pressures since they lie along or adjacent to major highway networks. Based on the findings of other wellhead protection projects, the static water levels in these wells are dropping and organic compounds are increasingly being detected.
- Only a small number of the Highland communities have a public sewer and water service which serves more than a small portion of the municipality.
- One of the older urbanized towns has "tapped out" its wellfield capacity and has instituted water restrictions and has drilled wells in adjacent municipalities to serve its needs. It can't serve any new customers. It has exceeded the annual rainfall recharge capacity of its wellfields.
- A typical developed property, outside of a village or town center, contains a well, septic system, and an underground heating oil tank. There are an estimated 40,000 properties within the study region's 29 municipalities which meet this description. Most are individual homes.
- The study region is suburban/rural in character, with town centers or village centers located at major county or state road intersections. The area, like much of New Jersey, outside of the New York and Philadelphia metropolitan regions, began to grow substantially in the post-1945 period.
- In general, there are very few manufacturing facilities in the Highlands communities. Future growth in the areas will be residential, office, light industrial, warehousing and strip malls. The big anchor shopping centers will be located in areas served by public sewers and public water from large capacity groundwater wells.

- Historically, municipalities in New Jersey, including the hard rock aquifer regions of the Highlands, have inconsistently and indirectly used their zoning and land use development control powers to protect their drinking water aquifers. The best way to describe local efforts in this area is a highly variable patchwork quilt across the region.
- It is extremely rare to find a municipality which has a map in its Master Plan which depicts the various aquifers and their estimated yields, upon which the overlying zoning depends; however, several townships are working in this direction.
- The general citizenry has a poor concept or limited knowledge of groundwater, aquifers, rainwater recharge, safe sustained yield, or wellhead protection needs.
- Each municipality has hundreds or thousands of these types of unmanaged sources of groundwater pollutants, some percentage of which will leak and go unnoticed each year.
- There are no functioning, viable state or local programs which govern or manage the manner in which the thousands of hazardous substances or toxic wastes which are held in “small” above-ground storage tanks of 2,000 gallons or less. There is no “Best Management Practices” program at any level of government. There is only “after-the-spill” enforcement.

## **2. CONCLUSIONS**

### **a. General Conclusions**

There are +/- 430 Public Non-Community Wells (PNCW's), a few dozen Public Community Wells (PCWs) and +/- 40,000 individual domestic wells in the study region. A pattern of spread-out use of the aquifer by low density zoning is typical for the Highlands and can be expected to continue except for a few town centers, the commercial strips along the major highway corridors and certain Buried Valley Aquifer areas.

The nature of rural/suburban development in the Highlands area does not lend itself to the development of large public sewer or water systems.

The most serious and immediate threats to the quality of groundwater which will continue into the future are one or a combination of the following:

- The lack of any specific municipal “prevention program” focused on protecting wellhead recharge areas or aquifer recharge areas from potential chronic low level discharges of hazardous substances from businesses;
- The reliance on septic systems in fractured rock aquifers without any type of continuing health and safety consumer education or management;

- Very little zoning based on the “safe sustained yield” capacity of the underlying aquifer in each zone. This will have an future impact of increasing the concentration of contaminants which will get drawn into the depleted aquifer area.

**b. New Jersey Municipal Land Use Law**

The New Jersey Municipal Land Use Law permits the protection of ground water supplies as a legitimate public purpose.

**c. Case Law**

There is no case law as yet specifically on point of municipal wellhead protection or aquifer protection land use or development regulation programs.

**d. Local Planning and Development Regulations**

There is a need for municipal planning and development regulations to protect wellhead and drinking water aquifers.

**e. State Planning**

The State of New Jersey’s “State Development and Redevelopment Plan” encourages the protection and management of “Groundwater Aquifers” with ten (10) distinct policies. Unfortunately, most “Drinking Water Dependent Communities” do not have these policies integrated into their municipal landuse plans, over which they have control and autonomy. (See pages 64-65 of the New Jersey State Development and Redevelopment Plan included as Exhibit I-C).

**3. RECOMMENDATIONS FOR THE PLANNING BOARD**

**a. Master Plan Mapping**

In order to begin to manage the protection of its drinking water resources, a municipality must know and understand the nature and limits of its water supply and the location of hazards which pose a risk to the supply.

The following are a series of essential mapping tools which should be prepared for the Master Plan to support the Wellhead Protection and Drinking Water Aquifer Protection Programs and other basic zoning decisions based on the capability of the aquifers to reliably supply water in the future.

1) Municipal Geology Map

Every groundwater dependent municipality should obtain and adopt a Municipal Geology Map based upon the State Geology Map. The State Geology Map can be obtained from NJDEP in paper or digitized electronic format. It will require some

professional work to excerpt out a specific municipality from the digitized format. *NOTE: This work is in progress with the help of skilled GIS volunteers working for the South Branch Watershed Association and the Hunterdon County Planning Board.*

2) Municipal Drinking Water Aquifer Map

Based on the municipal Geology Map, municipalities should prepare and adopt a Municipal Drinking Water Aquifer Map. The Municipal Drinking Water Aquifer Map is a graphic or color coding of the various geologic formations into individual units or groups of rocks with similar water bearing characteristics based on state or local databases (consult with NJDEP). This map will serve as an educational tool as well as part of the basis for any type of “Safe Sustained Yield” “Dependable Yield” or “Carrying Capacity” zoning and development regulations. The NJDEP Geological Survey has prepared a “Bedrock Aquifers Map” for Hunterdon County and other portions of the state.

Municipalities should identify and map any portion of the municipality which has “Special Aquifer Area” characteristics, i.e. fault lines, limestone sinkholes, buried valley aquifers, etc., and add these geographic areas to the Municipal Geology Map.

3) Wellhead Protection Area Map

Municipalities should prepare and adopt a map which locates Public Community Wells (PCW) and Public Non Community Wells (PNCW) and their wellhead protection areas (or interim protection – planning areas).

a) Wellhead Location and Wellhead Protection Area Maps can be plotted on lot map, land use maps, tax maps, or a GIS map using global positioning (GPS) technology. *The precision of the location of each well on the map is not as important as the general information it depicts and the type of review it triggers at the Planning Board.*

b) In order to immediately implement a Wellhead Protection Program, the Planning Board can adopt tax lot and block well ownership lists produced by the Health Department and require certain regulated applicants to accurately plot all PNCW’s or PCWs within 500 feet or some other specified distance from a newly proposed regulated use.

4) Potential Drinking Water Aquifer Hazards

The Board should begin a process of preparing a map code and key which provides the location of known facilities which are permitted by NJDEP or other state or federal agencies that typically regulate hazardous materials and/or toxic wastes. The NJDEP is in the process of preparing GIS maps of all of the various facilities for which it provides permits. The municipality will eventually have access to this data and can add it to any of its own GIS maps.

The Planning Board can identify those businesses and industries which are generally associated with the handling and storage of hazardous substances and toxic wastes by referring to the Standard Industrial Classification (SIC) list presented in the New Jersey Safe Drinking Water Act at NJAC 7:10A-1.14 – Table II (N) A (see Exhibit I-B, p. 26). The Board may also be able to obtain a list of all the facilities on this list which exist in its community by making a request of the New Jersey Department of Commerce for a listing of all industries within the community organized by SIC Code.

*NOTE: The U.S. Standard Industrial Classification system will be replaced by the North American Industrial Classification System (NAICS) which was approved in November 1997.*

5) Sole Source Aquifers (Federal Designation)

Most of New Jersey is within a Federal Sole Source Aquifer designation. This designation means that more than 50 percent of the population in these areas rely on groundwater for their drinking water supplies, and do not have any viable alternative water supply. The NJDEP does not have individual municipal or county versions of this map. There is just one statewide map. The map is digitized and in hard copy and can be excerpted for local or county use. Most municipalities are wholly within the designation. This is another very valuable Master Planning Map and a legal defense for those municipalities which intend to pursue wellhead protection regulations and “Safe Sustained Yield” or “Carrying Capacity” zoning.

All five of these maps should be adopted into the official Municipal Master Plan Document. These maps are essential ingredients of the model ordinances presented elsewhere in this report.

**b. Subdivision and Site Plan Ordinance**

- 1) Adopt Wellhead Protection Setbacks. A community which relies on groundwater should adopted a subdivision and site plan ordinance to protect all its Public Community Wells and Public Non-Community Wells and existing individual wells with specific setback standards for the handling, use and storage of hazardous substances.
- 2) Adopt Drinking Water Aquifers. A community which relies on groundwater should adopt a subdivision and site plan which specifies Best Management Design/Development Practices for the handling of hazardous substances in any new development located anywhere within Drinking Water Aquifer Areas identified on the Municipal Drinking Water Aquifer Map.

**c. Zoning for Safe Sustained Yield:**

A groundwater dependent community should adopt a zoning and development

regulations ordinance to manage the withdrawal of groundwater so that community development does not exceed the “Safe Sustained Yield.” “Safe Sustained Yield” or “Dependable Yield” are terms which define the maximum sustained groundwater withdrawal which can safely occur from an aquifer during an expected 10 year drought cycle while still maintaining stream flow adequate for stream ecosystems.

Several municipalities have taken action on this concern by increasing the average residential lot size to 3 to 5 acres in portions of the community which are underlain by crystalline rocks with historically low water yields. This type of zoning is also called “Carrying Capacity” zoning. In order to be more scientifically and legally defensible, this type of zoning will require that the Planning Board utilize the latest research studies and publications and records relating to the groundwater yield of its specific types of aquifers within each of the municipality’s watersheds.

Guidance and technical assistance can be obtained by calling the New Jersey Geological Survey (609-984-6587), and utilizing its latest groundwater recharge publication entitled New Jersey Geological Survey Report #GSR-32, A Method for Evaluating Groundwater Recharge in New Jersey (NJDEP, Office of Maps and Publications, 1-609-777-1038).

**d. Model Wellhead Protection Ordinance**

This project has developed a draft model wellhead protection ordinance for use by local Planning Boards which incorporates the principles recommended above. (See Model Ordinance in Exhibit I-B).

**CHAPTER I EXHIBITS**

**APPENDIX**

- I - A**            Municipal Land Use Law Analysis on Wellhead and Aquifer Protection
- I - B**            Model Draft Municipal Ordinance for Wellhead Protection Areas and Drinking Water Aquifer Protection
- I - C**            The New Jersey State Development and Redevelopment Plan - Groundwater Policy Excerpts

## CHAPTER II

### TASK II: “DEVELOP MODEL STATE ENABLING LAND USE LEGISLATION”

#### II - A. Deliverable A: “DRAFT MODEL AMENDMENT TO THE MUNICIPAL LAND USE LAW”

##### 1. FINDINGS

###### a. Existing State Legislation

- The New Jersey Municipal Land Use Law (MLUL) as cited in the findings in Chapter I of this report authorizes municipalities to protect natural resources and assure adequate water supply (NJSA 40:55D-38b and 40:55D-41a). The term “adequate” is not defined; however, it can logically be assumed to mean assuring the quantity and quality of the water supply for the life of the approved project which depends on an aquifer which is “controlled” to varying degrees by the municipality through its land use laws.
- The Municipal Land Use Law only authorizes local municipalities to undertake these water supply assurances; it does not mandate that a municipality undertake these measures.
- Even though most of New Jersey is comprised of Sole Source Aquifer Communities under the Federal Safe Drinking Water Act (meaning that more than 50 percent of the population relies on groundwater for drinking water and does not have any viable alternative water supply), there is no state legislation requiring, encouraging or explicitly authorizing any focused municipal effort to carefully manage the quantity and quality of this critical, finite resource.

###### b. Case Law

The project did not identify any case law in New Jersey on the point of protecting wellheads or potable groundwater supplies pursuant to the authorizations of the municipal land use law.

##### 2. CONCLUSIONS:

- The current New Jersey Municipal Land Use Law authorizes, but does not require local authorities to undertake the protection and regulation of the use of ground water supplies, which serve “in essence” as municipal reservoirs. The authorizing language is so non-specific that it underplays the importance of the issue.

- Most municipal governing bodies have not enacted any specific land use rules or regulations for protecting the quality or quantity of the underlying municipal aquifers or publicly owned or utilized well field areas.
- Except for municipalities which have zoned for large residential lot sizes due to a known history of a limited water availability in a particular rock type, most planning boards simply defer the approval of the public or private water supply to the board of health or to NJDEP.
- Due to the history of traditional planning and zoning regulations, there is often a large gap in the knowledge base and management of groundwater supplies at the local level. In most instances, there is no integration of local planning and the gathering of any scientific evidence on the status of the quality and stability of those portions of the aquifer which have been committed to development. Most wells, after they are approved, drilled and tested, are ignored in the on-going local planning and zoning of the aquifer in which they are located.
- Except for the required 100-foot well setbacks for septic systems, virtually no municipality has developed any procedures designed to limit impervious coverage in wellhead recharge areas or to manage the storage or handling of hazardous substances in wellhead recharge areas.

### **3. RECOMMENDATION**

Based on these findings and conclusions, it is recommended that the Municipal Land Use Law be amended to explicitly authorize (but not mandate) municipalities to:

- Regulate, adopt and enforce general development regulations for the proper storage and handling of hazardous substances and toxic wastes in Wellhead Protection Areas and Drinking Water Aquifer Areas.
- Initiate planning to regulate land use consistent with the “Safe Sustained Yield/Dependable Yield” of the municipality’s drinking water aquifers.

Without this type of explicit enabling legislation, which calls attention to the need for protecting the approximately 5,000 existing Public Non-Community Wells and 2,500 Public Community Wells in New Jersey, little progress will occur in this area. Over time, more and more public use wells will become contaminated, and local governments will look to the State Legislature to fund costly major regional water supply projects to provide local drinking water supplies.

This type of explicit MLUL authorization by the State Legislature will also help protect (from litigation) those municipalities which have taken such forward-thinking protective action, based on sound planning principles and the best available scientific information.

**Model Legislation**

This project has developed a model draft amendment to the Municipal Land Use Law which incorporates the recommendations stated above (see Exhibit II-A).

**CHAPTER II EXHIBITS**

**APPENDIX**

- II-A** Draft Municipal Land Use Law Amendment - This Amendment explicitly authorizes municipalities to prepare planning, zoning and development regulations for the protection of wellhead areas and the utilization of aquifers based on their “dependable yield” or “safe sustained yield”.

*This page left intentionally blank*

### CHAPTER III

#### TASK III: “COUNTY OR LOCAL HEALTH DEPARTMENT REGULATIONS AND LOCAL CONSTRUCTION CODE REGULATIONS”

##### III - A. Deliverable A: “DEFINE THE LEGAL AUTHORITY OF BOARDS OF HEALTH AND CONSTRUCTION CODE DEPARTMENTS”

###### 1. FINDINGS

The objective of this task was to examine the various legal authorities of the Municipal Boards of Health and the Construction Code Departments in order to determine how they could play a role in wellhead protection.

###### a. Local Board of Health Authority

Boards of Health in New Jersey have autonomous powers granted by the State Legislature to develop ordinances and programs to protect public health, safety and welfare. These powers are set forth in Title 26 of the New Jersey Statutes. Boards of Health are the only non-elected bodies in New Jersey with the power to adopt their own ordinances, and levy their own fees.

The statute outlines many specific powers, the first of which is: The local Board of Health shall have the power... “to protect the public water supply and prevent the pollution of any stream of water or well, the water of which is used for domestic purposes”...(NJSA 26:3-31, a.)

The court, in litigation pertaining to NJSA 26:3-31, has liberally construed the power of local Boards of Health (NJSA 26:3-31, Westlaw Note #1) to extend to areas other than those to which the statute explicitly refers.

In some instances, the municipal governing body appoints itself as the Board of Health. Boards of Health must provide certain core services known as “Recognized Public Health Standards of Performance for Local Boards of Health in New Jersey” and set forth in NJAC 8:52 et seq.

Boards can establish their own budgets collect their own fees and hire their own staff. Local Boards of Health present a budget to the governing body which then determines the amount of tax revenue which will be apportioned for public health services.

Local Boards may hire their own staff or establish mutual service agreements with other Municipal Boards of Health. The vast majority of municipalities in New Jersey contract with County Health Departments which have been established by the County Boards of Freeholders to provide the professional services necessary for them to

deliver their core health services. In these instances, the County Board of Freeholders establish a county tax rate for public health services. The local Board of Health may still retain other fee based programs for non-core health programs such as animal licenses, etc.

Occasionally state legislation requires that certain local ordinances adopted by governing bodies or local health agencies must first be reviewed by NJDEP in order to determine consistency with state law. Such state review currently covers the subject areas of noise, septic systems and underground storage tanks (UST) containing regulated hazardous substances, fuels, oils or wastes.

**b. County Health Department Authority**

Nineteen of the twenty-one counties in New Jersey have County Health Departments. These county agencies do not have any legislative authority to adopt health ordinances. One county (Ocean) has a County Board of Health which does have ordinance authority which has been given to it by its participating municipalities. One county (Morris) does not have a County Health Department but does have a Regional Health Commission. This Commission has ordinance authority over those municipalities which have chosen to participate. All other Morris County municipalities have their own Health Departments. Mercer County is the only county without a Health Department or a Regional Health Commission.

The County Health Departments and Regional Health Commissions have one potential authority they may exercise which a local Board of Health cannot. Under the County Environmental Health Act (CEHA) NJSA 26:3A-21 et seq., these agencies may enter into a service contract with NJDEP (New Jersey Department of Environmental Protection) to provide inspection and review services for certain state environmental and regulatory programs. The counties are paid a fee by NJDEP to provide these services.

The County Health Departments which have a CEHA service contract through their Freeholders with NJDEP may even be able to initiate innovative countywide environmental protection programs under the umbrella authority of various state environmental laws, as long as they are not preempted or in conflict with an existing NJDEP program. These powers could be explored for wellhead protection and aquifer protection if a Freeholder Board has an interest.

**c. Construction Code Department Authority**

Local Construction Code Departments operate under the Uniform Construction Code Statute, NJSA 52:27D-119 et seq. Their specific duties are set forth in NJAC 5:23 et seq.

Local governing bodies adopt ordinances to empower the construction code official to enforce the construction code. The construction code officer controls the construction and demolition of most structures. The construction code official conducts his responsibilities with respect to construction or demolition practices or standards according to the New Jersey Uniform Construction Code, (UCC) which is based on the nationally recognized Building Officials and Code Administrators (BOCA) standards adopted by the New Jersey Department of Community Affairs and binding on all construction code officials. The UCC cannot be amended by local ordinance.

The local construction code official issues building or demolition permits for all underground storage tanks (UST's) containing hazardous or flammable materials.

Local construction code officials have been preempted from specifying the construction materials or demolition practices for the installation of UST's containing gasoline or hazardous substances as defined by state law and regulated by NJDEP. However, local code officials still retain authority to specify the materials and installation methods for heating oil tanks which are 2,000 gallons or less in capacity and all residential or agricultural gasoline or diesel UST's.

The New Jersey Department of Community Affairs (DCA), Division of Codes and Standards, oversees the administration of the Uniform Construction Code as it is implemented by local construction code officials. From time to time the DCA issues guidance bulletins on clarifications or interpretations of the Code. DCA has issued several bulletins since 1988 on underground storage tanks. These Bulletins have now been consolidated into Bulletin #95-1.

However, local code officials can choose to ignore the updating Bulletins and issue permits based on the basic code. In such cases, single walled steel tanks can still be installed without cathodic protection, secondary capture, or monitoring wells. This poses future danger when the tank eventually rusts and leaks.

## **2. CONCLUSIONS ON AUTHORITY**

### **a. Local Health Agencies**

Every municipality in New Jersey is required to ensure the delivery of certain minimum health services. This can take the form of a local Board of Health, a County Board of Health, a Regional Health Commission, or the governing body itself. The governing body determines the agency it will contract with or create.

Each of these health delivery agencies has the power and responsibility to adopt programs to assure the provision of an adequate and safe water supply, whether from individual wells, public wells or other public water supplies.

These authorized agencies have the power to adopt and enforce a wellhead protection

and aquifer protection program.

**b. Local Construction Code Agencies**

The authority of local construction code agencies, as it relates to protecting local aquifers and wellheads from contamination by hazardous substances, is limited to their enforcement of the provisions of the Uniform Construction Code (UCC) with respect to underground storage tanks. The UCC regulations cannot be modified or amended by local ordinance.

The local agency has the authority to adopt a policy of using the strictest interpretation of the code and require compliance with DCA advisory bulletins when approving permits to install underground storage tanks. The governing body may adopt an ordinance directing the Construction Code Official to abide by all DCA bulletins with respect to UST's, especially if the community is a groundwater-dependent community that requires the strictest protection.

Following the review of the authority of each of these health agencies, research was undertaken to determine what wellhead protection services it could best perform and drafted ordinance language to achieve it.

**III - B. Deliverable B: “DEVELOP MODEL ORDINANCES FOR LOCAL HEALTH AGENCIES OR CONSTRUCTION CODE AGENCIES”**

**1. FINDINGS**

In order to determine what type of local health or construction permit ordinances might be needed, an evaluation of both local issues and local efforts to protect drinking water supplies was undertaken. The following summarize the findings:

- Presently, most Boards of Health generally have two programs aimed at protecting the quality of the drinking water supply in local aquifers. These are septic system reviews and the issuance of a well permit.
- A few municipalities have recently adopted more rigorous well interference pump tests, in conjunction with the standard well permit.
- Only one municipality in the Highlands study region (Tewksbury) requires a Volatile Organic Compound (VOC) Test. This test is only done on new wells.

- Once wells and septic systems are approved, the Boards of Health do not deal with well or septic system owners until there is a complaint, a contamination event, a voluntary application to repair either type of system, or a well runs dry.
- County Health Departments under an agreement with NJDEP pursuant to the County Environmental Health Act, periodically conduct compliance inspections of the water quality testing records of public non-community wells. (PNCW's). PNCW's serve more than 25 individuals or 15 connections more than 60 days a year, but are not residential supplies. These are typically schools, businesses, restaurants, municipal buildings, institutions, etc. The inspection of records is to ensure that the well owner is in compliance with the quarterly testing required pursuant to the New Jersey Safe Drinking Water Act, NJSA 58:12A-1 et seq., as administered under the regulations at NJAC 7:10 et seq. The required quarterly tests include bacteria, nitrates, metals and other schedules for Volatile Organic Chemicals (VOC's), depending on the type of population served by the well. This legislated method of reactive management is protective of public health, but not protective of aquifer quality. The program is designed to react to a problem long after it has occurred, rather than trying to prevent it.
- Except for one township (Roxbury), this study did not uncover any county or local program of education, permitting, inspection or enforcement which is targeted to drinking water aquifer quality in general or wellhead recharge areas in particular. Roxbury Township has adopted a fixed wellhead setback radius around public wells for certain specified activities.
- Interviews with several county and local health officers indicated that there were very few or no known cases of any type of chemical or heating oil product contamination of individual wells, except for the occasional gas station leak.

However, since so few municipalities require Volatile Organic Chemical testing or other chemical scans on individual wells or other publicly used wells which fall below the PNCW threshold, there appears to be no information on low levels of contamination in most municipal aquifers and for the vast majority of wells in current use.

Furthermore, a survey of health officers indicates that they generally do not keep specific well contamination records, annual reports, trend reports or retrievable electronic data on the number or type of well contamination cases or known or suspect causes.

Finally, County Health Department and NJDEP officials do not maintain records of community wells which become contaminated and are taken out of service. Such closures are not required to be reported. As a result, there is no good public information on aquifer quality trends or warning signs of possible contamination for land use officials.

- Virtually every potable well which has been contaminated in New Jersey has been the result of unknown non-point sources of contamination somewhere in the wellhead recharge area. Well and aquifer contamination historically have not been predictable or clearly correlated to a particular land use. Therefore, once well or aquifer contamination is discovered, it is usually years after the discharge event and nearly impossible to prove.
- Since heavy manufacturing is declining in New Jersey, and there are now a wide array of environmental regulatory programs in place at all levels of government, one would expect the frequency and size of new contamination events to be on the decline. However, there are 50+ years worth of soil contamination and dumping areas which will continue to show up in wells even though the original contamination event has long ceased. As a matter of fact, with the increasing water withdrawal from existing and new wells, pollution of these wells may increase as old contamination eventually gets pulled into the well field.
- An examination of the local well permit and approval process discovered that there is no attempt at the Board of Health level to correlate the long term water withdrawal budget with the rainfall recharge budget on-site or in the upslope recharge area, or in the overall watershed in which the withdrawal occurs. Obviously, if the site withdrawal budget exceeds the site's rainfall recharge budget, the site at some point will have to draw water from adjacent properties, streams or ponds, and/or run dry. Rapidly developing communities are increasingly finding that they are outstripping the aquifer's ability to safely support the water supply needs. This is happening in Cape May County, and parts of Camden, Burlington, Monmouth, Essex, Middlesex, and Ocean Counties.

As a result, the NJDEP has had to declare three vast areas of the New Jersey Coastal Plain as "water supply critical areas" due to water supply withdrawals exceeding the rainfall recharge budget and causing the infiltration of coastal saltwater into these porous aquifers.

- A recent study by the US Geological Survey (USGS) in the Highlands area study region indicates that if the projected future demand for groundwater in the headwaters of the South Branch of the Raritan River was accommodated, in all probability, the Drakes Brook, a large trout stream, would have its entire low flow drawn into the aquifer and dry up during a drought period. (Nicholson, R.S., McAuley, S.D., Barringer, J.L., and Gordon, A.D., 1996, "Hydrogeology of, and ground-water flow in, a valley-fill and carbonate-rock aquifer system near Long Valley in the New Jersey Highlands." U.S. Geological Survey Water-Resources Investigations Report 93-4157, 159 p., 3 pls. [1-609-771-3933])

- Since about 1945, several hundred thousand individual wells have received permits and been drilled in New Jersey. However the records have been recorded on sometimes illegible paper copies at the state. The bottom carbon copy is filed with the county and is often unreadable. All of these valuable data on aquifer geology, static aquifer water levels and pumping levels are essentially unsortable and unusable, as they are currently filed at NJDEP and the counties. As a result, New Jersey, as a whole, is almost completely in the dark with respect to understanding what has happened to the aquifer water table in the past half century of intense development in groundwater dependent communities. It is still simply hit and miss until the next sustained drought shows us the blind spots.

The present system of well record collection is still hand-written, on partially legible 4-part carbon paper copies filed with the NJDEP and County Health Departments. No sortable electronic storage and retrieval systems are being required of well drillers. NJDEP is preparing to implement an electronic recording (scanning) of a portion of the well record. The well location, number, depth and capacity will be recorded in a sortable format. However, discussions with NJDEP officials indicate that often the driller does not do a pump test and does not record static water level. As a result, the two most scientifically valuable pieces of information on aquifer status will not be included in the electronically retrievable system proposed by the Department.

The proposed system that NJDEP is poised to implement has not been designed with any water resource management objective in mind – it is purely a clerical system of retrieval of points which can be grouped in various configurations or eventually plotted on a map. This is a valuable management system which is under utilized.

- The Highlands Study Area, in general, is low density suburban or rural in character and, as such, home heating is fueled by heating oil stored in underground storage tanks (USTs). There are an estimated 30,000 to 40,000 heating oil USTs in the study region.

Virtually all of these tanks are less than 2,000 gallons in capacity, are not regulated by NJDEP, are single-walled steel, and will almost certainly fail during the lifetime of the dwelling or property they serve.

The failure rate of older oil tanks being removed as a result of real estate transactions is in the range of 15-17 percent, according to one local tank contractor in the Highlands. However, a poll of several local and county health officers indicated that there were no known cases of a leaking home heating oil tank contaminating the home well.

Local construction officials indicate that they issue UST permits for heating oil tanks (those unregulated by the NJDEP) according to the Uniform Construction Code and the latest advisory bulletins published by the Department of Community Affairs. The only way the system may be subverted is if a developer or home builder obtains one

overall construction permit for the project and installs tanks which do not meet the latest bulletin recommendations.

Several local construction officials indicate that, to the best of their recollection, all new and replacement heating oil tanks have been placed in basements, garages, or otherwise aboveground. It appears this trend to aboveground tanks is being driven by the legal and banking considerations in the real estate transaction marketplace.

## **2. CONCLUSIONS**

### **a. Local Boards of Health**

Based on the study findings above, the following conclusions can be made about the role of local Boards of Health with respect to their capability and interest in enacting a wellhead and drinking water aquifer protection program. (NJSA 26:3-31)

- 1) They have the necessary ordinating authority to develop and implement a comprehensive wellhead protection program.
- 2) They are mandated to protect the public's health and safety with respect to adequate and clean domestic water supply.
- 3) They have the existing administrative process and county or local staff in place to conduct a wellhead protection program.
- 4) As a general rule historically, Boards have not initiated preventative public health programs geared to wellhead protection or broad aquifer protection.
- 5) Without a direct public health/disease correlation with respect to contaminated water, i.e., infection, Boards have deferred to environmental agencies to enforce general soil, water, and air contamination cases after contamination has occurred.
- 6) Even though environmental and health scientists have been working continuously for over a decade to develop standards for Maximum Contaminant Levels (MCLs) in drinking water, local Boards of Health generally have not started any type of "preventative medicine" program to rigorously protect drinking water aquifers to insure to the greatest degree practicable, that they won't become contaminated with chemicals which may be deleterious to human health.
- 7) There are very few documented cases of chemically contaminated individual domestic wells or public non-community wells. This could be because there is little contamination in rural suburban residential areas or because most individual wells are never tested for hazardous substances or because contamination of the upper aquifer has not yet been drawn deeply enough into wellhead recharge areas.
- 8) There is no agenda or leadership interest among Board of Health Associations or Health Officer Associations on the issue of developing preventative programs to

protect drinking water supplies being drawn by wells. Their agendas are filled with other priorities dealing with communicable and infectious diseases and various health inspection codes.

- 9) Because only a few private and small PNCW's may be discovered to be contaminated in each municipality each year and they are isolated from each other, these occurrences are seen as private matters and do not generate public interest in prevention programs.
- 10) Because the rural, suburban, and small communities of the Highlands Region still have clean, relatively untapped and individually utilized groundwater supplies, it appears that Boards of Health, in general, do not yet see the need for "preventative medicine" programs for protecting aquifers which are used as the municipal supply via thousands of wells in each municipality.
- 11) The last 50 years of well records, containing valuable groundwater aquifer data, has been collected by drillers in a poor format and lies unused by local agencies in their groundwater policy and permitting functions. These data continue to be collected in an unusable format, in effect wasting millions of dollars of free deep drilling information on the potable aquifers of New Jersey each year.
- 12) Unfortunately, it appears historically that local and state government(s) need a crisis in the form of a sustained drought or major contamination or a cancer cluster scare in order to take definitive, comprehensive and immediate action even on an issue as serious as assuring a safe, sustainable local groundwater supply. The jury is still out on whether local Boards of Health will take up wellhead and aquifer protection as a public health prevention program before there is a problem.

**b. Construction Code Agency**

The following conclusions can be made about the role of construction code officials with respect to carrying out some aspects of a wellhead protection program.

The opportunity for construction code officials to become involved in wellhead protection is limited to issuing construction permits for USTs which may be located in specific wellhead recharge protection areas or drinking water aquifer areas, or special aquifer areas.

Municipalities have the power to adopt an ordinance directing the construction code official to enforce the strictest codes and setbacks to protect wellhead recharge areas and sole source aquifers. The authority to take this type of action to protect water supplies from contamination rests with the general police powers of the municipality.

Local construction code officials have reported with unanimity that new or replacement heating oil tanks are all being placed above ground. This trend appears to be driven by the banking, insurance and consumer interests in reducing the potential economic risk associated with an underground storage tank.

### **3. RECOMMENDATIONS**

#### **a. Board of Health Recommendations**

The Highlands Study Area region, like the vast majority of the New Jersey groundwater dependent municipalities, needs a widely targeted education program on the issue of wellhead protection practices, the adoption and dissemination of Best Management Practices for the handling and storage of hazardous substances and a program to issue well water withdrawal permits based on a percentage of the average recharge capacity of the aquifer in the watershed in which the well is located.

The local Boards of Health have the broadest and clearest mandate to assure a clean and adequate water supply for communities that are dependent on groundwater. Based on these findings and conclusions a working Draft Model Ordinance has been developed which can be used in whole or in part to begin a wellhead protection and drinking water aquifer protection program in groundwater dependent communities.

The Model Ordinance has the following components for consideration by Boards of Health:

- 1) Education. Establishing a community-wide groundwater protection and education program which is focused on every well owner. This may be called a “Well Owner Management Certificate Program” or some other similar title referring to responsibility of the owner.
- 2) Set Backs. Require that certain regulated quantities of hazardous substances and activities be set back a specified distance from all wellheads. This is called a “Wellhead Protection Area Program”.
- 3) Inspections. Establish inspections around Public Community Wells and Public Non-Community Wells to assure compliance with the setbacks for hazardous substances and activities (integrate this with existing inspections).
- 4) Adopt a set of Best Management Practices for hazardous substances or activities conducted in a drinking water aquifer area.
- 5) Adopt a well permit review process which assures well owners educational programs and implementation of the Best Management Practices on every property using a well.
- 6) Adopt a municipal Geology Map.

- 7) Adopt a municipal Drinking Water Aquifer Map/Bedrock Aquifers Map.
- 8) Adopt a municipal Wellhead Protection Area Map which depicts Public Non-Community Wells (PNCW's), Public Community Wells (PCW's), and Other Public Use Wells (day care facilities, preschools, etc.), and interim wellhead protection review areas. These areas would be replaced by the actual wellhead protection areas assigned to each well based on NJDEP adopted formulas.
- 9) Establish an electronic data file for well permit data for use by local, county, and state agencies in ongoing local planning and permitting. This would simply be a sortable file of the basic information on the "well record."
- 10) Commission a study of the "safe sustained yield/dependable yield of the local drinking withdrawal from drinking water aquifers vs. annual rainfall recharge within the various watersheds and aquifers within a municipality.
- 11) Adopt an Ordinance which does all of the above. A working draft Model Ordinance encompassing all of the points described above is presented in Exhibit III-A.

**b. Construction Code Department Recommendations**

Local construction code departments have a narrow area of authority which can be brought to bear on protecting wellheads based on their enforcement of the Uniform Construction Code.

The governing body of a municipality can take a visible leadership role in wellhead protection and public education by adopting an ordinance or resolution which emphasizes that the municipality is a groundwater dependent community and that local construction code officials will assist in providing drinking water aquifer protection services by enforcing the strictest Uniform Construction Code guidance with respect to the installation of underground storage tanks which contain gasoline, diesel or home heating oil.

However, since the requirements of the marketplace have forced virtually all new and replacement fuel oil tanks to be placed aboveground, this project determined it was of little value and redundant to propose a model ordinance to replicate what market forces have already addressed.

**III-C. Deliverable C: "MEET WITH COUNTY FREEHOLDERS"**

**1. FINDINGS**

The County Board of Freeholders can be a critical force in developing a widespread wellhead protection and aquifer protection program.

The Board of Freeholders in most of New Jersey's counties enter into service contracts

with their municipalities to provide the local Boards of Health with their professional staffing. The Freeholders also raise the county taxes that fund the County Health Departments, which hire the staff.

Therefore, the most efficient way to develop and deliver a wellhead and aquifer protection program would be to obtain the support of the County Freeholders.

A public meeting was held with the Hunterdon County Board of Freeholders. The presentation to the Freeholders consisted of the 30-minute project overview, utilizing overhead projections, the full scale wellhead and geology maps, and a one page summary of the project's legislative recommendations and options for Freeholder involvement.

The presentation proposed that the Freeholders consider taking a lead in county-wide aquifer protection. The following concepts were specifically presented and explained. It was recommended that the Freeholders consider:

- a. Studying, adopting, and funding a set of county-wide wellhead and aquifer protection services for the local County Boards of Health.

*and/or*

- b. Studying, adopting and funding a countywide aquifer protection program through the County Board of Health, Planning Board, and open space acquisition program.

*and/or*

- c. Supporting a county referendum on the question of initiating a countywide aquifer protection program.

The Freeholders listened intently, but provided no comment on the proposals presented at this first meeting. The press was present, and one article was written.

## **2. CONCLUSION**

This program was too early in its formative stages for the Freeholders to take any action.

## **3. RECOMMENDATION**

The South Branch Watershed Association (SBWA) will deliver the final report and recommendations to the municipalities and the County Planning Board and Health Department. Following these meetings, SBWA will advise the Freeholders that the Project Coordinator will be available for a public presentation of the Project's findings, conclusions, and recommendations upon their request.

**III-D. Deliverable D: “CONDUCT HEALTH AND ENVIRONMENTAL AGENCY MEETINGS”**

Multiple Health Agency interviews and meetings were conducted throughout the project. The meetings were held with the Hunterdon County Health Department, Roxbury Health Department, Mount Olive Board of Health, Ocean County Health Department, NJDEP Office of Water Policy and Planning, and the New Jersey Geological Survey. Interviews were conducted with multiple persons and agencies by phone, including USEPA Region II, Rutgers University, and NJDEP-CEHA Office.

The purpose of these meetings and interviews was to obtain baseline data, facts, opinions, studies, and the experiences of individuals or agencies working in the field.

These meetings helped formulate the basis of our recommended ordinances.

**III-E. Deliverable E: “CONSTRUCTION CODE OFFICIAL MEETINGS”**

Multiple discussions were held with local Construction Code Officials and DCA Code Officials.

The Project research verified that the local construction code is a statewide uniform code which cannot be changed by a local ordinance.

There is specific interest in the section of the Uniform Construct Code which regulates underground oil and gasoline tanks which are not regulated by NJDEP.

Local code officials regulate all heating oil tanks and farm or residential gasoline or diesel tanks.

NJDEP regulates all other underground tanks which contain heating oils for non-residential uses and are over 2,000 gallons in capacity, and all fuels, or hazardous substances.

The present construction code requires all underground fuel or oil tanks to be coated steel tanks or fiberglass tanks. However, the Department of Community Affairs has issued a further Guidance Bulletin which encourages local code officials to require cathodic protection on all steel tanks and monitoring devices on tanks over 1,000 gallons.

Local code officials uniformly confirmed that they require the standards which are recommended in the Bulletin. However, they also uniformly stated that to the best of their recollection no new heating oil tanks or home or farm fuel tanks are being placed in the ground. All these tanks are being placed in basements or garages or outside above ground.

**III-F. Deliverable F: “PRESENTATIONS TO AFFECTED INDUSTRY GROUPS”**

**1. FINDINGS**

Attempts were made to provide workshops to various affected organizations in New Jersey. The groups were as follows:

New Jersey Association of Realtors  
New Jersey Bar Association  
New Jersey Builders Association  
New Jersey Fuel Oil Merchants Association.  
New Jersey Health Officers Association  
New Jersey League of Municipalities

The interest in wellhead protection, in general, appears lukewarm to non-existent for most of these organizations. These organizations have so many existing “hot button” issues of interest that unless this program has the potential to move to the forefront of their agendas, in terms of an economic impact, it will stay a back burner issue.

Presentations were made to the New Jersey Builders Association’s Statewide Environmental Committee, the New Jersey Fuel Oil Merchants Association, and the Morris County Health Officers Association.

**a. New Jersey Builders Association**

The committee felt that although the issue of wellhead protection had merit in the long-term protection of drinking water for their customers, it really was a regional, not a statewide issue that only affected some of their members. Furthermore, their customer base generally did not use Public Non-Community Wells and therefore would not become involved in these type of wellhead issues.

**b. The Fuel Oil Merchants Association**

The Fuel Oil Merchants were narrowly focused on the issue of underground oil tanks. The Association meeting was a statewide meeting of all county and regional representatives. Their concern was that the wellhead program might call for the banning of underground storage tanks in wellhead areas.

The group indicated that the construction code does call for cathodically protected tanks which should prevent leaks due to metal corrosion. The group further indicated that a forced excavation of old underground oil tanks would harm their current remediation service program’s (“HELP”) fiscal stability and drive up remediation costs.

Shortly after this meeting it was announced that the Association's sponsored "leaking tank remediation" service program ("HELP") which was underwritten by A.I.G. Insurance Co. failed and was terminated. Subsequently, the Association has developed a new homeowner "leaking tank" service program to assist heating oil tank owners with leaking tanks.

The new program is called "STEP" (Storage Tank Environmental Protection). The program is offered by participating heating oil dealers to their automatic delivery customers for an annual fee. The program provides up to \$100,000 of leaking tank remediation coverage, with a \$500.00 deductible.

The Association also confirmed that most new fuel tanks are being placed above ground. The organization was cool to any local ordinance which dealt with underground tanks since installation or demolition (but not location) is governed by the Uniform Construction Code.

The organization is working on a legislative proposal to provide loans and grants to homeowners to remove leaky tanks.

**c. Morris County Health Officers Association**

A presentation of the wellhead protection health ordinance concepts was made to this group.

The consensus was that the wellhead protection concept would be accepted or ignored depending on the type of water supply existing in each municipality.

The concept of Boards of Health reviewing well permits based on requiring dedicated "safe-sustained yield" recharge areas was discussed. This was seen as interesting but controversial since it may affect existing zoning use or density.

The draft Wellhead Protection Ordinance will be submitted to this organization upon its completion. A second meeting has been requested to discuss this draft.

**d) Local Boards of Health**

Presentations were also given to five local Boards of Health in an effort to obtain early input in the ordinance drafting process. (The concepts were so new that most of the Boards only asked questions and are awaiting the final drafts to initiate further discussions.)

**2. CONCLUSIONS**

The overall interest in wellhead protection as a preventative health program or water resources protection program is low at the municipal and county level among elected and appointed officials. There is general interest in learning about the issue but little immediate momentum to take any regulatory protective action.

The interest in these programs is also low among various citizen, environmental, health, and business organizations, who have more urgent and immediate issues on their agendas.

### **3. RECOMMENDATIONS**

The ordinances which were developed for the municipal land use planning programs and for local Boards of Health reflect the technical findings of the meetings with these various groups.

These model working draft ordinances can serve as educational tools to initiate dialogue at the various local agencies where there is only lukewarm interest due to more pressing and urgent priorities. If, however, there is no local individual who has the time and interest to attend the local meetings and stir the debate for an extended period of time, it is not likely that any of these ordinances will be adopted.

## **CHAPTER III EXHIBITS**

### **APPENDIX**

**III-A**            Model Draft Board of Health Ordinance for Wellhead Protection and Drinking Water Aquifer Protection

## CHAPTER IV

### **TASK IV: “DEVELOP A HANDBOOK OF BEST MANAGEMENT PRACTICES (BMP’s)”**

#### **IV-A. Deliverable A: “ACQUIRE A LIBRARY OF BMP HANDBOOKS, GUIDES, STUDIES AND REPORTS”**

##### **1. FINDINGS**

The project conducted a search and review of USEPA, NJDEP, and other published Best Management Practices. The result is a library of Best Management Practice booklets, handbooks, and flyers housed at the offices of the South Branch Watershed Association, Inc. The library consists of more than a dozen of the best guides and pieces of educational BMP materials.

Most of the booklets and pamphlets were very detailed and complete in both their analysis of the problem and their recommended solutions.

The most thorough and detailed handbooks are included in the set developed by Rutgers University as the “Home-A-Syst” series. This is a series of Best Management Practices for handling hazardous chemicals and hazardous waste at the consumer/household level in such a way that they don’t gain access to soil and groundwater or surface waters. This series was developed for ground and surface water in the Barnegat Bay Watershed, but is applicable anywhere.

Another excellent guide of common-sense BMPs is presented in the NJDEP published “Groundwater Protection Practices” series dealing with motor vehicle services, roadway de-icing, septic systems, unregulated underground storage tanks, and urban/suburban landscaping.

Finally, NJDEP, in cooperation with other agencies, has published a series of one-page, fold-out flyers, stickers, magnetic stick-ups, bookmarks, etc. containing very readable, eye-catching, simple messages on common sense Best Management Practices.

The best of those reviewed are: the “Clean Water Information Series”; “Non Point Source Pollution”; “Help the Harbor”; “Water Resource Protection Practices” and the “Clean Water Rangers” series.

The single most comprehensive and quickly readable piece is the NJDEP’s “Clean Water Book - Lifestyle Choices for Water Resources Protection.” This is an excellent policy guide for local officials or activists who need a simple, straightforward plan of action on non-point source pollution.

## **2. CONCLUSIONS**

- Most of the materials which were reviewed appeared to be geared to officials, technicians, academicians or specialists in the field, who would be interested in reading this type of detailed, well-thought-out material.
- Some of the best materials cited are too detailed for regular use by a high proportion of the average citizenry.
- It is not likely that the average citizen, or more specifically, the average well owner, will take the time to read a half dozen booklets consisting of four to six 8 1/2 X 11” pages each, to learn how to protect him or herself from a problem he or she does not yet see as a significant danger to themselves or to their neighborhood.
- Given the detailed nature of many of these pieces, it is unlikely that more than one individual at a well site will read it, lessening its potential implementation.
- Most of the information is too wordy or complex to be read by children who drink from the hundreds of thousands of wells in New Jersey, and who could be good advocates for change in environmental attitudes at home, schools, and neighborhoods.
- A few of the NJDEP tri-fold single sheet color brochures could have their title page slightly reworded to be used as excellent wellhead protection mail-pieces for all well owners, children, and advocates for local protection.

## **3. RECOMMENDATIONS**

### **a. The Best Management Practices Library**

A library of published “Best Management Practices” for managing Non-Point Source Pollution has been compiled and filed at the offices of the South Branch Watershed Association. The titles include:

- 1) “Clean Water Information Series” (Each 1 page tri-fold) – NJDEP, 1992
  - a) “Managing Pesticides Around Your Home”
  - b) “Animal Waste”
  - c) “Pesticides”
  - d) “Fertilizers”
  - e) “Motor Oil”
- 2) Other Excellent “Non Point Source Pollution” BMPs
  - a) “Help the Harbor” series (two sided 3 1/2” X 8 1/2”): Several pieces of this series could be easily modified to wellhead protection fliers and the “quick read” style could be used to create more pieces.

- b) “Why Groundwater Should be a Household Word” (1 page 4 fold) published by the Groundwater Foundation – PO Box 22558, Lincoln, Nebraska 68542 – 1995.
- c) **“Water Resource Protection Practices”\***
  - i) **“What is Groundwater?” (1 page tri-fold)**
  - ii) **“What is a Watershed?” (1 page tri-fold) –NJDEP, 1996**
- d) “Groundwater Pollution in New Jersey”  
*NOTE: NJDEP, 1993, Page 3 of this 1993 4-page flier would make an excellent small poster to be hung in garages and home utility rooms.*
- e) “The Clean Water Book.” (92 pages) – NJDEP booklet edited by Kyra Hoffman, circa 1994.  
*(NOTE: This is an excellent starter handbook for municipal officials and local activists who want to initiate local programs to prevent non-point source pollution.)*
- f) “You Can Be Part of the Solution to Pollution.” NJDEP undated. (Fish on the cover.) This is an offsize 5”x5” tri-fold.
- g) **“Groundwater Protection Practices for...” Published by NJDEP, 1992. Each is 6 pages, 8 1/2” x 11”.**
  - i) **Motor Vehicle Services**
  - ii) **Roadway De-Icing**
  - iii) **Unregulated Underground Storage Tanks**
  - iv) **Septic Systems**
  - v) **Urban/Suburban Landscaping**
- h) “Home\*A\*Syst Program” for Barnegat Bay Watershed Series. Prepared by Susan Lance, Rutgers Cooperative Extension, NJDEP, and Ocean County Office of the USDA NRCS, 1997. (Each 10 pages, 8 1/2” x 11”)
  - i) “Drinking Water Well Management”
  - ii) “Stormwater Management”
  - iii) “Yard and Garden Care”
  - iv) “Liquid Fuels”
  - v) “Managing Hazardous Household Products”
- i) “Non-Point Source Pollution” (1 page tri-fold) – NJDEP, the 1989 and 1997 versions)

It is recommended that NJDEP, working with County Health Departments, cooperatively choose which of these non-point source pollution publications is best to use in local mail and school education programs. \*We recommend Items “c” and “g”

on the above referenced list. There is no need to “reinvent the wheel.”

**IV-B. Deliverable B: “DEVELOP A BEST MANAGEMENT PRACTICES HANDBOOK FOR WELL OWNERS”**

The Best Management Practices (BMP’s) Handbooks developed under this project were developed for two different audiences: a) the current general public who own and use wells for their water supply, in homes, schools, or businesses; b) Local Boards of Health or Health Departments and Local Planning Boards.

**a. BMP’s for the General Public**

Historically, once a new well and septic system receives a permit, the well owner never appears again before the Board of Health on a well or septic matter unless the supply has become contaminated. Furthermore, most well owners have never attended their own well and septic permit acquisition hearing – it is done by their builder.

Therefore, most homeowners and business owners do not have an intimate understanding of the workings of their well and septic, and underground oil tank and don’t care to. This is why there is a need to begin to educate these well owners – especially as their systems age. It has now been 30-50 years since the booming growth periods after World War II.

The adoption of a series of Best Management Practices in the form of small, permanent, and recognizable stick-up or hang up posters for the home and business, schools and institutions of government is warranted. This visible tool is essential in order to begin the process of creating a local public health ethic of protecting the community’s drinking water aquifers.

The project concluded that a streamlined non-wordy “marketing tool” was needed to get the wellhead protection message across. A series of water droplet-like graphic, “sky-hook” looking posterettes were designed to be the vehicle to get the message across and keep it in the well owners eyes. These are designed to be small permanent instructional postings to be hung, nailed, stuck or taped to various obvious features on places in all buildings served by well and septic systems.

- 1) Educating the New Well Owner. The logical point at which to begin a new public education process for wellhead protection and aquifer protection is at the issuance of a well use permit by the Board of Health. The Board should provide a copy of the Well Owner’s Best Management Practices Handbook to new well permit applicants.
- 2) Continuing Education for Existing Well Owners. The local Board of Health should adopt a continuing education program for well owners by instituting the annual “Well Owners Certificate” program. This program should include a one-time mailing of this Best Management Handbook to all existing well owners along

with the Annual Drinking Water Newsletter recommended in the model ordinance shown in Exhibit III-A.

- 3) Science Education. Finally, each Board of Health, in concert with the County Health Department and local elementary schools, could sponsor a series of annual drinking water aquifer and wellhead science education activities utilizing these take home posters as the focal point for third or fourth graders.
- 4) BMP Posterettes. The posterettes developed for the project are on electronic disc and can be enlarged or reduced and have new text created for new opportunities.

The posterettes are designed to be attached to sinks, toilets, water tanks, oil tanks, outside faucets, work bench areas, and garden supply areas, etc.

Copies of the eight posterettes are attached in Exhibit IV-B in the Appendix. An electronic disk of the posterettes is available for loan and copying at: SBWA, Echo Hill Park, 41 Lilac Drive, Flemington, New Jersey 08822, (908-782-0422).

**IV-C DELIVERABLE C: “A BEST MANAGEMENT PRACTICES HANDBOOK FOR LOCAL HEALTH AND PLANNING BOARDS”**

**a. Municipal BMPs**

Municipalities have the power to adopt development standards for the handling and storage of hazardous substances within Wellhead Protection Areas and in Drinking Water Aquifer Areas.

Exhibit IV-C presents an excerpt of the Municipal Ordinance developed in Chapter I which establishes Best Management Practices in the form of setbacks and a checklist of Basic Development Standards for uses which handle hazardous substances and/or toxic wastes.

**b. Board of Health BMPs**

Boards of Health should, without question, adopt Best Management Practices for the handling, and storage of regulated hazardous substances based on their threat to Wellhead Protection Areas, Drinking Water Aquifers, or other drinking water sources.

Exhibit IV-C presents a Best Management Practices Handbook for guidance in the handling and storage of regulated hazardous substances and facilities in drinking water aquifer areas.

<b>CHAPTER IV EXHIBITS</b>
----------------------------

**APPENDIX**

- |             |   |
|-------------|---|
| <b>IV-A</b> | SBWA Research Library Bibliography of Best Management Practices for Wellhead Protection and Groundwater Resources |
| <b>IV-B</b> | Best Management Practices Handbook for Well Owners  |
| <b>IV-C</b> | Best Management Practices Handbook for Local Health Boards and Municipalities                                     |

## CHAPTER V

### TASK V: “EDUCATION PROGRAM”

#### V-A/B Deliverables A and B: “INSTITUTE A WELLHEAD MANAGEMENT PANEL”

1. A Wellhead Advisory Panel was convened. The panel invitees were:

Association of New Jersey Environmental Commissions: Candace Ashman, Abby Fair  
Elizabethtown Water Company: Anthony Matarazzo  
Environmental Drilling: Art Becker  
Environmental Education Fund: Marie Curtis  
New Jersey Builders Association: Nancy Wittenburg  
New Jersey Business and Industry Association: Jim Sinclair  
New Jersey Department of Agriculture: Ferdows Ali  
New Jersey Department of Environmental Protection: Kimberly Cenno, Brenda Jogan, Thomas McKee, Terry Romagna  
New Jersey Farm Bureau: Peter Furey  
New Jersey Fuel Merchants Association: Fred Sacco  
New Jersey Petroleum Council: Jim Denton  
New Jersey Society of Municipal Engineers: Robert Lorentz  
Passaic River Coalition: Anne Kruger, Ella Filippone  
Quest Environmental: Darin Vogel  
Readington Township Environmental Commission: Ronald Krauth  
Rutgers, Department of Geography: Robert Hordon  
Upper Raritan Watershed Association: Dave Peifer  
United States Department of Agriculture Natural Resource Conservation Service: Tom Drewes  
United States Geological Survey: Anthony Navoy  
Penelope Althoff, Interested Public (Geologist)  
Jessica Sanchez, Interested Public (Geographer)

2. The Panel met six times over the course of the project. The Panel’s membership represented a wide cross-section of economic, environmental, and governmental interests.

The Panel members provided comment, critique, and encouragement as the various maps, outlines and ordinance drafts were completed.

#### V-C. Deliverable C: “TAKE A POLL”

A poll was developed for the purpose of obtaining some insight into the level of knowledge and understanding of well and groundwater issues of local officials and public non-community well owners. All 400+ PNCW well owners and 197 municipal officials were

polled. A 17 percent response rate was obtained for both groups.

A copy of the poll and its tabulated results is attached in Exhibit V-A. The purpose of the poll was to assist us in designing our education program.

## **1. FINDINGS:**

### **a. PNCW Owners**

The findings were tabulated for each group of well owners and municipal officials. Some of the more significant findings for public non-community well owners were:

- 1) Only 66% (40/60) knew how deep their well was.
- 2) 97% (63/68) did not know how wide an area from which their well drew.
- 3) 35% (22/74) responded that they had less than 25 users per day. (i.e., they were, therefore, not PNCW's)

The use of the PNCW's was about 50 percent employees and 50 percent transient customers.

### **b. Municipal Officials**

The findings for municipal officials indicated there was very little consensus on any of the questions. The following contrasts were observed:

- 1) 70% (19 of 27) indicated they had no knowledge on the distance from which wells drew water.
- 2) 86% (25/29) indicated that property use has an effect on drinking water.
- 3) 80% (25/31) respondents indicated that they did not have or did not know of any local regulations to protect wellhead areas.

## **2. CONCLUSIONS**

It was clear from the results of the two polls that the project needed to develop an education program for well owners and municipal officials that contained factual and conceptual information on the concepts of wellhead recharge areas, well function, aquifer function, and the basic facts on the numerous agencies which regulate the various threats to groundwater drinking water supplies.

## **3. RECOMMENDATION**

The project developed a municipal visual and verbal presentation which addressed the concepts of aquifer function, wellhead recharge, and the various agency responsibilities or lack of responsibility for protecting groundwater with preventative programs, rather than

spill response programs (see Exhibit V-A).

The Education Program materials consisted of:

- A series of overhead projections
- A Geology/Aquifer Map
- A Sole Source Aquifer Map
- A draft Wellhead Protection Map
- An outline of the various ordinance concepts

**V-D. DELIVERABLE D: “DEVELOP A WELLHEAD PROTECTION VIDEO”**

**1. HOME HEATING OIL TANKS CONCEPT (CONCEPT REJECTED):**

- a. The initial concept of a video focused on what was perceived as the biggest potential threat to groundwater – the tens of thousands of underground heating oil tanks, which are steel and aging.

The concept was developed to present a film showing the process of tank removal and remediation by homeowners and small businesses. Key points of emphasis were that once your well is contaminated, your property value plummets, you need special expensive water treatment units, and your homeowner’s insurance doesn’t pay for any of the clean-up or water treatment. This is usually a ten to twenty thousand dollar clean-up, just for the contaminated soil and tank removal. If it gets into the groundwater, the costs skyrocket.

- b. Two problems developed with this video concept. The first problem with the concept was that the local and county health records showed that very few home heating oil tank leaks wind up contaminating the well or groundwater. The heating oil does not dissolve very well in water and gets trapped in the soil near the tank.

The second problem was that the video company could not provide the depth of in-kind service we had needed for this type of video. This pushed the project out of its in-kind services budget of \$5,000.00, and the company declined to participate.

**2. TRAINING ENVIRONMENTAL COMMISSIONERS (CONCEPT ADOPTED)**

After much reflection as to what the best type of educational video might be, the project settled on a training video and overhead transparency kit for Environmental Commissioners and local groups of individuals interested in educating the public and local officials about groundwater/drinking water protection.

The series of overhead projection transparencies consists of:

- Project tasks
- Statewide geology
- The local geology
- Wellhead cones of depression and various configurations of wellhead/protection recharge areas
- Theoretical wellhead protection areas
- Draft wellhead protection areas and time-of-travel concepts

These training transparencies are included in this chapter as Exhibit V-B.

The video is a stand-alone presentation on the concepts of wellhead protection for use with any local audience, i.e., a local Planning Board, Board of Health, township governing body, interest group, or school group. The video's intent is to spark an interest sufficient to stir the viewer into action, and serve as an instructional guide.

Both the transparency presentation and the video presentation include directions on how the various boards can obtain copies of the model ordinances and get informational technical help from SBWA on wellhead protection, aquifer management, and watershed management.

The overhead transparency series is attached to this Report as Exhibit V-B.

The "Highlands Wellhead Protection Project" video is available (on loan) from the South Branch Watershed Association, Inc. (SBWA), 41 Lilac Drive, Flemington, New Jersey 08822. Phone: (908) 782-0422. Copies were also made available to the Hunterdon County Planning Board and Health Department, and to the Morris County Planning Board.

**V-E. Deliverable E: "PRESENT A PUBLIC EDUCATION INFORMATION SERIES"**

**1. FIRST YEAR – "PREPARE PRELIMINARY MAP AND DRAFT ORDINANCE PRESENTATIONS"**

Due to the size of the geographical area served by this project, the meetings were broken up into sub-regions. One meeting center was in Flemington at the Hunterdon County offices, and one center was in the Tewksbury Township Park offices.

The meetings served as the initial introduction of the Project to the 15 participating Environmental Commissions.

## **2. WELLHEAD HAZARD INVENTORY**

- a. A second series of region-wide meetings was held to train the participating Environmental Commissioners on the data recording protocols for a Wellhead Hazard Inventory.

The data gathering “Wellhead Hazard Inventory” forms are included as Exhibit V-D.

Each of the participating commissions conducted a visual inspection of the areas around each PNCW for an estimated distance of 200 feet on either side of the well on the road frontage and 100 feet front and rear of the well.

The forms were filled out and keyed to each well.

- b. These Wellhead Hazard Inventory data are recorded in a separate report for each municipality and the forms used are included as Exhibit V-D in this report.
- c. A well hazard notation is also recorded on each municipality’s draft wellhead protection map as a “Yes” or “No” in a “Hazard” column next to the well name, and map number. The individual report identifies the hazard.
- d. It was hoped the Project could obtain a further in-kind service contribution to plot the various wellhead hazards, using Global Positioning Survey (GPS) technology. This was not possible within the budget and task sequence constraints of this study.

## **3. LOCAL MUNICIPAL PRESENTATIONS**

The initial concept was to have the local Environmental Commissioners make a presentation to the local Planning Board and governing body. This presentation would include the project explanation, the map products and the draft ordinances.

It was discovered that the time necessary to properly train each of the Environmental Commissioners to do this themselves was not included in the project work plan and budget. After one group training session, the project consultant volunteered to conduct the first series of municipal meetings as an additional in-kind service to the project. These local presentations would serve as training sessions for the local Environmental Commissions.

The project consultant, Sean M. Reilly, Sr., of T&M Associates, conducted twelve local meetings before Township Committees, Planning Boards, and Boards of Health, at regular public meetings. These were: West Amwell, East Amwell (2), Kingwood, Lebanon, Union, Mt. Olive, Clinton, Bethlehem, Alexandria, Raritan, Readington and Washington Townships.

The presentations consisted of a 45 to 90-minute presentation and discussion of the project’s findings, and recommendations. The draft wellhead maps were exhibited, along

with local geology maps, the sole source aquifer designations, and the ordinance concept outline. The overhead transparencies in Exhibit V-B formed the basis of the presentation, and public discussion.

#### **4. CONDUCT SECOND SERIES OF PROJECT-WIDE MEETINGS**

##### **a. Meeting Agenda**

A second series of meetings were held with the local Environmental Commissions, the SBWA and the Project Consultant. The meetings focused on data management, local interest in the project, local groundwater problems, and the dissemination of a phone poll to obtain more definitive well information from some of the 430 +/- PNCW well owners.

##### **b. PNCW Phone Poll**

Each of the 15 Commissions were requested to poll by phone the PNCW owners in their municipality. The data requested was: well depth, average daily water use; average daily users; septic system design capacity; well pump capacity (See Exhibit V-E). This task was difficult for some Commissions to complete due to conflicting work schedules and the hours when the PNCW owners were available (often not in the evening), or the unwillingness of the PNCW owner to provide the data, or lack of knowledge of the data requested.

##### **c. Poll Data**

The attempt to obtain accurate data from PNCW owners met with limited success. Generally, PNCW well owners did not know the actual depth of their well, their daily water uses (these wells are almost never metered), the septic system's daily use design capacity, or the well's pumping capacity.

#### **5. FINAL WELLHEAD MAP AND ORDINANCE PRESENTATIONS**

In the fall of 1999 a meeting was held at which the completed work products of this Project were presented to the 15 participating Environmental Commissions.

The products include:

- The full Project Report
- Three copies of the draft Interim Wellhead Protection Map
- A municipal Geology/Aquifer Map
- Two model Wellhead/Aquifer Protection Ordinances
- The Best Management Practices Handbook

## **6. ADDITIONAL MUNICIPAL PRESENTATIONS BY LOCAL ENVIRONMENTAL COMMISSIONERS**

Each of the fifteen participating municipal Environmental Commissions will be making presentations to their Planning Boards and governing bodies throughout 1998. The draft ordinances (Board of Health and Municipal) and Wellhead protection Area Maps (and, if available, Drinking Water Aquifer and Geology Maps) will be presented to the respective Boards and municipal governing bodies. The Project Consultant will conduct a final training series of two public presentations to Planning Boards and two presentations to Boards of Health. All of the participating Environmental Commissions will be invited to attend these presentations in order to obtain some insight and experience into the public's response, before they conduct their own public meetings in their respective municipalities.

### **V-F. Deliverable F: "CONDUCT GRANT RECIPIENT WORKSHOPS"**

The SBWA hosted two workshops for other wellhead protection grant recipients.

The recipients who responded and attended were: Bergen County Health Department, Passaic River Coalition and Randolph Township and the Lake Hopatcong Group.

The grant recipients shared their successes and failures to date. Each of the recipients discovered the same problem with respect to obtaining accurate well construction and use data. They found it was either non-existent on current forms or was dated and unreliable. Interviews with PNCW well owners did not get much more accurate or complete data since they didn't know the pump size, well depth, or gallons of daily use.

The general finding was that very few people in the community are knowledgeable about where their drinking water comes from, how it's treated or not, and how surface activities affect their drinking water's quantity and quality.

Each project was also running a little behind its deadline due to data acquisition and GPS mapping problems.

### **V-G. Deliverable G: "DEVELOP A SCHOOL SCIENCE LESSON"**

#### **a. AN ELEMENTARY SCHOOL PRESENTATION**

A two-lesson school program was prepared and presented to a fourth grade class at the Three Bridges Elementary School in Readington Township.

The lesson was presented on two back-to-back days and included a homework lesson.

The lesson was taught by the project consultant and the SBWA staff. The lesson, overhead graphics and take home Best Management Practices materials are included in Exhibit V-C.

**b. CONCLUSIONS**

The students liked the graphics, enjoyed the hands-on experience with soil, rock and water and groundwater pollution examples. They did the homework well and enthusiastically took home their hand colored BMP hang-ups. The students quickly saw the relationship between soil contamination and eventual well water contamination.

**c. RECOMMENDATIONS**

A wellhead protection lesson which is integrated with the new statewide Core Curriculum Standards should be prepared for teachers by NJDEP. Otherwise, busy teachers will not have time to develop this type of lesson plan on their own.

**CHAPTER V EXHIBITS**

**APPENDIX**

- V-A** THE WELLHEAD PROJECT POLL
- V-B** PUBLIC MEETING PRESENTATION MATERIALS
- V-C** ELEMENTARY SCHOOL SCIENCE LESSON
- V-D** WELLHEAD HAZARD INVENTORY FORMS
- V-E** PUBLIC NON-COMMUNITY WELL OWNERS PHONE SURVEY FOR WELL DATA
- V-F** ANNUAL PNCW/PCW WELL OWNERSHIP AND LOCATION LISTING FORM

## **CHAPTER VI**

### **TASK VI: “WELLHEAD MAPPING/GPS/GIS”**

#### **VI-A. Deliverable A: “PREPARE AN ELECTRONIC DATA FILE OF THE PROJECT AREA’S PNCW’S”**

##### **1. WELL DATA ORGANIZATION**

The project area contains 29 municipalities, comprising all of Hunterdon County and a portion of Morris County in the headwaters of the South Branch of the Raritan River, and contains approximately 430 Public Non-Community Wells (PNCW’s).

Records of all the Hunterdon County PNCW’s were obtained from the Hunterdon County Health Department. The County has a current record of these wells because it inspects them for compliance with the New Jersey Clean Water Act’s Water Quality Testing requirements. The County Health Department conducts these inspections under a contract and fee arrangement with NJDEP pursuant to the terms of the County Environmental Health Act (CEHA).

In Morris County, the well records were obtained from each individual Board of Health or the Regional Health Commission. There is no County Health Department in Morris County.

In order to make the GIS mapping as cost-effective as possible, an intern at the South Branch Watershed Association visited each well site and plotted and numbered it on a municipal road map. This field map became a very efficient locating tool for the GIS consultants, significantly reducing survey costs.

##### **2. GLOBAL POSITIONING SYSTEM SURVEY**

Rutgers University, under a grant contract with USEPA, provided a team of trained individuals and equipment to plot the ±400 public non-community wells. The final electronic file was then plotted by the Hunterdon County Planning Board staff.

In the second year, ±30 additional well records were discovered and plotted by trained individuals at the South Branch Watershed Association, using the GPS equipment provided by the Hunterdon County Engineering Department.

**VI-B. Deliverable B: “PRODUCTION OF PRELIMINARY WELLHEAD LOCATION MAPS AND FIXED PROTECTION TIERS”**

**1. MAP PREPARATIONS**

The project obtained the digitized GIS base map of roads, streams and municipal and county boundaries from NJDEP. The road network was the U.S. Census “TIGER” mapping.

The Hunterdon County Planning Board integrated the GPS plotted wells on the NJDEP generated base map.

The Hunterdon County Planning Board also subsequently substituted a new digitized county road map network for the NJDEP-supplied “TIGER” road network, further enhancing the road map’s accuracy. The three Morris County municipality maps still contain the “TIGER” roads on their base map. Morris County is in the process of digitizing its road network.

The Hunterdon County Health Department invested considerable time in clipping out each municipality, including the three Morris County municipalities

The project then retained the services of a GIS consulting company, (Vertices-GIS, Highland Park, New Jersey), to complete the draft maps and symbolic wellhead protection tiers. After making revisions and changes in title blocks and legends and revising the tier configurations, Vertices completed the final set of 29 municipal maps.

**2. WELLHEAD PROTECTION TIER CALCULATIONS**

**a. Findings**

The Project had as one of its objectives the plotting of the three wellhead protection tiers particular to each PNCW.

The expectation was that either the County Health Department well records or the NJDEP well records would have the three critical pieces of information necessary to calculate the three tiers based on the draft NJDEP “Calculated Fixed Radius” model.

The Project’s finding (and that of all the other grantees in this round of wellhead projects) was that neither the County nor the NJDEP records had the requisite data necessary for the calculations, that is, geology, well depth, pumping capacity or daily use estimates.

The Project team then met with NJDEP Project Managers to try to solve these problems. We agreed to utilize the published data in Special Report #24 (Geology of Hunterdon County) to obtain median well depth, general rock type and the lowest pumping range on the proposed CFR matrix. Virtually every well in the Hunterdon Plateau came out with the same three radii because most of the rock formations have

the same porosity rating (0.05), and pumped less than 20 gallons/minute, which was the lowest category on the CFR matrix and had the same median depth of 200-300 feet.

The Project then undertook an analysis of these proposed tiers with respect to the actual facilities served by these wells and found broad discrepancies for most of the situations. Most of these wells serve low volume water use establishments other than the schools. The tiers were too small for the regional schools and too big for the small schools, restaurants and offices.

Even though the size of the tiers was not resolved by this point in time (in the life of the project), the Project had to produce the first draft of the maps for use by the commissions in their Wellhead Hazard Inventory work.

Therefore, the Project decided to provide uniform generalized tiers for every well until this discrepancy in the lack of data and the tier calculation formula could be resolved at some later date. The Project decided on a 100 foot Tier I, 200 foot Tier II, and 500 foot radius Tier III, and called them “Draft Wellhead Protection Theoretical Tiers.”

Approximately 18 months into the project, the NJDEP produced a revised draft of the wellhead protection tier calculation methodology and matrix.

The Project applied the new matrix calculations to its “median well profiles.” The size of the tiers was reduced for the theoretical median well. However, when the calculated fixed radius mathematical formula was applied to the specifics of the small volume wells, the tier radii shrunk radically. The typical PNCW with a water use of less than 2,000 gallons/day (which is almost all the PNCW’s in the study region except for schools), yields a Tier I calculated fixed radius of approximately 30 feet. These radii were too small to map on the municipal maps the Project was preparing at 1”=2,000’ scale.

In a final effort to get accurate well data, the Project Consultants requested that the fifteen participating Environmental Commissions conduct a phone poll of the PNC well owners in their municipalities. The poll requested well depth, known or estimated daily use, and/or pumping capacity. A general analysis of these polls indicates that the knowledge of the PNC well owner concerning wells and wellhead protection is sporadic at best. (See Exhibit V-E).

These well construction and use data will be made available to the Planning Board, and Board of Health, by the Environmental Commission for use in ongoing planning and wellhead protection efforts.

**b. Conclusion**

Given the significant flux still in the draft regulatory formulas and the lack of real data in the local and state records, the Project decided to plot all the wellhead protection areas as “Draft Wellhead Protection Time-of-Travel Theoretical Tiers” areas in order to make it clear that specific calculations had to be done on each well and that these first maps could not be used for any enforcement or bright line regulatory test. The theoretical tiers are 100 feet, 200 feet, and 500 feet.

An example of one of the project’s working maps is shown in Exhibit VI-A. An excerpt of a close-up of one of the PNCW draft wellhead protection theoretical tier maps is shown in Exhibit VI-B.

These Theoretical Wellhead Protection Area Tiers can serve as interim wellhead review areas which simply target an area around a well which can be further refined in the local Board of Health or Planning Board review.

**c. Recommendations**

There are a variety of options a municipality can use to prepare a map for use in its wellhead protection, education, planning and regulation programs.

- 1) GIS Survey Maps. The most exacting method is to prepare a Geographic Information System (GIS) Base Map and land survey the wells of concern (PNCW’s and PCWs). This method is the most expensive, but the most accurate.
- 2) GIS-GPS Maps. Another method is to prepare the GIS base map and plot the wells of concern using a Global Positioning System (GPS). This will plot the wells to within +/- 50 feet accuracy.
- 3) Tax Maps. The final option, especially if no budget is available for options 1 or 2 above, is the use of a variety of base maps or tax maps which identify each property which has a well. This is only a relative tool which can be used for conceptual planning or educational purposes. However, this type of map, used in conjunction with a list of all PNCW and PCW wells, identified by tax block and lot, is a perfectly adequate tool for use by the Planning Board and applicants, to target wells of concern during the development application process. The wells of interest can then be adequately plotted by the applicant.

*A municipality should not hold up its wellhead protection program simply because it does not have a budget to create a fancy new map showing all the wells and all the various wellhead protection tiers and hazards with a high degree of accuracy. A good Wellhead Protection Ordinance can proceed without a precise map. The map can be “built” as data is collected.*

- 4) Wellhead Protection Tier Map. The Planning Board and Board of Health should

have a current public list of all the PNCW's, PCWs, and other public use wells (i.e., preschools, day care centers or other child care facilities with less than 25 daily occupants). This list can be structured as a chart which contains all the essential well information needed by Boards or applicants in order to calculate their interim Wellhead Protection Tiers for their review purposes. This chart would be updated as NJDEP adopts official tiers for PCW's and PNCW's (see Form Exhibit VI- C).

- 5) NJDEP, GIS Well Data. NJDEP should institute an improved well drilling regulation which requires well drillers to record critical wellhead data and aquifer yield information in a sortable electronic format. This revised permit data would include date drilled, tax lot and block, state plane coordinates, well address, well depth, static water level, yield and rock type. This data can then be utilized by municipalities when they have the planning budgets to prepare GIS maps for a variety of local wellhead and aquifer protection efforts.

## **VI-C. Deliverables C and D: "PREPARE MAP REVISIONS AND WELLHEAD HAZARD INVENTORY NOTATIONS"**

### **1. FINDINGS**

- a. Thirty additional wells were discovered after the initial GPS well location work was completed. Volunteers from SBWA, trained by the Hunterdon County Engineering Department, and using the County's equipment, plotted an additional 30 wells throughout the study region.
- b. The GIS consultant changed the solid line tier designations to dashed lines, signifying their "draft" or "theoretical" status.
- c. A wellhead hazard notation of hazards identified within 100-200 feet of the well was included in a text file and plotted as a separate key on the map. Since there was no budget to GPS these hazards, they were simply keyed to each well on the map and identified in a separate report.
- d. The map key was expanded to include future data which may be plotted on this wellhead protection area map. These additional items are:
  - \* Public Community Wells
  - \* Facilities with various NJDEP permits
  - \* The slope of the land toward the well

### **2. CONCLUSIONS**

- a. The first set of draft maps were taken into the field by 15 Environmental Commissions and used to verify the GPS plot and identify a proscribed list of hazards within a 200 feet X 400 feet rectangle surrounding the well. The 200 feet X 400 feet rectangle was chosen as the limit of the hazard inspection area for the following

reasons:

- \* The actual wellhead protection area was unknown and
- \* The windshield survey could visually inspect a property from the road for a distance 100 feet deep into the property and 100 feet deep across the road and transverse the road for a distance of 200 feet in either direction from the well site. The center of this “Inventory Box” is where the subject property (with the PNCW) intersects the frontage road.

### **3. RECOMMENDATIONS**

#### **a. Hazard Inventory**

In order to facilitate the creation of accurate Wellhead Hazard Inventory Maps, the Department should contract with the County Health Departments (under CEHA) to conduct an ongoing hazard survey around each PNCW at the same time they conduct their PNCW audit.

The Health Officer would have the authority to “trespass” within the specified tier, in order to record the hazard(s). No other municipal officer has this investigative authority, by right.

#### **b. Hazard List**

Given the fact that underground heating oil tanks are ubiquitous and have not been implicated in well contamination events, they should be considered for deletion from the hazard ranking so that the data base and eventual map will not be cluttered.

A standardized “Well Hazard Category List” should be developed by NJDEP for use by all hazard inventory personnel so that it does not become unwieldy or trite.

#### **c. Slope**

At the same time that the Hazard Inventory is conducted around each PNCW, the dominant geographic slope or slopes of land toward the well should be noted at some specified distance, i.e. perhaps at the Tier II limit.

#### **d. Global Positioning Survey (GPS)**

Wherever possible, Global Positioning Survey equipment should be used by the agency or contractors who are conducting the Hazard Inventory and recording the slope of the land toward the well.

However, in the absence of GPS, a recording and identification of all the hazards within the Tier I proximities to a PNCW can still serve as a valuable educational and

regulatory tool.

**VI-C. Deliverable E: “PRODUCE A MAP SET FOR EACH TOWN”**

**MAP PRODUCTS**

- a. T&M Associates utilized the zip drive produced by the Project GIS Consultant, (Vertices, Highland Park, New Jersey) to generate three copies of the Wellhead Protection Planning Maps for each participating municipality.
- b. The Hunterdon County Planning Board produced a Hunterdon County Wellhead Protection Planning Map for Hunterdon County and a subset for the three adjacent Morris County municipalities.
- c. The Hunterdon County Health Department and Planning Board and South Branch Watershed Association, and the Morris County Planning Board were each provided with a zip drive file of the entire project area map (29 municipalities). This is available to loan to any agency which would like to use it to generate maps or make a copy of it for their own continuing planning and protection efforts.
- d. Each actively participating municipality received three copies of the finished Theoretical Wellhead Protection Maps for use in their ongoing educational programs. Each actively participating municipality received three copies of the finished programs on wellhead protection. The Board of Health of the non-participating municipalities will each receive one copy of their own map (see Exhibits VI-A and VI-B for examples of the map products).

**CHAPTER VI EXHIBITS**

**APPENDIX**

<b>VI-A</b>	Typical Theoretical Wellhead Protection Map
<b>VI-B</b>	Close-up of Exhibit VI-A – A Draft Wellhead Protection Area Map
<b>VI-C</b>	(Sample Document) Public Community and Public Non-Community Wellhead Protection Data Form for Boards of Health and Planning Boards
<b>VI-D</b>	Public Non-Community Wells of the Study Area – Identification/Ownship

*This page left intentionally blank*

## CHAPTER VII

### HIGHLANDS WELLHEAD PROTECTION PROJECT

#### BIBLIOGRAPHY

Analysis of Ground-Water Recharge in Regional Water Resource Planning Areas in New Jersey. Robert Canace, et.al., July 15, 1992.

Aquifer Protection Overlay District. Town of Southampton, New York, 1963.

Assessing Nassau County's Water Conservation Program. Mark Maimone and Michael Labiak, Journal of Water Resources Planning and Management, Jan/Feb 1994.

The Basics of Groundwater Regulation, Jon Witten, AICP, American Planning Association, June 1992.

The Cape Cod Aquifer Management Project (CCAMP). United States Environmental Protection Agency, Region 1  
EPA 901/3-88-003, September 1988

Cape May County New Jersey Well Head Protection Plan. Prepared by the Cape May County Planning Board, February, 1991.

Cape May County New Jersey Well Head Protection Plan for Domestic Wells. Prepared by the Cape May County Planning Board in cooperation with New Jersey Department of Environmental Protection, June 1992.

A Community Guide to Groundwater Guardian. Prepared by the Ground Water Foundation, 1995.

Core Curriculum Content Standards. New Jersey State Department of Education, 1997.

Delineating Zones of Contribution for Public Supply Wells to Protect Ground Water in New England. Scott W. Horsley and Thomas C. Cambareri, September 19, 1984.

Fifty Ways Farmers Can Protect Their Groundwater. North Central Regional Extension Publication, March 1994.

Geology and Groundwater Resources of Hunterdon County: Special Report #24.  
Haig F. Kasabach, New Jersey Bureau of Geology.

Ground and Surface Water. Prepared by Hunterdon County Planning Board, December 1967.  
Ground Water Ecology. Edited by Jack A. Stanford and H. Maurice Valett, copyright 1994 by the American Water Resources Association.

Ground Water and the Rural Homeowner. Prepared by Roger M. Waller for the Department of the Interior and the U.S. Geological Survey, 1994.

Groundwater Management in the Prime Aquifer Area, Borough of Mountain Lakes. (Morris County), August 1988.

Groundwater Protection: A Guide for Communities. Metropolitan Area Planning Council, Groundwater Protection Efforts in Merrimack, New Hampshire, Richard Worden, EPA Program Analyst, Office of Groundwater Protection, EPA Region, February 10, 1988.

Ground-Water Protection. United States Environmental Protection Agency, August 1984.

Ground Water Recharge Management Handbook. Environmental Division, Middlesex County Planning Board, March 1981.

Ground Water Resource Assessment of Franklin Township, New Jersey. Prepared for Franklin Twp. By Leggette, Brashears, and Graham, Inc., October 1994.

A Ground Water Strategy for New Jersey. New Jersey Department of Environmental Protection, June 1989.

Ground Water Study of the Argillite Formation in Kingwood Township Hunterdon County, New Jersey. Prepared for the Kingwood Planning Board by Robert Hordon professor of Geology, Rutgers University, November 1995.

A Guide to Ground-Water Supply Contingency Planning for Local and State Governments. Office of Ground-Water Protection, U.S. Environmental Protection Agency, May 1990.

A Guide to Well Head Protection. American Planning Association, August 1995.

A Guide to Wellhead Protection. Jon Witten and Scott Horsley with Sanjay Jeer and Erin K. Flanagan.

Handbook Ground Water. United States Environmental Protection Agency, Technology Transfer, EPA/625/6-87/016.

How-to Manual for Ground Water Protection Projects. Lillian Smith Madarchik, National Association of RSVP Directors, Inc., 1992.

Land Use Issues in the Control of Wellhead Protection Areas. Thomas Reese, Attorney at Law, St. Petersburg, Florida

Local Financing for Wellhead Protection. United States Environmental Protection Agency, EPA 440/6-89-00, June 1989.

Local Ground Water Protection Effort in Topsham, Maine. Richard Worden, EPA Program Analyst, Division of Water Management, EPA Region 1, February 10, 1988.

A Method for Evaluating Ground-Water-Recharge Areas in New Jersey. New Jersey Geological Survey Geological Survey Report GSR-32.

Model Limestone Ordinance. Limestone Resource Committee, North Jersey Resource Conservation and Development Council, Annandale, New Jersey, August, 1993.

Nassau County Public Health Ordinance. George Picket, M.D., M.P.H. Commissioner, Mineola, New York, August 17, 1992.

A New England Groundwater Profile. Susan Redlich.

New Jersey Well Head Protection Program Plan. New Jersey Department of Environmental Protection, December 1991.

New Jersey GIS Update. New Jersey Department of Environmental Protection and Energy, Issue #21, Spring 1993

Notice I-78. South Brunswick Township Board of Health Water Supply Ordinance, 1978

Nutrient Study for Town of Clinton Wastewater Treatment Facility. Prepared for Town of Clinton by Omni Environmental Corp., July 1993.

Ocean County Board of Health Well and Individual Sewage Disposal System Ordinance. Ocean County Board of Health, May 6, 1987 and Amended June 6, 1990.

Passaic Valley Ground Water Protection Committee. Model Municipal Ordinance, Control of Toxic and Hazardous Materials, Passaic Valley Ground Water Protection Committee.

Planning Advisory Service Report Number 457/458. American Planning Association.

The Planning Process for Local Ground Water Protection. Groundwater Standing Committee Land and Water Resources Council, State of Maine, January 1988.

Precious Gems: Groundwater Education Strategies That Work. W.K. Kellogg Foundation, 1993.

Protecting Local Ground Water Supplies Through Well Head Protection. United States Environmental Protection Agency, May 1991.

Realities of Wellhead Protection. Brad Caswell.

Reinventing Government for Ground Water Protection: The Need for County-Local Partnerships. Michigan Society of Planning Officials, November 1995.

Rhode Island Wellhead Protection Program. Rhode Island Department of Environmental Management Division of Groundwater and Freshwater Wetlands, Groundwater Section, February 1990.

State and Local Ground-Water Programs Related to Wellhead Protection, Water: Laws and Management. American Water Resources Association, Rose M. Lew and Steven P. Roy, September 1989.

Upper Raritan Water Quality Management Plan Draft. New Jersey Department of Environmental Protection, May 1979.

Using a GIS for Analytical Modeling of Wellhead Protection Areas Around Public Water Supply Wells. Allan J. Scott, Suffolk County Water Authority, Sunrise Highway-Pond Road, Oakdale, New York, 11069.

Variables Indicating Nitrate Contamination in Bedrock Aquifers, Newark Basin, New Jersey. Rick M. Clawges and Eric F. Vowinkel, Water Resources Bulletin, American Water Resources Association, October 1996.

Water for the 21st Century: “The Vital Resource” New Jersey Statewide Water Supply Plan. New Jersey Department of Environmental Protection, Sept. 1995.

Watershed Management – Kit in a Box. A Guide to Watershed Partnerships. Coordinated by Conservation Technology Information Center.

Wellhead Programs: Tools for Local Governments. United States Environmental Protection Agency, EPA 440/6-89-002, April 1989.

Well Head Protection – A Decision Maker’s Guide. United States Environmental Protection Agency, May 1992.

Wellhead Protection: A Decision-Maker's Guide. United States Environmental Protection Agency, Washington, DC, May 1987.

Well Head Protection – A Guide for Small Communities. United States Environmental Protection Agency, February 1993.

Well Head Protection Area Delineation Code. Prepared by T.N. Blanford, P.S. Huyakorn, and Yu-Shu Wu of HydroGeologic, Inc. for the United States Environmental Protection Agency Office of Ground-Water, September 1993.

Wellhead Protection Efforts, Region 1. Environmental Protection Agency, Washington, DC,

August 1988.

Well Head Protection in Confined, Semi-Confined, Fractured, and Karst Aquifer Setting. United States Department of Environmental Protection, September, 1993.

Well Head Protection Demonstration Project. Camp Dresser & McKee, February 1993.

Wellhead Protection Pilot Study for Public Community Water Supply Wells. Ocean County Planning Board, February 1993.

Wellhead Protection Plan for Domestic Well Clusters. Cape May County Planning Board, June 1992.

Wellhead Protection Programs: Tools for Local Governments. United States Environmental Protection Agency, EPA 440/6-89-002, April 1989

Well Head Protection – Tools for Local Governments. A National Drinking Water Clearinghouse Publication.

Well Head Protection – Tools for Local Governments in Virginia. A National Drinking Water Clearinghouse Publication.

West Amwell Township Board of Health, Ordinance BOH 96-01, An Ordinance Establishing A Code Regulating On-Site Water Supply Systems. West Amwell Township Board of Health, 1996.

What is Groundwater? Lyle S. Raymond, Jr., New York State Water Resources Institute Center for Environmental Research, Cornell University, July 1988.

### **Videos**

Luck Isn't Enough: The Fight for Clean Water. University of Connecticut Cooperative Extension.

Management Workshops in Innovative Techniques for Well Head Protection. United States Environmental Protection Agency – Office of Groundwater Protection, November 1990.

Ground Water Flow in Living Color. National Water Well Association, 1977.

*This page left intentionally blank*

# EXHIBITS

*This page left intentionally blank*